

The Depreciation of U.S. Supreme Court Precedent

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Abstract

An enduring piece of legal wisdom contends the value of court opinions depreciates as they age and a variety of factors lead some cases to depreciate faster than others. We test systematically these expectations by examining the rate at which U.S. Supreme Court precedents decided between the 1946 and 2004 Terms depreciate at the U.S. Supreme Court and the U.S. Courts of Appeals. Our results indicate, first, that precedents depreciate rather quickly and, for example, depreciate about 81% and 85% between their first and twentieth years of age at the Supreme Court and Courts of Appeals, respectively. Second, only two of the variables slow the pace of depreciation, both relating to the “citation history” of a case, but even this effect substantially decays as cases age. Third, while our study focuses on depreciation (i.e., the change in the frequency of citation over time), it also produces an important implication for explaining the frequency of citation itself (i.e., the probability of a case of being cited in a given year). We show prior studies significantly overestimate the effect of almost every variable used to explain citation rates because those variables become substantially less influential as cases age. Future studies must take into account that the effect of an independent variable on citations is conditional on the age of a precedent. This study therefore contributes to our understanding of the process by which law, as observed through citations to cases, changes.

I. INTRODUCTION

An enduring piece of legal wisdom contends the informational value of court opinions depreciates as they age. As society evolves and law changes due to economic, social, and political developments, the extent to which a precedent remains pertinent for deciding legal disputes diminishes. As judges analogically reason their way to conclusions, older cases are less likely to contain issues, principles, and reasoning appropriate for contemporary legal problems. Landes and Posner (1976, 263) provide one of the earliest explicit arguments in this regard, stating that a precedent “depreciates in an economic sense because the value of its information content declines over time with changing circumstances. . .” thus reducing “. . . the value of precedents as a source of legal doctrine.”

Precedents are a central element in the American judiciary and create rules providing decision makers with information that enables them to make predictions about the consequences of alternative courses of action (Cardozo, 1964 [1921], 19-35; Holmes 1897; Hurst 1956; Wahlbeck 1997). Precedents do so by defining legal principles that indicate the relevance or importance of different factual circumstances for a legal dispute and setting forth legal consequences or tests that follow from particular sets of factual circumstances (Aldisert 1990; Schauer 1987). For instance, one way precedents matter is by helping judges compare and group factual circumstances so that similar cases can be treated similarly (Kornhauser 1989; Lax 2007; Levi 1949; Schauer 1987; Wahlbeck 1997). Precedents are therefore one of the principal raw materials judges use to decide cases.

The meaning and scope of precedents, and thus their ability to offer this informational role, are not static but change over time as judges choose whether and how to apply them in subsequent cases (Gerhardt 2008, 200; Hansford and Spriggs 2006, 5; Landes and Posner 1976,

250; Merryman 1954, 614-16). Legal rules change in part as precedents are cited by other cases, and when courts reduce or eliminate their use then those cases' ability to structure outcomes and contribute to the law diminish. As a result, the patterns in case citations convey important information about the development of the law. Merryman (1954, 615) makes this point when stating that citation choices have "a profound effect on the way the law grows and the shape legal doctrines take." Cross et al. (2010, 493) articulate the same idea, maintaining: "An opinion's citations are the operationalization of the practice of stare decisis." Recent research demonstrates one can use case citations to measure such concepts as legal change (Hansford and Spriggs 2006), the legal importance of Supreme Court opinions over time (Fowler et al 2007; Cross and Spriggs 2010), ideological bias among judges (Choi and Gulati 2007, 2008), and the ideological location of Supreme Court precedents (Clark and Lauderdale 2010).

One reason citations have the effect identified by Merryman (1954) and Cross et al. (2010) is that an important element of stare decisis, analogical reasoning, instructs judges to use the examples set by prior cases to help decide new disputes and to thus cite cases based on their legal relevance and authority (Aldisert 1990; Schauer 1995, 1987). More specifically, reasoning by analogy requires judges to compare the factual circumstances in cases they are deciding with those in past cases and to utilize those precedents that are the most factually similar to cases being decided. Prior research offers empirical support for this idea, showing the Supreme Court is more likely to legally interpret a precedent if it has greater legal and factual similarity to a case it is deciding, even after accounting for other important variables related to Court decision making--such as the Justices' ideological orientations and the legal authority of a precedent (Hansford and Spriggs 2006; Spriggs and Hansford 2002). Other studies indicate federal courts are more likely to cite Supreme Court cases that possess greater legal relevance at a given point

in time (Black and Spriggs 2008; Cross et al. 2010; Fowler et al. 2007). In summary, case citations contain information regarding how judges view the relationship of cited cases to the issues in the cases they are deciding and therefore provide information on the formation and change in the law.

As the current literature stands, it is well established that older cases are generally less likely to be cited by courts (Black and Spriggs 2008; Cross and Spriggs 2011; Cross et al. 2007; Fowler et al. 2007; Friedman et al. 1981; Hansford and Spriggs 2006; Landes and Posner 1976, 1980; Merryman 1954, 1977; Spriggs and Hansford 2002, 2001). It is possible, however, that considerable variation exists regarding which precedents depreciate more quickly than others. Indeed, there is much speculation that variables such as the generality of a precedent (Landes and Posner 1976), the area of law or the interpretational basis of a case (Landes and Posner 1976; Gerhardt 2008), the path by which a case develops as evidenced by its previous citation history (Gerhardt 2008; Merryman 1954, 619), the size of the precedent-setting majority (Cross et al. 2007; Johnson 1987), and the ideology of sitting judges (Cross et al. 2007) may influence case citations and thus the manner in which a case depreciates. While these claims appear regularly in the writings of judges and scholars, no rigorous empirical test of the way these factors affect the pace of precedent depreciation exists.

This imbalance between an abundance of hypotheses and a lack of empirical evidence serves as the motivation for our paper, which asks the following questions: (1) What is the rate at which U.S. Supreme Court precedents depreciate at the Supreme Court and Courts of Appeals?; and (2) What factors explain variation in the rate at which cases depreciate? In what follows, we first describe the existing empirical evidence and then present a series of hypotheses regarding why some precedents depreciate faster than others. We then describe our statistical tests, which

consist of cross-sectional time series analyses of citations to U.S. Supreme Court precedents, released between the 1946 through 2004 Terms, by the U.S. Supreme Court and U.S. Courts of Appeals. Like others (e.g., Landes and Posner 1976, 1980), we capture the rate of precedent depreciation by estimating the change in the frequency with which a precedent is cited as a function of it becoming older. Importantly, we move beyond existing research by determining whether this baseline rate of depreciation varies by the factors identified in the literature. This formulation allows us to gauge whether and by how much an independent variable slows or speeds the rate of depreciation by estimating whether the baseline change in the frequency of citation as a precedent ages varies across the values of an independent variable of interest.

By way of preview, our results indicate the following:

- (1) Precedents depreciate rather quickly at the Supreme Court and Courts of Appeals. The effect of going from being recently decided to just ten years of age reduces a precedent's value by 65% and 72% at the Supreme Court and Courts of Appeals, respectively. However, the depreciation rate is nonlinear, with younger precedents depreciating at a much faster rate than their older counterparts. A ten-year increase in age at forty years of age, for example, yields only an 11% and 30% reduction in citation rates at the Supreme Court and Courts of Appeals, respectively.
- (2) With the exception of two variables--both of which show cases with greater legal relevance in the overall fabric of Supreme Court law depreciate more slowly--the factors hypothesized to affect depreciation do not do so. However, even this result, which one can think of broadly as the influence of the citation "history" of a case--that is, the previous way in which the Supreme Court has dealt with a precedent--significantly weakens as a case ages.

- (3) Our results offer an implication for studies of the citation of precedent (as opposed to depreciation, which is the change in citation rates over time). We find that independent variables used in previous studies are strongly conditioned by the age of a case. Previous research has found that, for example, the salience, complexity, or legal centrality of a case correlate with how frequently it is later cited. Our results show this characterization is incomplete. Our general conclusion is that while many of these variables influence the likelihood of citation initially, as a precedent ages these initial differences become substantially smaller.

In sum, our paper offers a refined and nuanced understanding of the citation and depreciation of precedent and thus provides a better understanding of the process by which law is formulated and altered.

II. THE EMPIRICAL EVIDENCE REGARDING PRECEDENT DEPRECIATION

The study of legal citations has a long history, providing a considerable body of information regarding courts and law (see Posner 2000). One of the earliest legal citation studies is John Merryman's (1954) examination of case citations in California Supreme Court opinions decided in 1950. He argued citations to cases influence the development of law and affect the prestige and authority of the cited cases. The empirical regularity he identified most relevant for our purpose is the age profile of cited cases. He discovered the California Supreme Court tended to cite recent decisions, and one-half of the cases cited in 1950 had been decided in the preceding ten-year period. Merryman (1977) later expanded his analysis to include cases decided in 1960 and 1970, showing the California Supreme Court continued to be more likely to cite younger cases. A study of citations in a broader sample of state supreme court cases reached a similar

conclusion, finding state courts were over time increasingly more likely to cite younger out-of-state court opinions (Friedman et al. 1981).

The contemporary study of legal citations owes much of its origin to a paper by Landes and Posner (1976). They conceptualized precedents as being analogous to capital stock, producing a flow of information that depreciates over time as societal conditions change. They argued one can observe the informational currency of a case based on the frequency with which it is cited in other court opinions, where fewer citations indicate a precedent with less informational value. To analyze precedent depreciation, they examined the cited cases in a random sample of approximately 800 federal courts of appeals decisions decided in 1960, 1974, and 1975 and the cited cases in all Supreme Court opinions decided in 1974. They learned the median age of cited cases in Court opinions in 1974 was 13 years, and cases depreciated at a rate of 2 percent to 5 percent each year. They further determined the rate of depreciation varied by the subject matter of a case, with common law cases, for instance, depreciating slower than economic regulation or civil rights cases, and Supreme Court cases depreciating slower than courts of appeals decisions. Landes and Posner (1980) also examined the subsequent rate of citation to a sample of about 500 state supreme court and federal courts of appeals diversity jurisdiction cases decided in 1950. They concluded the informational value of these cases depreciated over time, as evidenced in fewer citations to cases as they aged, though they found few variables (other than opinion length and federal versus state opinions) correlated with the rate of depreciation.

A series of more recent studies provide additional evidence. They often include precedent age as a variable in the analysis, but it is typically seen as more of a “control” variable, as something potentially correlated with the theoretical variables of interest and thus not

something at the center of the analysis. For example, Hansford and Spriggs (2006) and Spriggs and Hansford (2002, 2001), in addition to offering empirical support for their theory that the interpretation of precedent results from an interactive relationship between the ideological distance between the Justices and a precedent and a precedent's legal authoritativeness, show there is a curvilinear relationship between precedent age and the probability of positive or negative interpretation. Generally speaking, cases are progressively less likely to be interpreted over their life, and this effect substantially flattens out for the oldest cases. Other studies confirm this general pattern regarding the depreciation of precedent (Cross and Spriggs 2011; Fowler et al. 2007; Black and Spriggs 2008).

In summary, it is now a well-established empirical regularity that Supreme Court precedents experience depreciation, whereby cases are generally less likely to be cited as they get older. What has yet to be done, however, is for scholars to move beyond either examining the bivariate relationship between precedent age and citation rates or utilizing it as a control variable in a multivariate model. Indeed, as we discuss in the next section the literature offers a remarkably rich set of hypotheses regarding the conditions under which precedents should depreciate more or less quickly, but as of yet little in the way of systematic empirical testing of these expectations has been conducted.

III. THE CORRELATES OF PRECEDENT DEPRECIATION

Why would some precedents depreciate more quickly than others? The existing literature suggests the rate of depreciation—the decrease in the probability of a case being cited as it ages—will not be constant but will vary due to a series of factors, including ideological considerations, characteristics of precedents, and the “history” of the citations within and between precedents (i.e., the path by which a case develops over time). While previous studies

examine the relationship of many of these variables with citation rates, they do not determine (and most do not even inquire) whether those factors actually affect the degree to which precedents depreciate as they age.

A. Ideological Considerations

Most political science accounts of judicial decision making assume judges (and especially Supreme Court Justices) seek to move the law closer to their preferred ideological positions (Epstein and Knight 1998; Hansford and Spriggs 2006; Maltzman, Spriggs, and Wahlbeck 2000). It is generally recognized that one way of changing law, and thus for Justices to bring it into closer conformity with their preferred outcomes, is by citing cases. Consistent with this view is a pattern observed by Choi and Gulati (2008, 2007), who find federal appeals court judges are more likely to cite opinions written by their ideological allies. Hansford and Spriggs (2006) show the Supreme Court is more likely to follow ideologically favored precedents and distinguish or even overrule ideologically disfavored precedents. Additional evidence suggesting the interpretation of precedent is ideological exists in Johnson (1987), Benesh and Reddick (2002), and Klein (2002). The only study to assess directly the role of ideology and precedent depreciation is Cross et al. (2007), who suggest the rate of depreciation of 77 Warren Court precedents during the Rehnquist Court years may have resulted from ideological considerations.

Ideological Distance Hypothesis: As precedents become ideologically removed from sitting judges they will depreciate more quickly.

