Reasonable Doubt: An Economic Approach

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April 30, 2016

Abstract

The “reasonable doubt” standard is a cornerstone of American criminal trials. Legal scholars have long recognized the relationship between reasonable doubt and Blackstonian formulations of the form, “It is better that x guilty escape than one innocent be wrongly punished.” This paper provides an analysis of what x should be in order to efficiently balance the cost of type-I and type-II errors using Becker’s 1968 model of criminal deterrence. This implies several surprising results about the relationship between the reasonable doubt standard, sentence severity, the probability of detection, and the social cost of criminal activities. We also present data on the Blackstonian ratio articulated in all U.S. jurisdictions, updating and filling gaps in Volokh (1997), to investigate the extent to which these relationships are realized in practice.

Keywords: reasonable doubt, Blackstone’s ratio

JEL Codes: K14, K41

1 Introduction

In a criminal trial, it is the burden of the prosecution to prove a defendant’s guilt “beyond a reasonable doubt.” This principle is a cornerstone of the common law;
In every criminal trial in the United States,\(^1\) as well as those in Canada,\(^2\) Australia,\(^3\) and New Zealand,\(^4\) filters through this most stringent standard of proof. Yet despite its paramount importance in determining the fates of the accused, courts have heretofore demonstrated exceeding reluctance to articulate a precise measure of how certain a juror must be for guilt to be determined “beyond a reasonable doubt.”\(^5\) Moreover, courts and legal scholars have made numerous confusing and contradictory claims about what factors determine what the reasonable doubt standard should be.

In his *Commentaries on the Laws of England*, Sir William Blackstone famously declared, “[T]he law holds it better that ten guilty persons escape, than that one innocent suffer.”\(^6\) Let us call such schemata, identifying the optimal ratio of type-I errors to type-II errors,\(^7\) as “Blackstonian ratios.” Though Blackstone’s statement proposes a Blackstonian ratio of \(1/10\), we shall refer to any \(\beta \leq 1/x\) formulation as being a “Blackstonian ratio.” Legal scholars have long recognized that the reasonable doubt standard may be inferred from Blackstonian ratios. However, courts have heretofore shown themselves reluctant to take such inferences seriously.

In this paper, we pursue three complementary objectives. First, we provide qualitative arguments as to why courts should take precise articulations of reasonable doubt seriously. More specifically, we argue that courts should allow statements of numerical thresholds of certainty, implied by Blackstonian ratios, in jury instructions. Second, we seek to clarify some of the supernumerary confusions about the factors determining and motivating the reasonable doubt standard. We derive the optimal Blackstonian ratio from a modified version of the model of criminal deterrence in Becker (1968). Finally, we investigate to what extent real-world practice tracks efficiency, comparing the Blackstonian ratios articulated in all U.S. jurisdictions with the probability of detection and sanction severity for automobile thefts. The collection of judicial articulations of the Blackstonian ratio across jurisdictions updates and fills gaps in Volokh (1997).

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1. In the United States, not only must the overall certainty of guilt meet the reasonable doubt threshold, indeed *every element* of the offense must meet this standard. See In re Winship, 397 U.S. 358 (1970).
7. The cost of mistaken convictions and the cost of mistaken acquittals.
1.1 The Present State of the Reasonable Doubt Standard

Unlike criminal trials, American civil trials are decided upon “preponderance of the evidence.” The burden of persuasion in these cases is reducible to a precise measure of juror certainty. If a juror’s certainty $p$ of the defendant’s liability is greater than 50%, then the plaintiff prevails. If $p \leq 0.5$, then the defendant prevails. Sometimes, this level of precision will not be useful in an obvious way. When juror certainty is not easily quantifiable, then the “preponderance of the evidence” standard might be more usefully stated in non-probabilistic terms.

Yet cases will often arise, where a probabilistic measure will be useful. Suppose some harm befalls a plaintiff, and the cause of the harm is unknown. For example, imagine a cow escapes from its pasture and causes damage, though no one was present to observe how the cow went past the fence. Suppose further that there were two possible ways the cow could have escaped: (1) a gap in the fence, which the defendant had a duty to repair, but which he failed to repair, and (2) a gap in the fence, caused by some third party, of which the defendant was not yet aware, and which he had no opportunity to repair. Trivially, if the cow escaped through the first gap, then the defendant is liable for the harm, but if the cow escaped through the second gap, then the defendant is not liable for the harm. Here, the precise measure of a 50% standard of proof makes the decision simple (ceteris paribus, $p = 0.5$ and the defendant wins).

More generally, adopting a precise measure ensures that across juries, jurisdictions, and divergent subject matter, the bar for civil liability remains relatively consistent. There can hardly be any trait more desirable of courts than consistency—that like cases should be treated alike.8

In contrast with the preponderance standard, the reasonable doubt standard has no precise numerical equivalent. There is no consensus and indeed few attempts to articulate whether the standard is equivalent to 90% certainty, 95% certainty, 99% certainty, or whatever. Juries are told that the reasonable doubt standard is more demanding than preponderance (as well as the less commonly used “clear and convincing” standard), but less than 100% certainty; all further guidance is given in vague qualitative terms.