B. Precedent Characteristics

The literature identifies a wide array of case attributes potentially related to depreciation rates. One of the most frequently discussed opinion attributes is the legal basis of an opinion,

with scholars and judges maintaining deference to precedent varies by whether it is based on common law, statutory law, or constitutional law (Freed 1996, 1770-71; Levi 1949, 6-7; Maltz 1988, 388; *Payne v. Tennessee* 1991, 828; Rehnquist 1986, 350). As summarized by Justice Powell (1990, 287): “The idea has long been advanced that *stare decisis* should operate with special vigor in statutory cases because Congress has the power to pass new legislation correcting any statutory decision by the Court that Congress deems erroneous.” Michael Gerhardt (2008, 49-50, 96-98) claims this distinction is crucial to understanding the role of precedent and contends the Court is less deferential to constitutional opinions. Posner argues common law decision making is more law like, less politically contentious, and more incremental, disciplined, and predictable than constitutional law (Posner 2008, 82-87, 277). If this long-held piece of legal wisdom is accurate--and the Court pays more deference to statutory cases--then statutory precedents should depreciate less quickly than their constitutional or common law counterparts:

Statutory Interpretation Hypothesis: Cases based on statutory interpretation will experience a slower rate of depreciation than either constitutional or common law precedents.

One of the advantages of *stare decisis* is its ability to produce stability in the law and ameliorate problems associated with legal uncertainty. Individuals, especially when structuring economic relationships, value the ability to make decisions with an understanding that the law applied to them in the future will resemble the law of today. Judges and scholars routinely argue this concern is most prominent with regard to contracts, wills, conveyances, commercial transactions, securities, property, and related economic issues (Gerhardt 2008, 25; Padden 1994, 1691; Rehnquist 1986, 347; Stevens 1983, 2). They further suggest the norm of *stare decisis* is

stronger in economic cases because of the reliance interests at stake in them. As Justice Powell (1990, 286) wrote: “Stare decisis also enhances stability in the law. This is especially important in cases involving property rights or commercial transactions.” The majority opinion in *Payne v. Tennessee* (1991, 828) echoes this idea, stating: “Considerations in favor of *stare decisis* are at their acme in cases involving property and contract rights, where reliance interests are involved.” This idea leads us to suggest:

Economic Issue Hypothesis: Statutory cases involving economic issues will depreciate slower than other cases.

In their landmark study, Landes and Posner (1976) argued general precedents depreciate at a slower rate. By general precedents, they mean cases that are broader in terms of the facts and issue they potentially cover. As they state (1976, 268): “A general precedent is less likely to be rendered obsolete by a change in the social or legal environment in which the precedent is applied.” They tested this hypothesis indirectly by examining variation in the rate of depreciation between Supreme Court cases and U.S. Courts of Appeals opinions, where they assumed Supreme Court opinions were more general in nature. Their analysis demonstrated Supreme Court opinions depreciated more slowly than their Courts of Appeals counterparts. While Supreme Court opinions may be more general than Courts of Appeals opinions, their assumption provides no way of explaining variation between Supreme Court opinions.

We assess this hypothesis through consideration of three attributes of court opinions that, while indirectly related to generality, are reasonable proxies. Our first variable is the number of words contained in a majority opinion. We assume opinions with more words are more general, at least in the way defined by Landes and Posner (1976) and as discussed by Schauer (1987). Law is ultimately a function of the language in Court opinions (Tiller and Cross 2006, 518), and

thus, as pointed out by Judge Wald (1995, 1394), “words matter.” In a recent paper, for example, Black and Spriggs (2008) show, among other things, longer Supreme Court opinions are the product of collegial interaction among the Justices as they bargain and negotiate their way to establishing legal doctrine. It is thus likely the larger the number of words in an opinion, which resulted in part from the bargaining process, the more likely the language contained in an opinion can be viewed by future judges and lawyers as being applicable to a wider set of circumstances. Consistent with this idea, Black and Spriggs (2008) show the number of times Supreme Court opinions are cited in the lower federal courts is substantially higher for longer majority opinions, even after controlling for a wide array of additional variables potentially correlated with both opinion length and citation rates. Cross (2007) and Landes and Posner (1980) find a similar relationship between the length of U.S. Courts of Appeals opinions and their subsequent citation rates.

Our second proxy for the generality of a precedent is its breadth, or the number of legal issues in a case (e.g., search and seizure, freedom of speech, etc.) and the number of legal provisions (e.g., Constitutional Amendments, federal statutes) interpreted in the precedent. Cases that cover a broader array of issues and interpret a wider set of legal materials are likely to in the future cast a wider net. Our third proxy relates to the usage of footnotes in an opinion. One of the most common critiques of modern court opinions is their increasing tendency to be larded with footnotes. Typical is the comment: “Footnotes have been a public nuisance of long standing” (Forrester 1995, 186). Judge Posner (2000, 400) agrees, noting: “Footnotes in judicial opinions tend to confuse the reader.” It is likely cases with many footnotes, as with additional

words in an opinion, offer future readers wider luxury to interpret a case as relating to a broader set of legal disputes.¹ We therefore hypothesize the following:

Majority Opinion Length Hypothesis: Longer majority opinions will depreciate more slowly than shorter opinions.

Breadth of Precedent Hypothesis: Majority opinions with greater breadth will depreciate more slowly.

Footnotes Hypothesis: Cases with a larger share of text devoted to footnotes will depreciate at a slower rate.

The lack of consensus in a case, as evidenced by separate opinions or a smaller majority coalition, can raise doubts about the legal rationale in the majority opinion and thus potentially weaken its influence. The typical claim made in the literature is that cases with separate opinions and smaller majority coalitions may be seen as less credible, legitimate, and well reasoned (Baum 1981, 51; Danelski 1986; Murphy 1964, 66; Wasby 1970, 251). Prior work thus suggests they will receive fewer citations, be at greater risk of being overruled, and be more likely to suffer from noncompliance (Johnson 1979, 1987; Spriggs 1997). Judge Posner (2008, 400) makes this point, declaring: “a dissenting opinion undermines the majority opinion not only by indicating a lack of unanimity but also by expressing criticisms of the outcome.” For example, Justice Rehnquist, in *Payne v. Tennessee*, suggests the Court has greater latitude to overrule cases decided by “the narrowest of margins” (501 U.S. 808, at 829). Research has produced mixed results regarding these expectations. Cross et al. (2007) found coalition size was unrelated to the depreciation of a sample of 77 Warren Court precedents during the Rehnquist Court. Other studies, while not directly examining depreciation, show coalition size is

¹ Data presented by Posner, however, (1996, 234-36) suggest courts of appeals opinions with more footnotes are cited less often.

related to the negative (but not positive) interpretation of precedent by the Supreme Court (Hansford and Spriggs 2006) but is unrelated to the number of lower federal court citations to or treatments of a Supreme Court precedent (Hansford and Spriggs 2006; Black and Spriggs 2008; cf. Posner 1996).

Coalition Size Hypothesis: Precedents decided by a unanimous coalition will depreciate slower, while those decided by minimum winning coalitions will depreciate faster.

Length of Separate Opinions Hypothesis: Precedents with more language in separate opinions will depreciate at a faster rate than other opinions.²

Research suggests cases with greater legal and political salience when they were decided have higher citation rates and may thus depreciate slower. For example, existing evidence shows cases with a larger number of amicus briefs filed on the merits are more likely to be legally interpreted by the Court (Hansford and Spriggs 2006; Spriggs and Hansford 2001) or cited by the Supreme Court and lower federal courts (Fowler et al. 2007; cf. Black and Spriggs 2008). Additionally, most people recognize per curiam opinions involve less contentious and salient issues and as such are a less integral part of future legal decision making. Research confirms this expectation by showing per curiam opinions are less likely to be legally interpreted by the Court (Hansford and Spriggs 2006) and less likely to be cited or legally interpreted by lower federal courts (Black and Spriggs 2008). We thus suggest these factors should influence a precedent's rate of depreciation:

² One might argue that longer separate opinions will actually increase the rate of future citations because, like longer majority opinions, separate opinions might allow others to find the precedent applicable to other situations. Ultimately, the data will discriminate between these two possibilities.

Case Salience Hypotheses: Cases with a larger than average number of amicus briefs at the merits stage or cases with an authored majority opinion (rather than a per curiam) will depreciate more slowly than other cases.

C. The Role of Citation “History” in Depreciation

The role of stare decisis in adjudication can be thought about in terms of network effects (e.g., Chandler 2005; Fowler et al. 2007; Fowler and Jeon 2008; Gerhardt 2008; Smith 2007) and the role of “history.” First, one can conceptualize law as a network, as consisting of a set of cases and the connections (as revealed through citations) among them. The legal rule in an area of law is thus a function of the language contained in a series of cases, as well as the way in which those cases have been cited in and legally treated by other opinions. As Post and Eisen (2000, 545) state: “...one could plausibly suggest that the web of citations from one case to another is a critical component of the network of rules that comprise ‘the law’ in any area . . .” Second, one way of characterizing the role of stare decisis is to say that “history” matters. As judges analogically reason, they rely upon a specific form of history (i.e., precedents) and apply their understanding of that history to the factual circumstances in cases. To submit that precedent helps structure judges’ decisions is thus an argument about the role of history in the law.

These two aspects of precedent mean the individual history or path of a case has implications for its later use by judges and the rate at which it will depreciate. A case, for example, that has been cited more frequently, especially if in a favorable manner, is likely to have developed the authority and reach permitting it to command a more central role in defining law (Gerhardt 2008, 151, 200; Hansford and Spriggs 2006, 23-27; Landes and Posner 1976, 250; Merryman 1954). Hansford and Spriggs (2006), for instance, show the Supreme Court is more

likely to positively interpret precedents that have greater legal vitality, even after controlling for the role of ideology. Fowler et al. (2007) demonstrate federal courts are more likely to cite a Supreme Court precedent if it is more strongly embedded in the network of Supreme Court law. Michael Gerhardt (2008, 192) summarizes this idea by stating: “The more courts and other institutions approvingly cite precedents, the more their value increases and the clearer and more stable their meanings become.”

It follows from this discussion that the citation history of a case is likely to condition the degree to which it is subject to depreciation. We expect cases whose citation histories indicate they are more influential or legally authoritative to depreciate less rapidly than other cases because they continue to be a more integral part of the law and thus have a higher likelihood of being used as a justification in any given decision. As discussed below, we measure these citation histories using variables that assess separately the legal relevance (“network centrality”) of a case and its degree of legal vitality (or authoritativeness) based on the previous patterns of case citations and treatments (Fowler et al. 2007; Fowler and Jeon 2008; Hansford and Spriggs 2006).

Citation History Hypothesis: The more legally relevant or authoritative a precedent is at the Supreme Court, as evidenced by its citation history, the slower it will depreciate.

IV. DATA AND METHODS

To examine the correlates of precedent depreciation, we constructed a cross-sectional-time-series dataset of citations from majority opinions in the U.S. Supreme Court and the U.S. Courts of Appeals to previously decided Supreme Court opinions. The dataset covers all Supreme Court opinions (i.e., the precedents in the analysis) released starting with the beginning of the Vinson Court during the 1946 term and ending with the last case decided during the

Court's 2004 Term, for a total of 6,729 precedents.³ The unit of analysis is the precedent-year, and the data set contains an observation for each precedent in each year, beginning with the year it was decided and ending in 2005. In other words, a precedent decided in 1946 will have a total of 60 observations in the dataset, whereas a precedent decided in 1999 will appear only seven times. The total number of "precedent years" in our dataset is 207,807.⁴

Our first dependent variable, *Precedent Cited by Supreme Court*, is coded as 1 if in a given year a majority opinion of the Supreme Court cited that precedent.⁵ We obtained these data from Fowler et al. (2007), as updated and cleaned by us,⁶ who collected them from *Shepard's Citations*.⁷ This formulation of the dependent variable is standard in the literature, and many others have adopted it as a way to assess the "influence" or "value" of opinions, courts, and judges (see, e.g., Cadeira 1983; Farber 2005; Fowler et al. 2007; Klein and Morrisroe 1999; Kosma 1998; Landes, Lessig, and Solimine 1998; Landes and Posner 1976, 1980; Solimine 2005; Post and Eisen 2000). As Landes and Posner (1980, 374) argue: "the number of citations in later opinions appears to provide reasonable proxies for the precedential value of an

³ This list of Supreme Court precedents is an updated version of Fowler et al. (2007), who built a list of all "front of the book" majority opinions of the Supreme Court, both signed and per curiam. While the Fowler et al. data excluded nonorally argued per curiam opinions, we now include as a precedent in this analysis any nonorally argued "front of the book" per curiam opinion that contains legal reasoning, however limited it may be. We essentially differentiated between orders and opinions, excluding orders from our list of Supreme Court precedents (see Hellman 1983, 807-809).

⁴ The estimation sample includes 6,587 cases and 201,001 observations, and it is smaller than the dataset because our statistical model includes several one-year lags of independent variables and because we use an AR(1) autoregressive lag structure. We used Stata 11 for all statistical analyses.

⁵ Technically speaking, the underlying dependent variable is a count, since the Court could theoretically cite a precedent more than once in a given year. As the empirical distribution of the variable takes on values greater than 1 in only 3.6 percent of the observations, we opt for this more parsimonious operationalization of the dependent variable. We note that our substantive results are similar if we use the count variable instead (and estimate a negative binomial regression model).

⁶ We fixed a series of problems with the Fowler et al. (2007) data resulting from either typos in *Shepard's Citations* (such as incorrect decision dates for cases) or Fowler et al.'s (2007) incorrect exclusion of some citations (e.g., the Fowler et al. (2007) data excluded any citation in a majority opinion if there was also a citation in a dissenting opinion). Going forward, any scholar wishing to use the Fowler et al. (2007) data should instead use the updated version of those data based on this paper.