There are two questions on which courts diverge with respect to the reasonable doubt standard. First, it is unclear whether the reasonable doubt standard should be a function of sentence severity. Some courts have expressed the proposition

\footnote{8. Behavioral economists have shown that lay people tend to be extraordinarily bad at understanding probabilities. Yet this should not count against the adoption of precise probabilistic thresholds. It seems intuitively plausible that regardless of how inept juries are at estimating and calculating probabilities, it is still better to provide a precise measure than not. Equipping juries with more precise guidance for determining liability or guilt would seem obviously preferable unless it can be demonstrated that jurors’ confusion and ineptitude with numbers is so great that articulating an $x\%$ threshold could paradoxically lead to less consistency.}
that all “crimes,” broadly defined, should be subject to the same standard of ev-
idence, including misdemeanors and actions for recovery of penalties arising from
municipal ordinances. Yet others have predicated the application of reasonable
doubt upon the severity of punishment entailed by the accusation, and indeed
some courts have employed language suggesting varying levels of certainty required
by the reasonable doubt standard, tending toward an absolutely certainty require-
ment as the severity of prescribed punishment increases. Whether there is one
reasonable doubt standard, or whether there are many subspecies of reasonable
doubt (within some range called “reasonable doubt”) is a question not explicitly
addressed either by courts or legal scholars.

The second question which courts have answered inconsistently is how the rea-
sonable doubt standard should be analyzed. Articulations of the reasonable doubt
standard commonly include: the charge that the jury should acquit “if your minds
are wavering or the scales are even,” the elaboration that “proof beyond a rea-
sonable doubt must, therefore, be proof of such a convincing character that a
reasonable person would not hesitate to rely and act upon it in the most most
important of his own affairs,” the paraphrase “moral certainty,” and the suspiciously
tautologous “doubt based on reason.” There is great disparity among U.S. juris-
dictions on whether such articulations are required, encouraged, discouraged, or
forbidden. Among courts that discourage and forbid, the rationale seems to be
that explaining “reasonable doubt” will tend to cause more confusion than eluci-
dation. On this, we sympathize with Judge Jon O. Newman’s sentiment, “I find
it rather unsettling that we are using a formulation that we believe will become
less clear the more we explain it.”

10. In re Winship, 397 U.S. 358 (1970) takes this view, holding that the loss of liberty or
standing in the community attendant to a criminal conviction justifies the application of the
reasonable doubt standard, and further that this proposition has “constitutional stature” under
the Due Process Clause.
11. ADD CITES.
12. This language seems particularly popular in New York, despite the appeals courts “strongly
13. Sand et al. (1 2006, Instruction 4-2).
17. CITE THAT CASE THAT FOUND MERIT IN ALLOWING JURIES TO “DEFINE
WHAT IT MEANS FOR THEMSELVES”
1.2 The Need for Precise Measures

We expect it should not require much to demonstrate the inadequacy of the commonly used articulations of reasonable doubt. The charge to acquit “if your minds are wavering or the scales are even,” suggests a standard barely more stringent than preponderance.\(^\text{19}\) Equating reasonable doubt to “proof of such a convincing character that a reasonable person would not hesitate to rely and act upon it in the most important of his own affairs,” ignores the heterogeneity of individuals’ risk preferences and is, moreover, fatally ambiguous.\(^\text{20}\) Yet more problematically, “moral certainty,” and “doubt based on reason,” are barely informative and connote subtly distinct concepts not likely desirable nor intended by the phrase “beyond a reasonable doubt.”\(^\text{21}\)

Yet the absence of any explanation at all may well entail far worse consequences. Mock jury experiments and surveys have found extraordinary disparities in how individuals understand the phrase “guilty beyond a reasonable doubt.” Thus, the very consistency of the criminal justice system seems threatened by this failure to inform. Given the heterogeneity of individuals’ understanding of reasonable doubt, a criminally accused person goes to trial facing a veritable roulette wheel—what may be sufficient evidence to meet the reasonable doubt threshold for one jury may be insufficient for another.

ADD MORE HERE.

1.3 Blackstonian Ratios

Yet a precise articulation of the reasonable doubt threshold is frequently rehearsed, though its use in jury instructions is disfavored by courts.\(^\text{22}\) Blackstone’s statement that “the law holds it better that ten guilty persons escape, than that one innocent suffer,”\(^\text{23}\) entails the sort of numerically precise formulation of the reasonable doubt standard that might well obviate the concerns raised by other analyses of reasonable doubt.