⁷ Hansford and Spriggs (2000) used a quantitative reliability analysis to show that *Shepard's Citations* data regarding both the citation of precedent and the coding of the potential legal effect of the citing case on the cited case (e.g., follow, distinguish, overrule) are highly reliable.

appellate decision” (1980, 374).⁸ The dependent variable equals 1 in 20.1% of the precedent-year observations. Our second dependent variable counts the number of times majority opinions of the U.S. Courts of Appeals cited a given Supreme Court precedent in each year of a precedent’s life.⁹ The mean value on this variable equals 4.4, with a standard deviation of 15.7, and an interquartile range of 0 and 4 citations.

The argument we seek to test, to reiterate, is that there are factors conditioning the rate at which a precedent depreciates over time. Empirically, we estimate the baseline rate of precedent depreciation by determining the change in the frequency of a case being cited as it ages. We determined the best-fitting functional form for *Age of Precedent* by using a fractional polynomial model. A fractional polynomial is a model-building approach, developed by Royston and his coauthors (1994, 2008) for determining the best-fitting nonlinear functional form for a continuous variable. The fractional polynomial approach allows for more flexibility than the conventional polynomial approach of, for example, a quadratic. In the fractional polynomial method, a series of terms of the form X^p are estimated, where the exponents p are chosen from the set $\{-2, -1, -.5, 0, .5, 1, 2, 3\}$. The best-fitting function is then chosen based on overall model fit using the deviance criterion, in which the model with the lowest deviance has the best fit (see Royston and Altman [2008, 82], for a description of the test procedure for selecting the best-fitting function). For the Supreme Court, the best-fitting functional form is: $Age\ of\ Precedent^{-2}$, $Age\ of\ Precedent^{-2} * \text{Log}(Age\ of\ Precedent)$, $Age\ of\ Precedent^{-2} * \text{Log}(Age\ of\ Precedent)^2$, and $Age\ of\ Precedent^{-2} * \text{Log}(Age\ of\ Precedent)^3$. For the Courts of Appeals model, the best-fitting

⁸ The use of citations to analyze law has been criticized for a variety of reasons. For instance, some suggest using case citations to measure the importance of a case is problematic because a truly important case might settle the law and thus not be cited because it dampens or eliminates litigation in an area. For a discussion of why case citations remain a meaningful, albeit imperfect, measure of aspects of the law, despite this criticism (and others), see Cross and Spriggs (2010, 420-30).

⁹ We count citations from the 11 numbered circuits and the D.C. Circuit. We thus exclude the specialized federal appellate courts from this analysis.

functional form is: $Age\ of\ Precedent^2$, $Age\ of\ Precedent^2 * Log(Age\ of\ Precedent)$, $Age\ of\ Precedent^3$, and $Age\ of\ Precedent^3 * Log(Age\ of\ Precedent)$.¹⁰

To determine the rate of depreciation, we examine the change in the predicted frequency of citation as a case ages. We then test whether the baseline depreciation rate varies by the hypothesized factors by statistically interacting each independent variable with the fractional polynomial for *Age of Precedent*. To be clear, we include each of the “constituent” variables in the model (e.g., *Constitutional Precedent*), as well as an interaction term between each variable and the fractional polynomial for *Age of Precedent*.¹¹ It is necessary to include all of these variables in order to assess correctly the conditional effects we seek to uncover (see Brambor, Clark, and Golder 2006). Table 1A summarizes how we operationalized each of the independent variables for the Supreme Court dependent variable, and Table 1B does so for the additional variables included in the U.S. Courts of Appeals model. Table 2 provides descriptive statistics for these variables.

[TABLES 1A, 1B, & 2 ABOUT HERE]

In addition to our substantive variables of interest, we included four variables to control for variability in the opportunity for a case to be cited in a given year and to account for changes in citation practices over time, which if left unaddressed could lead to autocorrelation and/or heteroskedasticity (see Beck 2001). We describe these variables’ measures in Table 1A and Table 1B, and they are the following: *Total Number of Precedents*, or the total number of prior Court cases available to be cited in a year; *Total Yearly Citations*, which, since it is based on the total number of citations in all majority opinions in a year, controls simultaneously for the

¹⁰ Repeated powers are permitted in a fractional polynomial approach, and the second variable in the polynomial of a repeated power is transformed as a log of the first power.

¹¹ We could alternatively interact each variable only with the first term of the polynomial for *Age of Precedent*. We interact each independent variable with all four terms of the polynomial to allow the effect of each variable to itself change in a nonlinear way as a case ages.

number of majority opinions released in a given year and the frequency of citation within them¹²; *Issue Area Activity*, which controls for the degree to which the Supreme Court, in any given year, releases opinions dealing with the same subject matter as a precedent¹³; and *Precedent Previously Overruled*, which equals one if the precedent had been previously overruled by the Supreme Court.¹⁴ We also interacted each of these variables with the fractional polynomial for *Age of Precedent*.¹⁵

With cross-sectional-time-series data, one must address within-cluster (in our case, precedent) dependence (error correlation) over time. To do so, we used a Generalized Estimating Equation model (GEE) that directly captures within-precedent dependence over time by specifying the covariance structure across time (see Zorn 2001; Rabe-Hesketh and Skrondal 2008, 200-203). Specifically, we used a population average GEE model (with an autoregressive residual structure in the form of an AR(1)), which allows within-precedent correlation over time to geometrically decline in lag length. We also utilized robust standard errors, clustered on each precedent, to further control for within-precedent dependence over time. Our dependent variable for Supreme Court citations is dichotomous, and we therefore used GEE logistic regression to estimate the parameters of interest, and the dependent variable in the Courts of Appeals model is a count, and we therefore used a GEE negative binomial regression model.

¹² Obviously, we measured this variable differently for the two dependent variables, and it is the number of total cites at the Supreme Court for the Supreme Court dependent variable and the total number of cites to all cases in the U.S. Courts of Appeals for the Courts of Appeals dependent variable.

¹³ As this variable pertains solely to the Supreme Court, we did not include it in the Courts of Appeals model.

¹⁴ We also tested for whether precedents that have been legislatively overridden by Congress depreciate more quickly. We did not include this variable in the main analysis because we have data for it from Hansford and Spriggs (2006) for only part of the time period in this study (for cases decided between the 1946 and 1999 Terms). We find there is no discernible difference in depreciation based on this variable.

¹⁵ Multicollinearity does not pose a problem for our analysis. Multicollinearity arises when one does not have enough independent information for each independent variable (due to shared variation among them), and the effect of multicollinearity is to make the standard errors less efficient (meaning they are larger) but coefficients remain unbiased. As one can see in the noninteractive models in Table 3, nearly every variable is statistically significant and in the direction anticipated by prior theory. As a result, multicollinearity in the non-interactive model is not problematic. In addition, as a general rule including multiple interaction terms in a model does not induce multicollinearity problems (see Friedrich 1982, 803; Brambor, Clark, and Golder 2005, 70).

Finally, since they are of recent origin, we describe two of our measures of the citation history of a case, *Inward Case Relevance* and *Outward Case Relevance*. Each is a measure of the “centrality” of a case (see Scott 2000, 83-94), meaning how influential and legally relevant a case is in the overall network of all Supreme Court case law. Fowler et al. (2007) created these measures by applying network theory to the Court, where they considered each Court opinion as a node in the network and each citation from one case to another as a link. The combination of all nodes (cases) and links (citations) forms the network of relationships among Court cases. Their approach emphasizes that: (1) law can be conceptualized as an interconnected set of legal rules resulting from the repeated use and interpretation of those rules in different cases over time; and (2) one cannot understand the full meaning of a case in isolation from the other cases to which it is related.

Fowler et al. (2007) developed a way to determine which cases are most central or relevant in the Court network by using a network analytic technique that takes advantage of the number and “quality” of citations within and between cases. One reason why citations are meaningful is that a citation from one case to another indicates the precedent has a connection to the present legal dispute and continues to possess relevance for deciding current legal questions. *Inward Case Relevance* is based on the number of subsequent citations to a case by the U.S. Supreme Court, where each citation is weighted by how outwardly legally relevant those citing cases are in the Supreme Court network. That is, *Inward Case Relevance* starts with the most commonly-used measure of case centrality in the precedent citation literature--the number of citations to a case (see Hansford and Spriggs 2006; Kosma 1998; Landes and Posner 1976)--and then weights each citation by information regarding its continuing importance at the Court. This measure therefore uses information on the importance of the citing cases to improve the estimate

of the importance of the cited case. Precedents with a high value of inward relevance are those seen as “influential” in the law because they are cited frequently by Supreme Court cases that are themselves central to the network of law at the Court (Fowler et al. 2007, 331).

Outward relevance, by contrast, examines how important or central the cases cited within a given Supreme Court precedent remain over time at the Court. This measure starts with the number of precedents cited by a given case, and weights each cited case by how inwardly legal relevant it remains in the network of Court law. A precedent with high outward relevance will *itself* cite important Court cases, and it thus captures how “legally grounded” a case remains in the sense that its legal reasoning continues to be based on cases that are legally influential. Both of these measures vary over time based on changes in the patterns of citations to a case and between it and other cases.

V. RESULTS

In what follows, we first describe the results from our model of the depreciation of Supreme Court cases in the network of Supreme Court case law, and we then discuss the analogous results for the depreciation of Supreme Court precedent in the U.S. Courts of Appeals. We report the results of the noninteractive models, which calculates the baseline rate of depreciation, in Table 3. Because the model with interaction terms between the fractional polynomial for *Age of Precedent* and our other covariates contains several dozen parameters and many of them are interactive terms, whose statistical and substantive significance cannot be assessed from a standard table of results (Kam and Franzese 2007; Ai and Norton 2003), we present that table of results in an online appendix. The most effective way to analyze and present the interactive results--which determines whether a factor speeds or retards the pace of depreciation--is through graphs that depict predicted probabilities (and confidence intervals)

based on the interactive effect of precedent age and an independent variable.¹⁶ We provide a sampling of these graphs in the paper and place the full set of graphs for every independent variable in an online appendix.¹⁷

[TABLE 3 ABOUT HERE]

A. Depreciation of Supreme Court Precedent in the U.S. Supreme Court

We begin with a look at the baseline rate at which precedents depreciate, as seen in Figure 1.¹⁸ The top panel displays the predicted probability (with a 95 percent confidence interval) of a case being cited in a given year, conditional on its age.¹⁹ The downward slope in the top panel shows the likelihood of citation substantially decreases as a case ages. We make this comparison explicit in the bottom panel of Figure 1, which displays the marginal effect of a five-year increase in a precedent's age, conditional on how old the precedent already is.²⁰ The bottom panel shows the rate at which a case depreciates is decreasing over time, as well. That is, while a case is most likely to be cited immediately after it is decided, that is also the period of time during which the pace of depreciation is the greatest. As the panel makes clear, while the

¹⁶We generate predicted probabilities and confidence intervals using stochastic simulations (see Brambor, Clark, and Golder 2006; King, Tomz, and Wittenberg 2000). For each of the variables of interest presented in Tables 1A and 1B, we performed simulations to determine whether and by how much they influenced the rate of depreciation as seen through the effect of age on the likelihood that a particular precedent is cited. We then graphed and visually examined these results to determine whether, by how much, and with what level of statistical confidence a particular variable conditioned the magnitude of the effect of precedent age.

¹⁷The full set of tables and figures are available at <http://XXX>.

¹⁸We calculated these probabilities and confidence intervals based on the GEE logit model reported in Table 3. To calculate predicted probabilities, we hold all other variables constant at their means (or modal values for dichotomous variables) and vary the value of the independent variable of interest.

¹⁹One might be concerned that our estimates for depreciation for large values of age are problematic because the number of cases available for a given value of age decreases as age rises. Only for the maximum value of *Age of Precedent* do we have a small number of case observations; and we have only 25 cases for the precedent age = 59 because our analysis starts with the 1946 Term and only 25 cases were decided by the Court in 1946. However, for any other large value of precedent age we have a reasonably large number of cases representing it: we have 156, 269, 396, 483, and 577 cases in our estimation sample for *Age of Precedent* equal to 58, 57, 56, 55, and 54, respectively. One should also recognize that our simulation analysis for generating predicted probabilities takes uncertainty due to sample size into consideration, and we therefore report point predictions and confidence intervals.

²⁰The x-axis in the bottom panel of Figure 1 presents the *baseline* age for the marginal effect; for example, the value of “5” on the x-axis corresponds to the change in probability experienced as a precedent goes from 5 to 10 years of age.

effect of going from zero to five years of age results in a 0.25 decrease in the probability of citation, going from fifteen to twenty years of age results in only a 0.04 probability decrease. In sum, we show that precedents depreciate rather quickly at the Supreme Court, and markedly so in the first two years after being decided, and that the pace of depreciation levels off when a precedent is in its mid-twenties.²¹

[FIGURE 1 ABOUT HERE]

Our goal in this paper is to move beyond the baseline rate observed in Figure 1 and understand whether certain factors alter this general pattern of precedent depreciation. As described above, we estimated a statistical model that includes each of the variables presented in Table 1A and an interaction term between each of them with the fractional polynomial for *Age of Precedent*. This formulation allows us to examine how a given independent variable affects the pace of depreciation by altering the relationship between precedent age and the rate of citation.

An example illustrates. In Figure 2, we examine whether a precedent's status as a constitutional or statutory decision alters the pace of depreciation. The arguments made in the literature give us good reason to suspect a difference. In particular, scholars suggest *stare decisis* is stronger in statutory decisions, which implies statutory precedents should depreciate more slowly than their constitutional counterparts.

In Figure 2, we examine whether this feature of a precedent affects depreciation. Before doing so, we note that one can also view whether a given independent variable affects the probability of citation. In the top panel of the figure, one can observe the frequency of citation for any given value of precedent age, and the gray shaded area indicates whether the intercepts

²¹ We also tested whether the observed depreciation (i.e., the effect of precedent age on citation rates) was an artifact of membership turnover on the Court. Specifically, we included a variable that was a count of the number of Justices serving on the Court in a given year who were on the Court when the precedent was decided (see Spriggs and Hansford 2001). The depreciation rate, as seen in Figure 1, is not materially different after controlling for this additional effect.

between the two lines (in Figure 3, for constitutional and statutory precedents) are statistically different from one another. The data indicate statutory precedents are slightly more likely to be cited, but only when they are between approximately five and 20 years of age.

To examine depreciation, one compares the slopes of the lines between any two values of precedent age. The bottom panel in each figure makes this comparison explicit by graphing the marginal effect of a five-year increase in age separately for constitutional and statutory precedents. The gray shaded area in the bottom panel represents the range for which the difference between the two marginal effects is statistically significant. This bottom panel thus allows one to see directly whether the pace of depreciation (i.e., the marginal effect of a specific increase in *Age of Precedent*) differs due to an independent variable.

Perhaps the most striking feature of Figure 3 is the lack of difference between the two lines, as graphed explicitly in the bottom panel of the figure. If the hypothesis we suggested above had been accurate, we would expect the marginal effect of precedent age for statutory precedents to be persistently smaller than that for constitutional precedents. While the shaded region denotes the presence of a statistically significant difference, as the ordering of the lines make clear, we actually observe that statutory precedents depreciate *faster* than do their constitutional counterparts. Thus, there is no support for the argument that statutory precedents depreciate slower than constitutional ones.

[FIGURE 2 ABOUT HERE]

Of course, the discussion so far speaks only to one out of more than a dozen variables included in our analysis. Accordingly, we repeated this simulation and post-estimation process for each basic constituent term in our interactive model. The full table of statistical results and a figure for the conditional relationship between age and each variable in the analysis are available

in our online appendix. Broadly speaking, the pace of depreciation does not systematically vary as a function of many of the hypothesized variables. Only two variables affect the rate at which a precedent depreciates, and each relates to a case's citation history.²² Our conclusion is that Supreme Court precedents do not evidence much systematic variation in the manner by which they depreciate, other than as a function of their past citation history.²³

First, cases that remain ensconced in the network of Supreme Court law (as measured by *Inward Case Relevance*) depreciate at a slower rate than cases that do not. This result indicates, consistent with the speculation of others (Cross et al. 2007; Gerhardt 2008; Hathaway 2001) there is a certain degree of path dependency in the law and that the "history" of a case matters. We present this result in Figure 3, where one can see the marginal effect of precedent age on the probability of citation systematically varies by how inwardly legally relevant a case remains. As seen in the bottom panel of this figure, more legally central cases depreciate slower than other cases, though this effect persists only for about the first five years after a precedent is released.

Second, precedents that have been legally interpreted more often by the Court--meaning there is language in the citing case that potentially exerts a legal effect on the cited case--depreciate more slowly. One should note that the statistical model takes into account the past citation of a case by the Court. Precedents substantively interpreted by the Court are more likely

²² Technically, speaking two other variables, *Ideological Distance* and *Economics Precedent*, affect the rate of depreciation. Less ideologically distant cases depreciate at a slightly lower rate than do their more distant counterparts, but this effect is only statistically significant for about the first year or so after a case is decided (and actually results because, during that time period, High Distance precedents *appreciate* more than Low Distance ones). Likewise, cases relating to the economic activity age slower than do non-economics cases, but the difference is tiny and only exists in the year or two after a case is decided and when a precedent is between four and 13 years of age.

²³ For a series of variables, the pace of depreciation is opposite our prediction. For example, for a period of time, cases with a higher volume of amicus brief filings depreciate more quickly than those with a lower number of filings. This effect, however, is an artifact of a variable exerting an influence on the probability of citation (resulting in an intercept difference between, for instance "high" and "low" amicus filings, and this initial difference in the probability of a case being cited for a given value of age is ultimately canceled out by the indirect effect of the age of a precedent on this intercept difference. In other words, the variable is not actually influencing the pace of depreciation. One can see this result visually, for example, in Figure 9.

to be subsequently utilized by the Court and depreciate less quickly than other cases, above and beyond how often it is cited by the Court. In Figure 4, we observe a rather large intercept difference between the two lines in the top panel of the figure, indicating that, for any given precedent age, cases that have been interpreted more often have a higher probability of being cited. The difference in the slope of the two lines—showing the change in the likelihood of citation for any two values of precedent age—captures depreciation, as seen in the bottom panel of the figure. For about the first 11 years after being decided, cases more often legally treated by the Court depreciate less quickly.

[FIGURES 3 & 4 ABOUT HERE]

These results, of course, are in one sense not surprising, as the measures are based on how a case has been previously cited and legally treated by the Court. One could thus interpret this relationship as merely showing the past influences the future. While this is obviously somewhat true (and we cannot truly rule out the possibility of endogeneity and thus a spurious relationship in this setting) one should recognize two points. First, at the core of any theory of stare decisis is the idea that history matters in that the past, or the law as articulated in previously decided cases, is related to the way present disputes are decided. While our data do not test that specific claim, they nonetheless demonstrate a certain degree of stability in the law. Second, it is essential to recognize that our data show that history does not *always* matter. The relationship between a precedent's citation history and later citation is itself conditioned by precedent age in that the effect of *Inward Case Relevance* decays as a case gets older. The citation history of a case, in short, does not always matter, and its effect depends on how old a case is.

B. Depreciation of Supreme Court Precedent in the U.S. Courts of Appeals

This section reports the results for our Court of Appeals dependent variable, which is a count of the number of times the U.S. Courts of Appeals cite a Supreme Court precedent in a year. The baseline rate of depreciation is similar to that for the U.S. Supreme, and cases depreciate about 72% during the first ten years of their lives (see Figure 5). Consistent with the results for the Supreme Court model, only two variables-- *Inward Case Relevance* and *Total Prior Supreme Court Interpretations*--affect how a precedent depreciates. We report the full regression table and a figure for each independent variable in our online appendix, and here we provide graphical illustrations for a representative set of variables.

[FIGURE 5 ABOUT HERE]

Figure 6 depicts whether depreciation varies by the legal basis of a decision (statutory versus constitutional). As is abundantly evident in this figure, there is no difference between the rate of depreciation of these precedents—there is no change in the slope of the effect of age for statutory versus constitutional precedents. There is thus no empirical confirmation for this hypothesis.

In Figure 7, by contrast, we observe a reasonably strong effect for *Inward Case Relevance* on the rate of depreciation. Recall that this variable measures the degree to which a case remains embedded in the network of law at the U.S. Supreme Court and thus shows that if a case is influential at the Supreme Court then it depreciates more slowly at the U.S. Courts of Appeals. Importantly, this result is based on a model that also controls for the centrality and authority of a case in the U.S. Courts of Appeals. We observe that more influential precedents at the Supreme Court depreciate at a slower pace, but only for about the first four years of their lives. In addition, the data also indicate cases which have been legally interpreted by the

Supreme Court at a high level depreciate at a substantially slower rate for about the first five years of their lives.²⁴

[FIGURES 6 & 7 ABOUT HERE]

C. An Implication for Modeling the Frequency of the Citation of Precedent

By changing our focus from the depreciation of precedent (i.e., the change in the probability of a case being cited as it ages) to the frequency of citation (i.e., the probability of a case being cited for a given value of age), we uncover an additional result new to the literature—previous research inaccurately characterizes the effect of nearly all independent variables used to explain citation rates. As parameterized in earlier studies, the estimated effect of a variable on the frequency of citation in a year was assumed to be constant across time. Our statistical approach allows us to question this assumption and our results show it is generally mistaken.

While earlier studies claim to show an effect of, for example, the length or breadth of a precedent on citation frequency, our results show these variables (and many others) diminish in magnitude as cases age.²⁵ As a precedent gets older, the overwhelming power of depreciation mutes any differences that initially existed between different types of precedents. As a result, by the time a precedent reaches its mid-twenties previously-important factors typically no longer exert the same type of effect. While there is variation in the length of time by which different

²⁴ In fact, until a case is seven years old, the citation rate actually increases for cases that have a high level of prior Supreme Court legal interpretations.

²⁵ The following variables manifest a statistically significant (two-tailed) relationship with the probability of a case being cited at the Supreme Court for at least some range of *Age of Precedent*: *Ideological Distance*, *Merits Vote Minimum Winning*, *Merits Vote Unanimous*, *Total Prior Supreme Court Interpretations*, *Precedent Previously Overruled*, *Breadth of Precedent*, *Constitutional Precedent*, *Common Law Precedent*, *Economics Precedent*, *Issue Area Activity*, *Precedent Amicus Briefs*, *Per Curiam Precedent*, *Separate Opinion Length*, *Majority Opinion Length*, *Footnote Ratio*, *Inward Case Relevance*, *Outward Case Relevance*, *Precedent Supreme Court Vitality*, *Total Yearly Citations*, *Total Number of Precedents*. For the Courts of Appeals dependent variable, the following variables have a statistically significant (two-tailed) correlation with the rate of citation: *Total Prior Supreme Court Interpretations*, *Precedent Previously Overruled*, *Breadth of Precedent*, *Common Law Precedent*, *Economics Precedent*, *Precedent Amicus Briefs*, *Per Curiam Precedent*, *Separate Opinion Length*, *Majority Opinion Length*, *Inward Case Relevance*, *Outward Case Relevance*, *Precedent Supreme Court Vitality*, *Circuit Court Vitality*, *Total Prior Circuit Court Interpretations*, *Total Yearly Citations*, *Total Number of Circuit Court Citations*, *Total Number of Precedents*.

variables cease to be important, with only a few exceptions, they lose much (if not all) of their systematic effect at some point in a precedent's age profile. What is more, even for those variables that remain statistically significant throughout the full range of *Age of Precedent*, we find that age leads to a significant dampening of the initial magnitude of any difference.

While the online appendix presents the results for all variables at both the Supreme Court and the Courts of Appeals, we pause to consider three representative examples of this general phenomenon. First, Figure 8 graphs, for the Courts of Appeals dependent variable, the influence of the length of the majority opinion in a precedent on citation rates. In the top panel of Figure 8, one can view the relationship between majority opinion length and the rate of citation for a given value of precedent age by comparing the height of the two lines (where the gray shaded region indicates whether there is a statistically significant difference between the two). One sees that longer opinions are initially more likely to be cited, but the size of the effect remains statistically significant for only about the first 15 years of a precedent's life. Thus, while opinion length initially matters, the influence of precedent age (i.e., depreciation) diminishes its effect.

[FIGURE 8 ABOUT HERE]

Second, even the role of the "history" of a case, depends on a precedent's age.²⁶ Consider how legally grounded an opinion remains as evidenced by the extent to which it cited precedents that themselves continue to be legally influential at the Court. Our analysis shows cases with greater *Outward Case Relevance* are substantially more likely to be cited by the Supreme Court and the Courts of Appeals, but this relationship sharply diminishes in the age of a

²⁶ The exception to this generalization is *Total Prior Supreme Court Interpretations* in the Supreme Court model, for which we observe a substantively large and statistically significant difference throughout the entire range of *Age of Precedent* (see Figure 4).

case. Figure 9 depicts this pattern for the Courts of Appeals' citation of Supreme Court precedent.²⁷

[FIGURE 9 ABOUT HERE]

Our other measure of the network centrality of a case, *Inward Case Relevance*, also manifests a conditional relationship with precedent age. Recall that this measure indicates how legally influential a case remains at the Supreme Court, as viewed by the degree to which a larger number of important cases have cited it. As seen in Figure 3, *Inward Case Relevance* at first has a strong association with case citations. This difference remains statistically significant throughout the full range of *Age of Precedent*, and its substantive magnitude diminishes somewhat over time. Unlike *Outward Case Relevance*, there is a reasonably big difference between cases of low and high *Inward Case Relevance* even when a precedent is quite old.

Simply put, previous accounts regarding the role of nearly all variables on the citation of precedent are, at best, incomplete. While those variables affect the rate of citation in the years immediately after a precedent is decided, the magnitude of these effects generally decreases with time and either disappears altogether or becomes substantially weakened.

VI. CONCLUSION

Precedents are a central element in the American legal system, articulating legal principles that provide decision makers with information allowing them, within various constraints, to determine appropriate courses of action. A case's ability to offer this informational role, however, is not static and can change over time. In particular, a sizable body of writing by scholars and judges suggests precedents depreciate as they age. The literature also advances a variety of hypotheses regarding why some precedents depreciate faster or slower than

²⁷ While this relationship remains statistically significant throughout the whole range of *Age of Precedent* in the Supreme Court model, the substantive magnitude of the effect goes from a substantial one for young precedents to a small one by the time a precedent is in its mid-30's.

others, including ideological considerations, characteristics of precedents, and the “history” of the citations within and between precedents. While previous studies examine the relationship of some of these variables with citation rates, they do not determine whether those factors actually influence the pace at which precedents depreciate.

Our objective was to provide a rigorous empirical treatment of this important legal phenomenon. We do so through the use of a cross-sectional time series analysis of the U.S. Supreme Court’s and U.S. Courts of Appeals’ citation of Supreme Court precedents decided between the 1946 and 2004 Terms. Like others (e.g., Landes and Posner 1976, 1980), we measure depreciation as a change in the frequency with which a case is cited as a function of its age. To test explicitly for whether and to what extent depreciation varies for the reasons we hypothesized, we examined the interactive relationships between precedent age and the other independent variables.

Our results provide considerable illumination to this issue. They indicate, first, that precedents undergo a stark process of depreciation in that as a precedent becomes older the likelihood of it being cited by federal appellate courts drops precipitously. Second, our analysis shows the depreciation of precedent is not influenced by most of the factors discussed in the literature. Indeed, the only variables to affect depreciation pertain to the previous citation “history” of a case. Cases that are more central to the network of law at the Court--as observed through the past citation patterns regarding a case--depreciate at a slower rate. But, even this relationship is strongly conditioned by the age of a case; for example, as a case becomes older, *Outward Case Relevance* loses much of its ability to insulate a precedent from the general effect of the aging process.

Third, our results offer a key implication for studies of the citation of precedent. They indicate past studies mischaracterize the influence of nearly all variables on the likelihood of a case being cited in an opinion. Existing research has not recognized that the effect of these variables strongly depends on the age of a case. That is, nearly all of the variables used to explain citations become less powerful as cases age, meaning the process of depreciation ultimately mutes much of their effects. For instance, our results show that the effect of majority opinion length is strongly conditioned by the age of precedent--while precedents are initially more likely to be cited if the precedent contains more language, this effect becomes smaller over time.

In summary, our study builds on the literature regarding the citation of precedent in the United States. The law, and the legal rules that comprise it, change in part as precedents are cited in court opinions. Judges' choices to reduce or eliminate citations to cases, which results observationally in the depreciation of precedent, can thus influence the shape the law takes. The results of this study therefore provide new information about the process by which precedents become less relevant for structuring legal outcomes and offer an enhanced understanding of the process by which law changes over time.

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Table 1A: Independent Variable Measures In Model with Supreme Court Dependent Variable

Independent Variable	Measure
Ideological Distance	Absolute value of difference in Martin and Quinn (2002) Justice ideology scores between median Justice in the majority opinion coalition of the precedent and the median Justice on the Court in each subsequent year. ²⁸
Merits Vote Unanimous	Was the final vote unanimous (i.e., 9-0 or 8-0) (0 = No; 1 = Yes)? [Spaeth 2007] ²⁹
Merits Vote Minimum Winning	Was the final vote decided by a margin of one vote (0 = No; 1 = Yes)? [Spaeth 2007]
Precedent Previously Overruled	Was precedent previously overruled by another Supreme Court decision (0 = No; 1 = Yes)?, as taken from Fowler et al.(2007), who collected it from <i>Shepard Citations</i> , and as updated by us (see footnotes 4 and 7).
Breadth of Precedent	The total number of legal issues in a case and the number of legal provisions interpreted by the Court in a case. We collected the data from Spaeth (2007).
Constitutional Precedent	Was basis for precedent constitutional or statutory? 1 = Constitutional; 0 = statutory, as taken from Spaeth (2007).
Common Law Precedent	Was basis for precedent common law or review of administrative action? (1 = Yes; 0 = No), as taken from Spaeth (2007).
Economics Precedent	Equals 1 if the case involved an economic issue and the interpretation of a federal statute (includes all cases in Spaeth’s “value” area of Economics, Unions, or Federal Taxation), from Spaeth (2007).
Issue Area Activity	A count of the number of majority opinions released in a given year (from Fowler et al. 2007), and as updated by us (see footnote 4) that is in the same broad issue area as the precedent (based on Spaeth’s (2007) “value” variable).
Precedent Amicus Briefs	Term-standardized score for level of amicus curiae briefs filed on the merits, as taken from Hansford and Spriggs (2006) and Hansford and Johnson (2008). ³⁰
Per Curiam Precedent	Was case decided by an unsigned (per curiam) opinion (0 = No; 1 = Yes)? These data are from Spaeth (2007).
Age of Precedent	A fractional polynomial of order four based on the number of years since a precedent was decided (see text for a detailed description).
Majority Opinion Length	Total number of words in the majority opinion portion of

²⁸ The Martin and Quinn judicial ideal point estimates are available at <http://www.mqscores.wustl.edu>.

²⁹ The U.S. Supreme Court Judicial Database is available at <http://www.cas.sc.edu/poli/juri/sctdata.htm>.

³⁰ The score equals the following: (the number of briefs filed in case X-average number of briefs filed in all cases decided in the same term as X)/ Standard deviation of number of briefs filed in same term as case X was decided.

	the precedent, from Black and Spriggs (2008).
Separate Opinion Length	Total number of words in the separate opinion portion of the precedent (unanimous decisions have a value of zero), from Black and Spriggs (2008).
Footnote Ratio	Proportion of words in majority opinion that were contained in footnotes, from Black and Spriggs (2008).
Inward Case Relevance	Inward relevance score of a precedent in the previous year, as measured by Fowler et al. (2007). ³¹
Outward Case Relevance	Outward relevance score of a precedent in the previous year, as measured by Fowler et al. (2007).
Total Prior Supreme Court Interpretations	Total number of previous times a majority opinion of the Court legally interpreted a precedent, as taken from <i>Shepard's Citations</i> and available from Fowler et al (2007) and as updated by us (see footnotes 4 and 7). ³²
Precedent Supreme Court Vitality	A one year lag of the total number times a precedent has been positively interpreted by the Supreme Court minus the number of times it has been negatively interpreted, as taken from <i>Shepard's Citations</i> and Fowler et al (2007) , as updated by us (see footnotes 4 and 7). ³³
Total Number of Precedents	The total number of Court precedents available to be cited by the Court, from Fowler et al (2007), as updated by us (see footnotes 4 and 7).
Total Yearly Citations	The logged value of the total number of citations by the Court in a given citing year, from Fowler et al (2007), as updated by us (see footnotes 4 and 7).

³¹ Data from Fowler et al. (2007) are available at <http://jhffowler.ucsd.edu/judicial.htm>. Our cleaned and updated version of the Fowler et al. (2007) data are available at <http://XXX>.

³² Legal interpretations include the *Shepard's* categories of Parallel, Follow, Distinguish, Criticize, Limit, Question, Overrule, and Overrule in Part.

³³ A positive interpretation includes the *Shepard's* categories of Parallel and Follow, while negative includes Distinguish, Criticize, Limit, Question, Overrule, and Overrule in Part.

Table 1B: Measures of Additional Independent Variables in Model with Courts of Appeals Dependent Variable³⁴

Independent Variable	Measure
Total Prior Circuit Court Interpretations	Total number of previous times a majority opinion of the Courts of Appeals legally interprets a precedent, as taken from <i>Shepard's Citations</i> and available from Fowler et al. (2007), as updated by us (see footnote 6).
Total Number of Circuit Court Citations	Total number of previous times a majority opinion of the Courts of Appeals cites a precedent, as taken from <i>Shepard's Citations</i> and available from Fowler et al. (2007), as updated by us (see footnote 6).
Circuit Court Vitality	A one year lag of the total number times a precedent has been positively interpreted by the Courts of Appeals minus the number of times it has been negatively interpreted, as taken from <i>Shepard's Citations</i> and available from Fowler et al. (2007), as updated by us (see footnote 6).
Total Yearly Citations	The logged value of the total number of citations by the Courts of Appeals in a given citing year, from Fowler et al. (2007), as updated by us (see footnote 6).

³⁴ The Courts of Appeals model includes all variables in the Supreme Court model but the following: the log of the total number of Supreme Court cites in a year (which we replace with the Courts of Appeals data), *Issue Area Activity* (which is inapplicable to the Courts of Appeals), and *Ideological Distance*. We exclude an ideological distance variable from the courts of appeals model because, given our unit of analysis, it would not test effectively the hypothesis. That is, we would have to aggregate the ideology of all courts of appeals judges in a year, which would gloss over the interesting variation across courts and within courts across panels.

Table 2: Descriptive Statistics

Variable	Mean	S.D.	Min	Max
Ideological Distance	0.733	0.581	0	4.421
Merits Vote Unanimous	0.355		0	1
Merits Vote Minimum Winning	0.202		0	1
Total Prior Supreme Court Interpretations	1.815	3.421	0	54
Precedent Previously Overruled	0.009		0	1
Breadth of Precedent	2.281	0.860	1	11
Constitutional Precedent	0.094		0	1
Common Law Precedent	0.392		0	1
Economics Precedent	0.256		0	1
Issue Area Activity	16.08	9.865	0	46
Precedent Amicus Briefs	0.010	1.006	-1.099	9.991
Per Curiam Precedent	0.080		0	1
Majority Opinion Length	3810	3007	2	65398
Separate Opinion Length	2205	3524	0	72287
Footnote Ratio	0.226	0.143	0	0.777
Inward Case Relevance	0.637	0.289	0.073	1
Outward Case Relevance	0.763	0.217	0.083	1
Precedent Supreme Court Vitality	-0.164	1641	-16	20
Total Yearly Citations	7.542	0.37	6.466	8.074
Total Number of Precedents	24708	1694	19948	26681
<i>Courts of Appeals Model Variables</i>				
Total Prior Circuit Court Citations	14.218	36.057	0	2698
Circuit Court Vitality	2.714	22.174	-208	2557
Total Yearly Citations	10.097	0.583	8.339	10.604
Total Number of Circuit Court Citations	76.055	182.473	0	9436

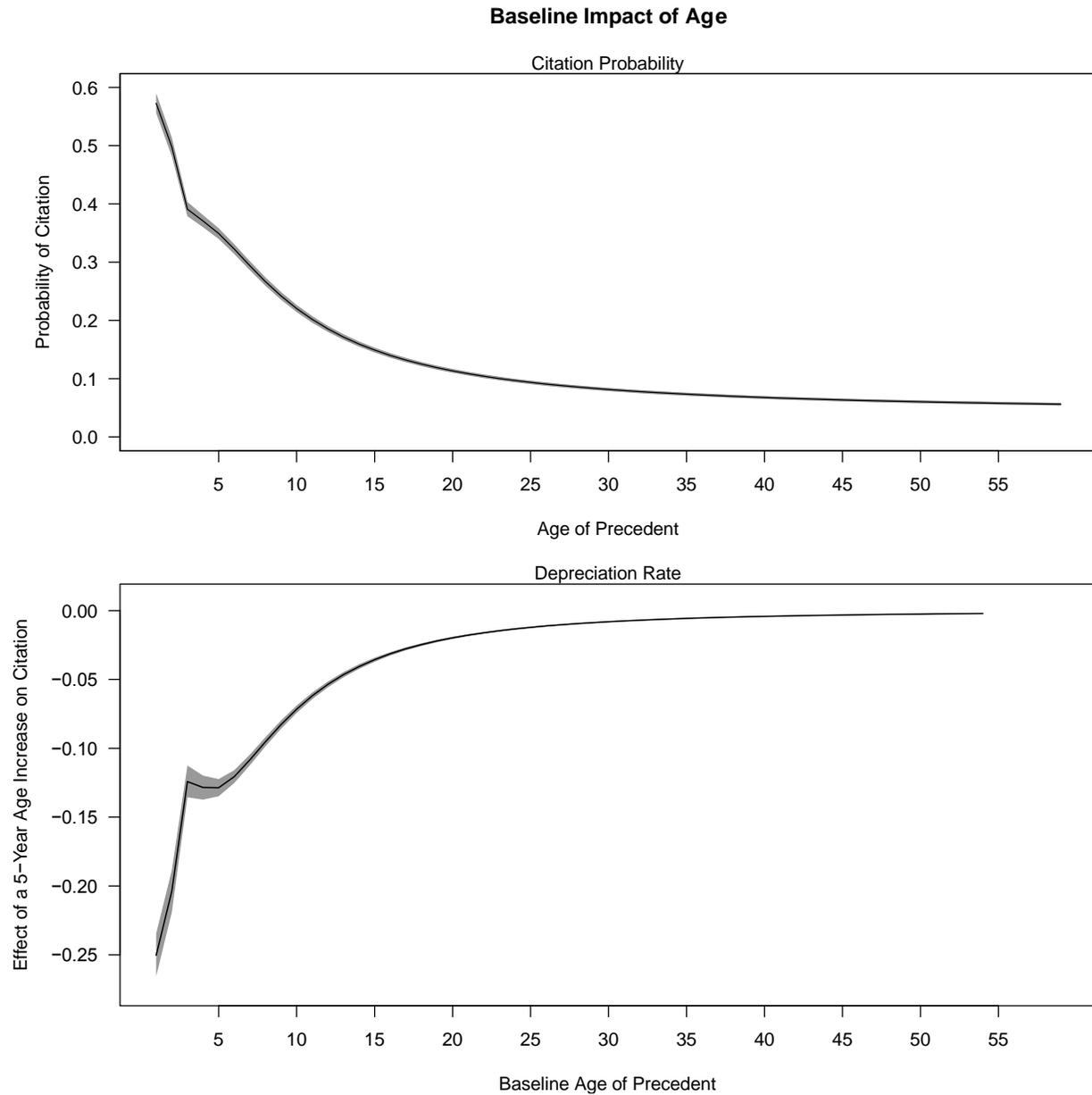
Table 3: Baseline Models of Depreciation

Variable	Supreme Court b/se	Courts of Appeals b/se
Age 1	3.46* (0.05)	-0.06* (0.001)
Age 2	20.56* (0.97)	0.03* (0.001)
Age 3	-26.46* (1.70)	-0.003* (0.0001)
Age 4	22.94* (0.81)	0.0005* (0.00002)
Ideological Distance	0.03* (0.01)	
Merits Vote Unanimous	0.07* (0.02)	0.01 (0.02)
Merits Vote Minimum Winning	-0.13* (0.02)	-0.02 (0.02)
Total Prior Supreme Court Interpretations	0.09* (0.002)	0.01* (0.003)
Precedent Previously Overruled	-0.36* (0.07)	-0.44* (0.08)
Breadth of Precedent	0.02* (0.008)	-0.03* (0.01)
Constitutional Precedent	-0.08* (0.02)	-0.08* (0.03)
Common Law Precedent	-0.08* (0.02)	-0.19* (0.03)
Economics Precedent	-0.05* (0.02)	-0.06* (0.03)
Issue Area Activity	0.008* (0.001)	
Precedent Amicus Briefs	0.05* (0.01)	-0.01 (0.01)
Per Curiam Precedent	-0.64* (0.04)	-0.80* (0.08)
Majority Opinion Length	0.00005* (0.000002)	0.00002* (0.000003)
Separate Opinion Length	0.00002* (0.000002)	0.000004 (0.000003)
Footnote Ratio	-0.24* (0.05)	-0.28* (0.07)
Inward Case Relevance	1.70* (0.04)	0.50* (0.03)
Outward Case Relevance	1.40* (0.06)	0.81* (0.08)

Precedent Supreme Court Vitality	0.02* (0.003)	0.006 (0.005)
Total Yearly Citations	0.71* (0.02)	1.25* (0.03)
Total Number of Precedents	-0.0001* (0.000005)	-0.0003* (0.00001)
Total Prior Circuit Court Interpretations		0.006* (0.0006)
Circuit Court Vitality		-0.007* (0.0007)
Total Number of Circuit Court Citations		0.008* (0.00009)
Constant	-8.62* (0.18)	-2.81* (0.17)
Observations	201,001	

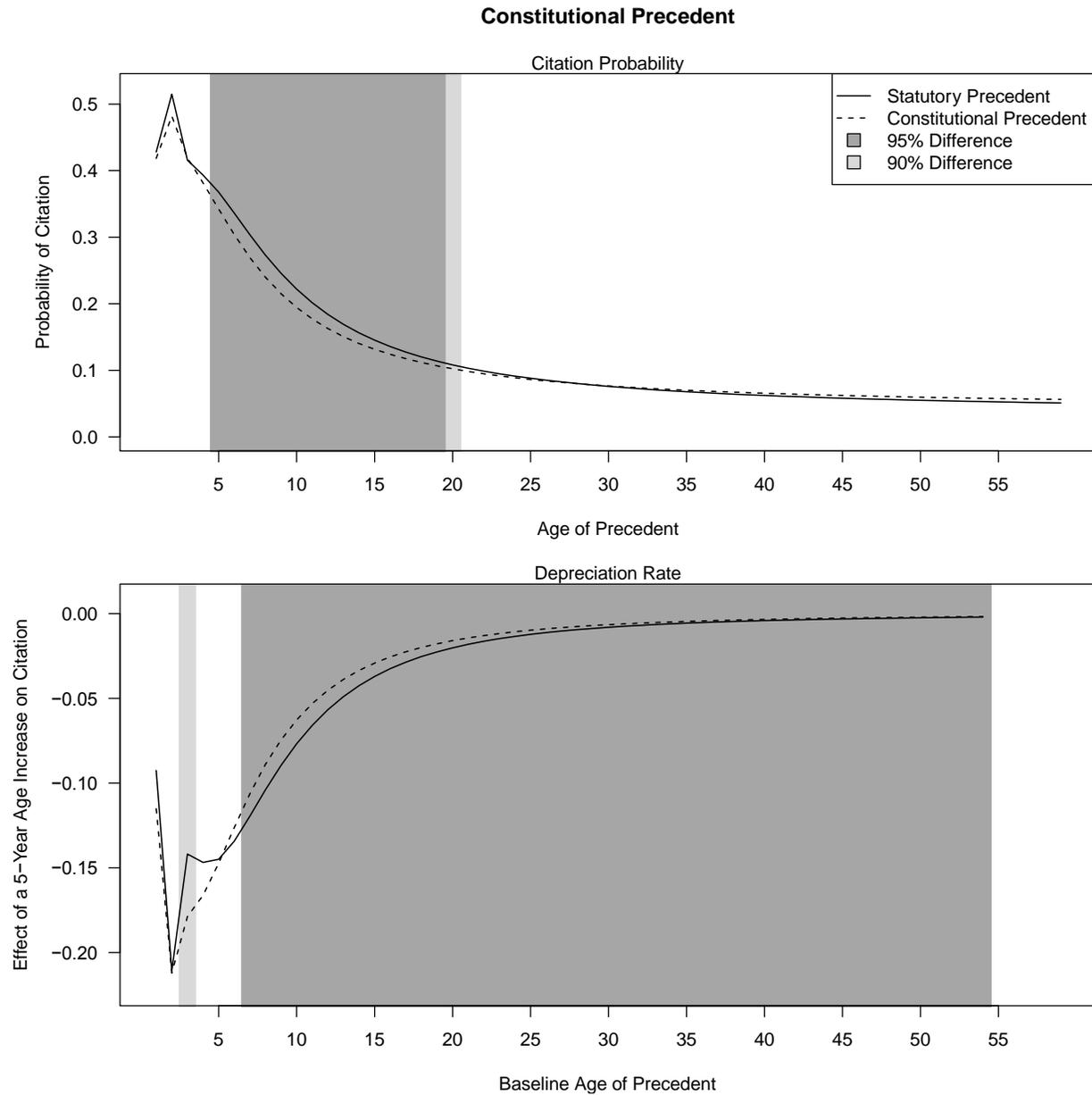
Note: Model estimates are from a population averaged GEE model with an AR(1) error structure. The dependent variable in the Supreme Court model is dichotomous and equals one if in a year the Court cited a given case; and we estimated it with a logistic regression model. The dependent variable in the Circuit Court model is a count of the number of cites in a year to a case, and the estimates for it are from a negative binomial regression model. * denotes $p < 0.05$ (two-tailed test). Age 1, Age 2, Age 3, and Age 4 correspond to a specific functional form for *Age of Precedent* estimated by the fractional polynomial modeling procedure described in the text.

Figure 1. The Baseline Rate of Precedent Depreciation at the U.S. Supreme Court



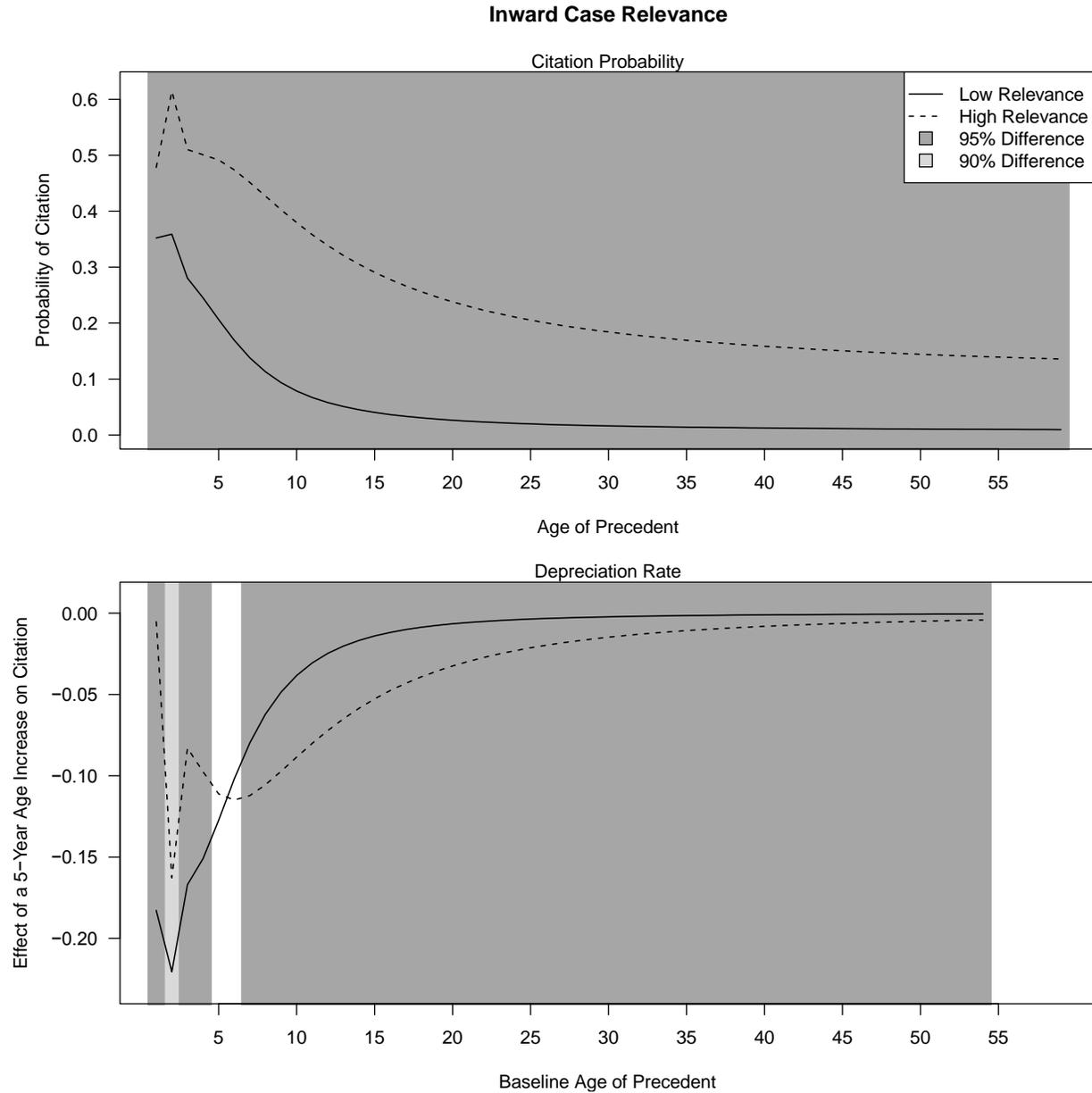
Note: The top panel presents the probability of a case being cited for a given value of *Age of Precedent*. The bottom panel plots the change in that probability for a five-year increase in age, meaning it plots the rate at which a precedent depreciates. The baseline age of a precedent is the “starting year” used in determining the impact of a five-year increase in age. Thus, a value of “5” corresponds to the marginal effect of going from 5 to 10 years of age on the probability of citation. Less negative values for a point in the bottom panel indicate a precedent has experienced greater depreciation during that five-year period.

Figure 2. The Influence of a Precedent's Legal Basis on Depreciation at the Supreme Court



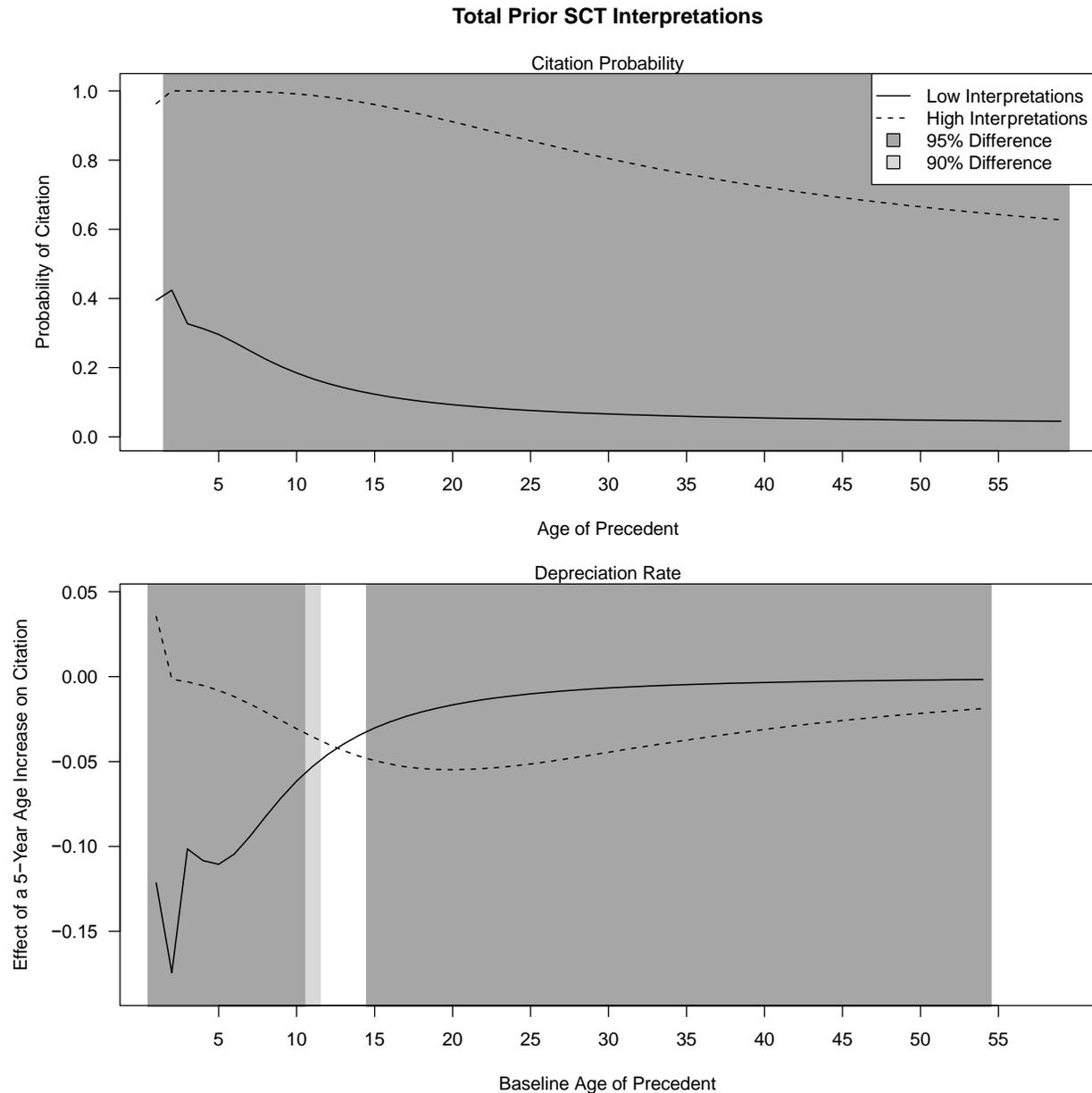
Note: One can examine two quantities of interest in the figure. First, one can view whether there is a difference between the probability of citation between the two lines for any given value of *Age of Precedent*. The dark and light gray regions indicate whether this intercept difference is statistically significant at the 95% and 90% level, respectively. To assess depreciation, one must compare the difference in the slopes of the lines in the top panel for any two values of precedent age. The bottom panel makes this comparison explicit by presenting the marginal effect for a five-year increase in age, or the change in the rate of citation over that five-year period. The baseline age of a precedent is the “starting year” used in determining the impact of a five-year increase in age. Thus, a value of “5” corresponds to the marginal effect of going from 5 to 10 years of age on the probability of citation.

Figure 3. The Influence of Inward Case Relevance on Depreciation at the Supreme Court



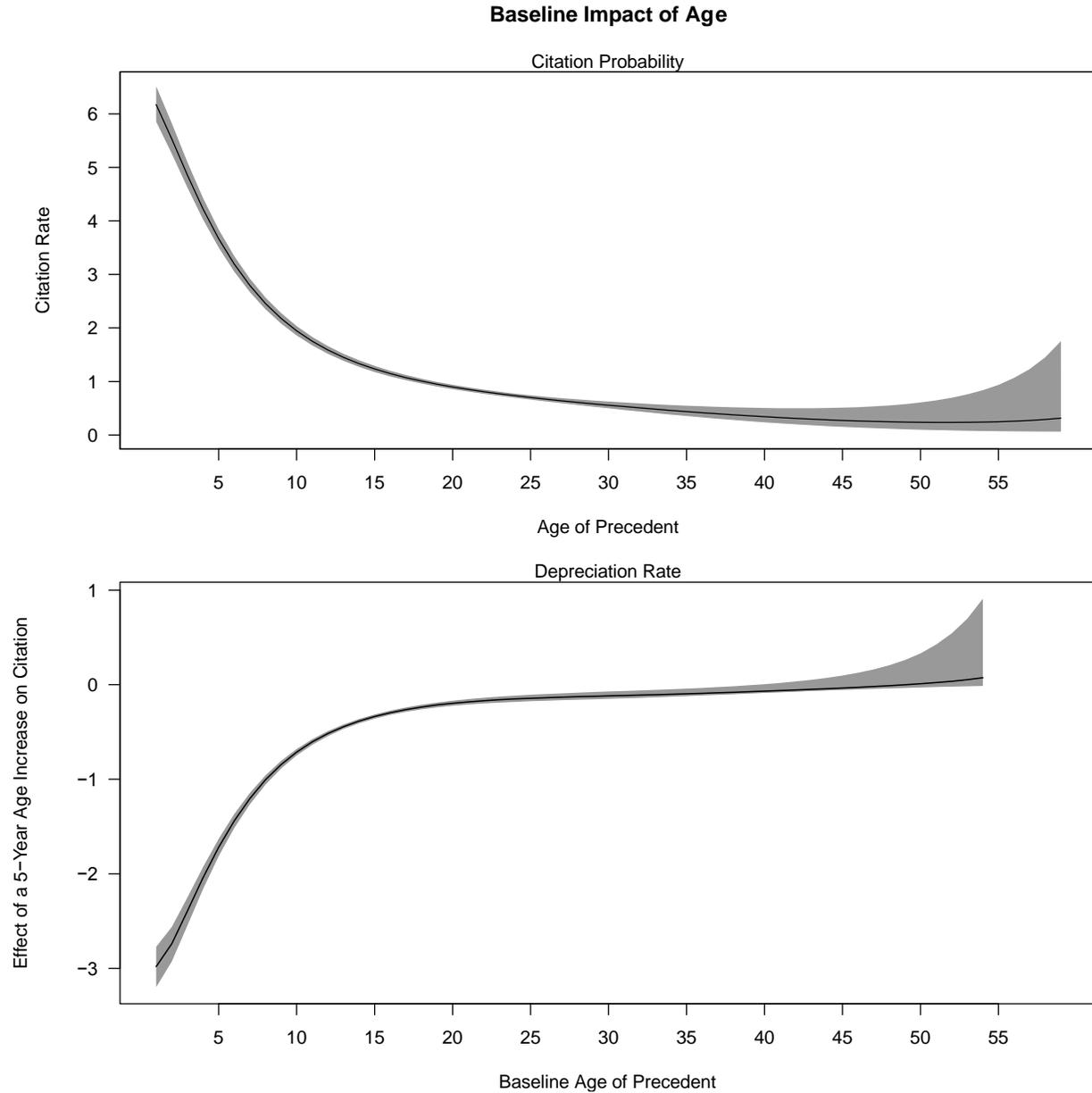
Note: One can examine two quantities of interest in the figure. First, one can view whether there is a difference between the probability of citation between the two lines for any given value of *Age of Precedent*. The dark and light gray regions indicate whether this intercept difference is statistically significant at the 95% and 90% level, respectively. To assess depreciation, one must compare the difference in the slopes of the lines in the top panel for any two values of precedent age. The bottom panel makes this comparison explicit by presenting the marginal effect for a five-year increase in age, or the change in the rate of citation over that five-year period. The baseline age of a precedent is the “starting year” used in determining the impact of a five-year increase in age. Thus, a value of “5” corresponds to the marginal effect of going from 5 to 10 years of age on the probability of citation. “Low” and “High” case relevance correspond to the sample minimum and maximum, respectively.

Figure 4. The Influence of Previous Supreme Court Interpretations on Depreciation at the Supreme Court



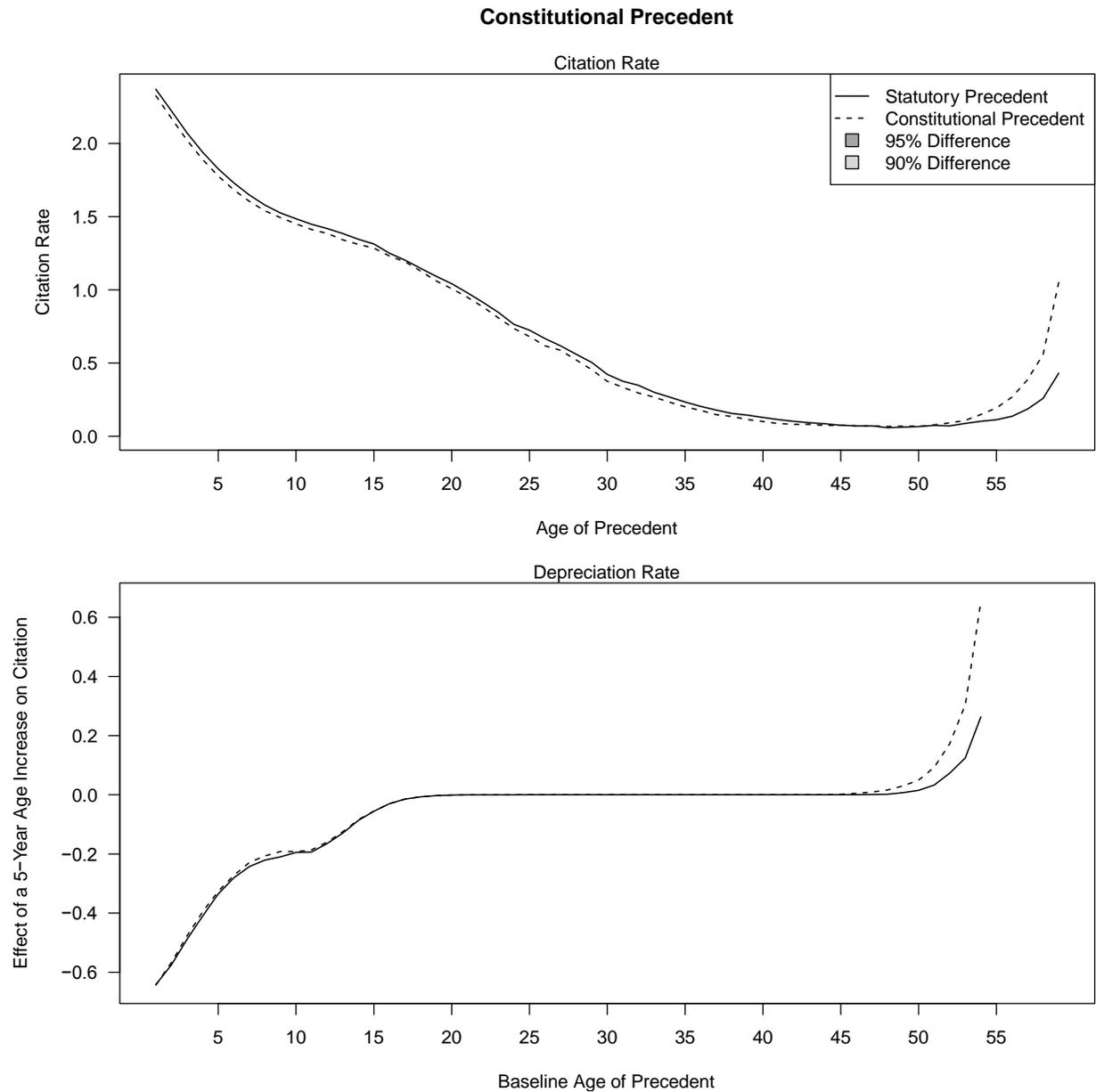
Note: One can examine two quantities of interest in the figure. First, one can view whether there is a difference between the probability of citation between the two lines for any given value of *Age of Precedent*. The dark and light gray regions indicate whether this intercept difference is statistically significant at the 95% and 90% level, respectively. To assess depreciation, one must compare the difference in the slopes of the lines in the top panel for any two values of precedent age. The bottom panel makes this comparison explicit by presenting the marginal effect for a five-year increase in age, or the change in the rate of citation over that five-year period. The baseline age of a precedent is the “starting year” used in determining the impact of a five-year increase in age. Thus, a value of “5” corresponds to the marginal effect of going from 5 to 10 years of age on the probability of citation. “Low” and “High” interpretations correspond to the sample minimum and maximum, respectively

Figure 5. The Baseline Rate of Precedent Depreciation at the Courts of Appeals



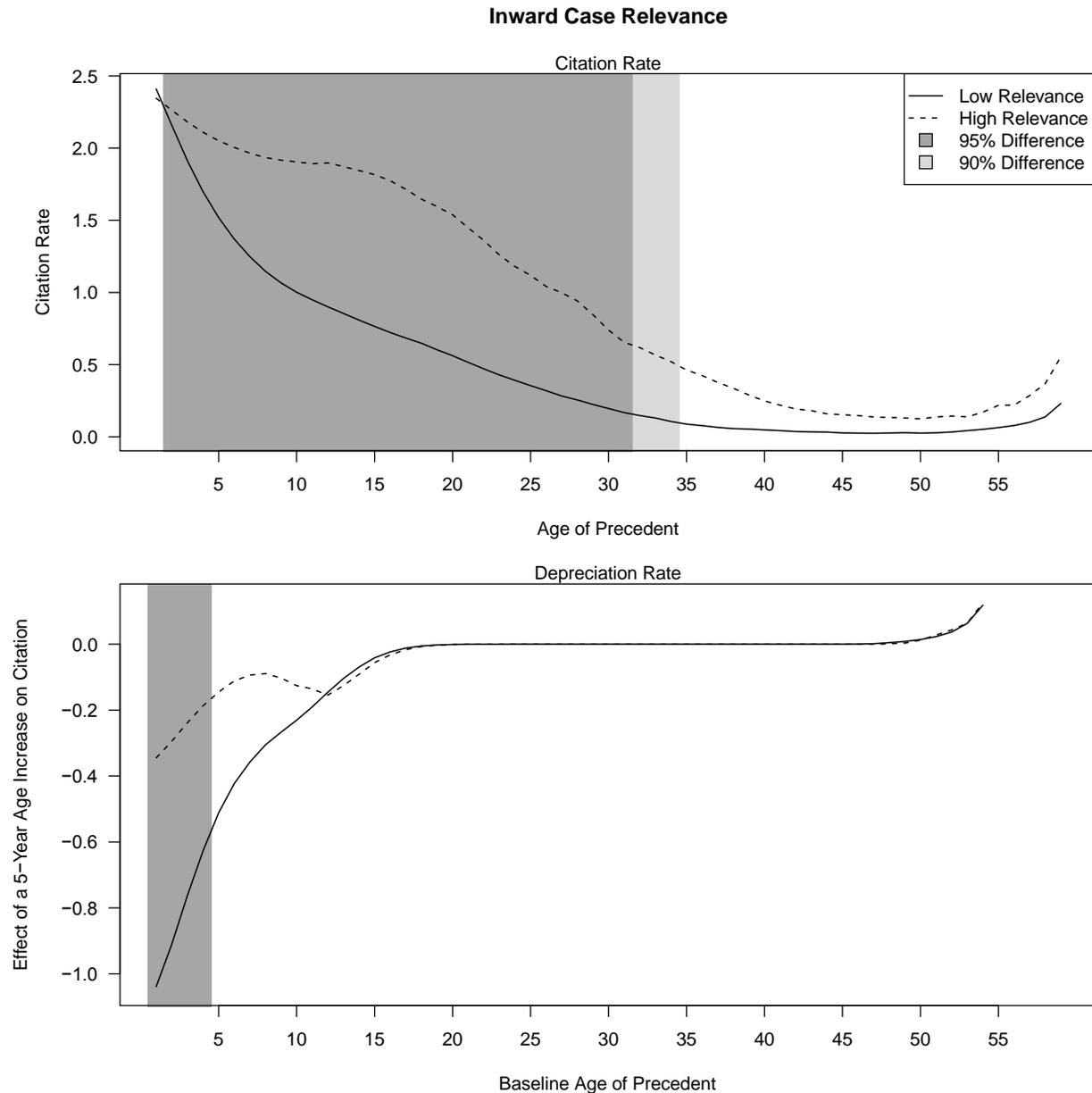
Note: The top panel presents the citation rate for a given value of *Age of Precedent*. The bottom panel plots the change in the rate of citation for a five-year increase in age, meaning it displays the rate at which a precedent depreciates. The baseline age of a precedent is the “starting year” used in determining the impact of a five-year increase in age. Thus, a value of “5” corresponds to the marginal effect of going from 5 to 10 years of age on the rate of citation. Less negative values for a point in the bottom panel indicate a precedent has experienced greater depreciation during that five-year period.

Figure 6. The Influence of the Legal Basis of a Decision on Depreciation at the Courts of Appeals



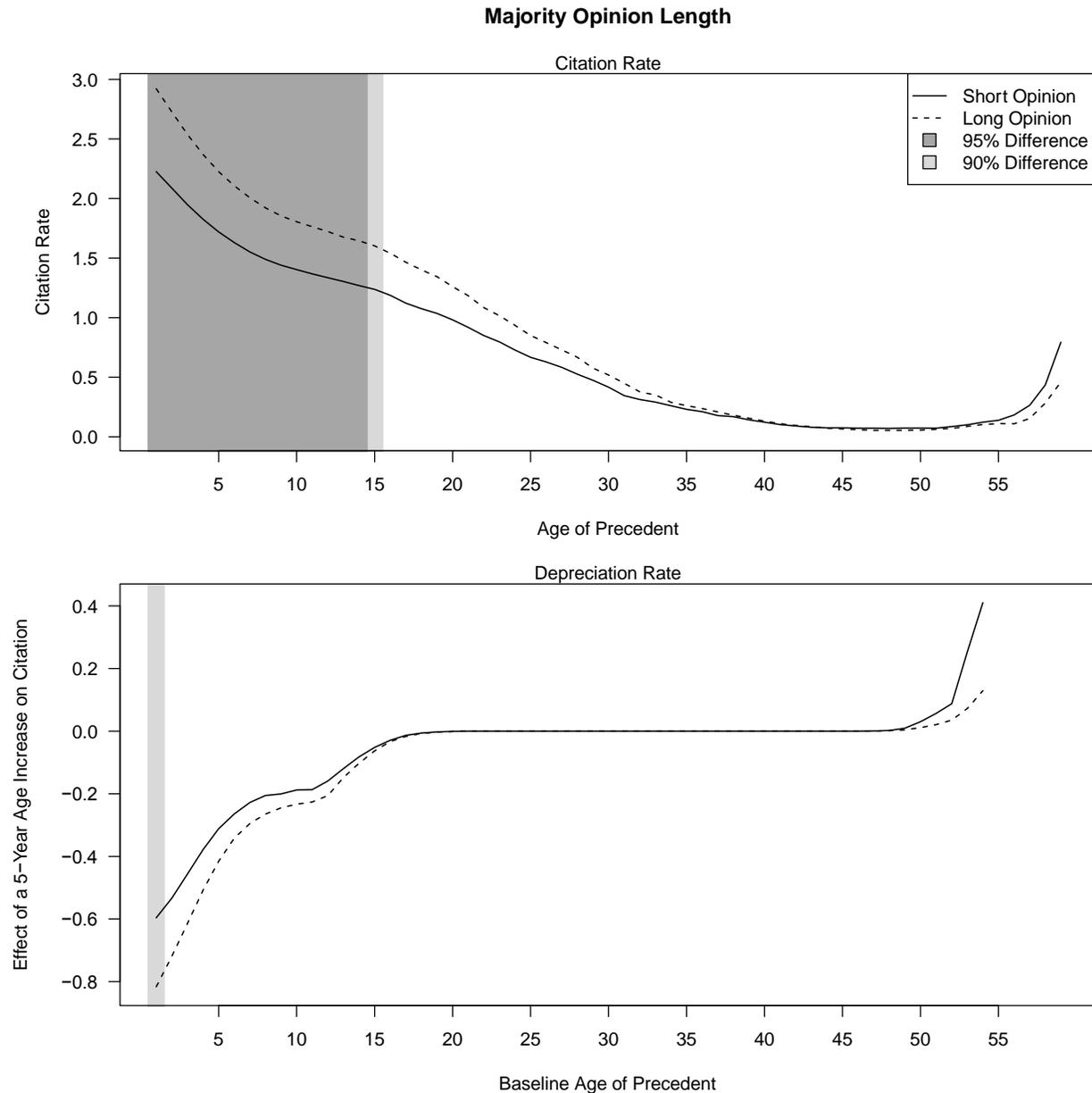
Note: One can examine two quantities of interest in the figure. First, one can view whether there is a difference between the rate of citation between the two lines for any given value of *Age of Precedent*. The dark and light gray regions indicate whether this intercept difference is statistically significant at the 95% and 90% level, respectively. To assess depreciation, one must compare the difference in the slopes of the lines in the top panel for any two values of precedent age. The bottom panel makes this comparison explicit by presenting the marginal effect for a five-year increase in age, or the change in the rate of citation over that five-year period. The baseline age of a precedent is the “starting year” used in determining the impact of a five-year increase in age. Thus, a value of “5” corresponds to the marginal effect of going from 5 to 10 years of age on the rate of citation.

Figure 7. The Influence of Inward Case Relevance on Depreciation at the Courts of Appeals



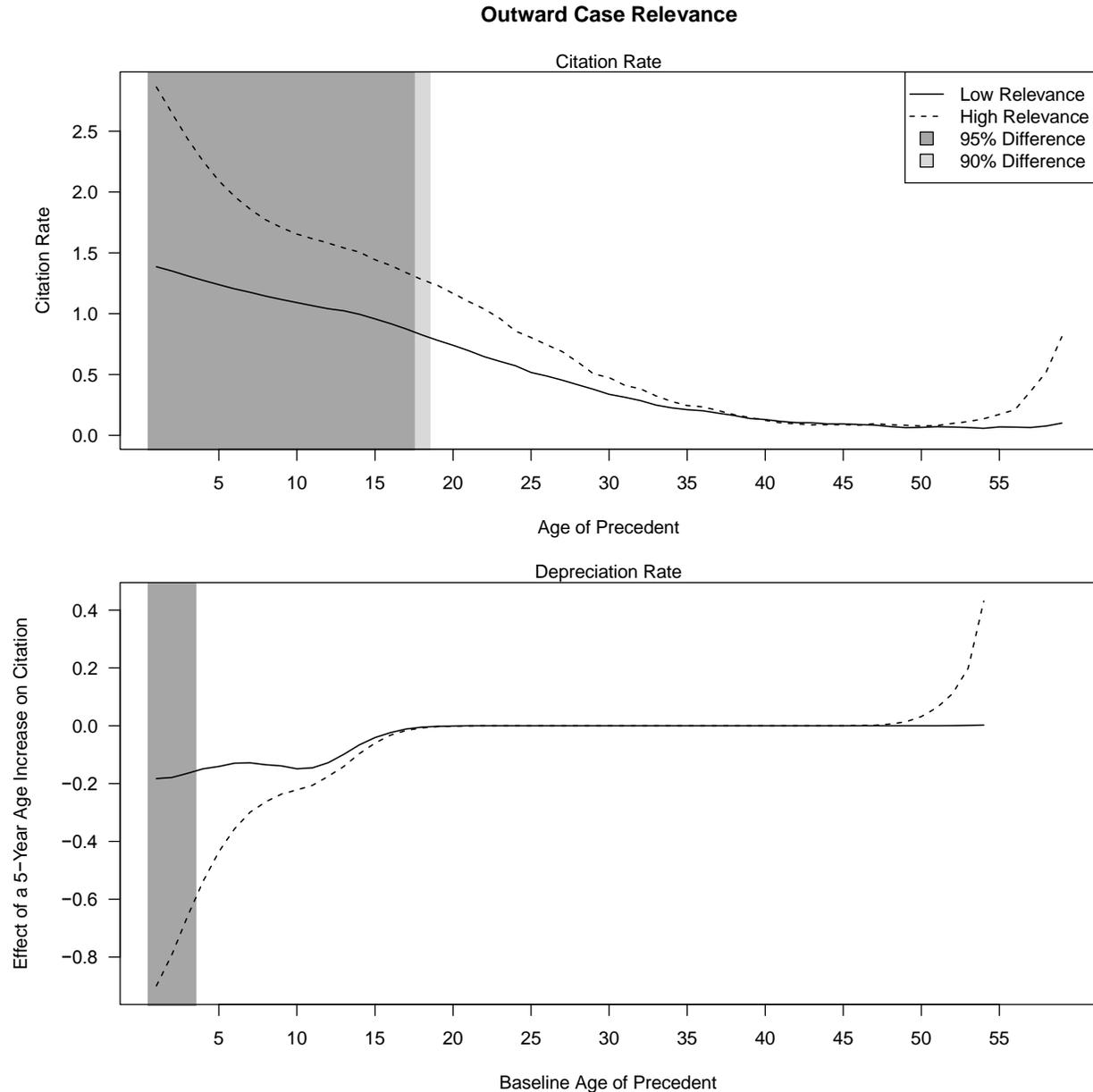
Note: One can examine two quantities of interest in the figure. First, one can view whether there is a difference between the rate of citation between the two lines for any given value of *Age of Precedent*. The dark and light gray regions indicate whether this intercept difference is statistically significant at the 95% and 90% level, respectively. To assess depreciation, one must compare the difference in the slopes of the lines in the top panel for any two values of precedent age. The bottom panel makes this comparison explicit by presenting the marginal effect for a five-year increase in age, or the change in the rate of citation over that five-year period. The baseline age of a precedent is the “starting year” used in determining the impact of a five-year increase in age. Thus, a value of “5” corresponds to the marginal effect of going from 5 to 10 years of age on the rate of citation. “Low” and “High” case relevance correspond to the sample minimum and maximum, respectively.

Figure 8. The Influence of Majority Opinion Length on Depreciation at the Courts of Appeals



Note One can examine two quantities of interest in the figure. First, one can view whether there is a difference between the rate of citation between the two lines for any given value of *Age of Precedent*. The dark and light gray regions indicate whether this intercept difference is statistically significant at the 95% and 90% level, respectively. To assess depreciation, one must compare the difference in the slopes of the lines in the top panel for any two values of precedent age. The bottom panel makes this comparison explicit by presenting the marginal effect for a five-year increase in age, or the change in the rate of citation over that five-year period. The baseline age of a precedent is the “starting year” used in determining the impact of a five-year increase in age. Thus, a value of “5” corresponds to the marginal effect of going from 5 to 10 years of age on the probability of citation. “Short” and “Long” opinions correspond to the sample minimum and maximum, respectively.

Figure 9. The Influence of Outward Case Relevance on Depreciation on the Courts of Appeals



Note: One can examine two quantities of interest in the figure. First, one can view whether there is a difference between the rate of citation between the two lines for any given value of *Age of Precedent*. The dark and light gray regions indicate whether this intercept difference is statistically significant at the 95% and 90% level, respectively. To assess depreciation, one must compare the difference in the slopes of the lines in the top panel for any two values of precedent age. The bottom panel makes this comparison explicit by presenting the marginal effect for a five-year increase in age, or the change in the rate of citation over that five-year period. The baseline age of a precedent is the “starting year” used in determining the impact of a five-year increase in age. Thus, a value of “5” corresponds to the marginal effect of going from 5 to 10 years of age on the rate of citation. “High” and “Low” relevance correspond to the sample minimum and maximum, respectively.