Many legal scholars and judges have echoed Blackstone’s $\beta \leq \frac{1}{10}$ pronounce-

\(^{19}\) See In re Winship at 367 (“[W]e reject the Court of Appeals’ suggestion that there is, in any event, only a ‘tenuous difference’ between the reasonable-doubt and preponderance standards”).

\(^{20}\) Newman (1993, p. 983) (“If the jurors encounter a doubt that would cause them to ‘hesitate to act in a matter of importance,’ what are they to do then? Should they decline to convict because they have reached a point of hesitation, or should they simply hesitate, then ask themselves whether, in their own private matters, they would resolve the doubt in favor of action, and, if so, continue on to convict?”)


\(^{22}\) ADD CITE.

\(^{23}\) Blackstone (1769), Book IV, Chapter 27.
ment, though others have favored different ratios. As a matter of terminology, let us refer to all such $1 : x$ formulations generally as “Blackstonian ratios,” which may either be $\beta \leq \frac{1}{10}$ as Blackstone originally articulated, or more permissive.

### 1.4 Having Our Cake and Eating It

Indubitably, there are benefits to allowing jurors some degree of flexibility in evaluating the idiosyncratic circumstances that often arise in criminal cases, and it is therefore understandable why courts might want to preserve a degree of informality in the definition.

Yet it is worth observing that we are not forced to choose between precision and flexibility. The criminal law may indeed benefit from having both formal and informal definitions, which could be regarded as legally equivalent and employed alternatively depending on the nature of the case. A similar situation exists in the law of torts, where the Hand Formula (to avoid liability, the marginal benefit of precautions should equal the marginal cost of expected harm) gives a precise articulation of negligence, and the “reasonable person” standard gives an informal (though putatively equivalent) articulation of negligence. The two formulations are meant to articulate the same standard, and the particular facts of a case determine which is more useful in a jury instruction. However, if we were forced to choose between a restrictively precise definition and a confusingly vague definition, the latter seems the obviously worse alternative. Thus, it seems a precise formulation of the reasonable doubt standard can only improve the administration of criminal justice.

### 1.5 Prior Literature


24. Other famous articulations include Fortescue (1616) prescribing a ratio of $\beta \leq \frac{1}{20}$ and Hale (1736) prescribing a ratio of $\beta \leq \frac{1}{5}$.

25. See Table reftab1, infra.

26. This motive was suggested with some derision by Cullison (1969) at 567 (“. . . courts shun responsibility for fixing a more precise threshold probability because they feel it should vary to some extent from case to case.”).

27. See United States v. Carroll Towing Co. 159 F.2d 169 (2d. Cir. 1947) and Vaughan v. Menlove (1837) 132 ER 490 (CP).
2 Efficient $\beta$

In this section, we derive the formula for efficient $\beta$. We start from a modified Beckerian framework.\textsuperscript{28} Let us first define our terms:

- $\beta = [0, 1]$ is the Blackstonian ratio, where $\beta \leq 1/x$, such that it is better that $x$ guilty go free than that one innocent be punished.
- $z = [0, 1]$ is the threshold certainty required to convict under the reasonable doubt standard.
- $p = [0, 1]$ is the probability that a guilty person will be detected, arrested, and charged for the crime.
- $q(z) = [0, 1]$ is the probability that a guilty accused will be convicted.
- $S$ is the magnitude of sanction for committing a crime.
- $c_1(p)$ is the cost of detecting, arresting, and charging guilty individuals.
- $c_2(z, S)$ is the cost of Type-I errors.
- $c_3(S)$ is the cost of punishing guilty individuals.
- $H(p, q, S)$ is the social cost of crime.

We rely on the following assumptions:

- $\frac{\partial p}{\partial \beta} > 0$. As $\beta$ approaches 1, the threshold of reasonable doubt decreases, and more guilty individuals will be convicted.
- $\frac{\partial c_1}{\partial \beta} = 0$. This is because $c_1$ reflects the cost of policing, which is not directly affected by $\beta$.
- $\frac{\partial H}{\partial p} < 0$. As the probability of conviction increases, more individuals are deterred, and the social cost of crime decreases.
- $\frac{\partial H}{\partial S} < 0$. As sanction severity increases, more individuals are deterred, and the social cost of crime decreases.
- $\frac{\partial c_2}{\partial \beta} > 0$. As the threshold for reasonable doubt decreases, more innocent people will be wrongly convicted.

\textsuperscript{28} Becker (1968).
We may express the social cost function as the cost of crime, \( H \), plus the cost of policing and punishment, \( c_1 \) and \( c_3 \), plus the cost of mistakenly convicting innocent people, \( c_2 \).

\[
C = H(p, q, S) + c_1(p) + c_2(z, S) + c_3(S)
\]  

(1)

The optimal reasonable doubt standard will thus be the value that minimizes the social cost function, \( z^{**} = \min_z C \), which will obtain when \( z \) satisfies the first order condition:

\[
\frac{\partial C}{\partial z} = \frac{\partial H}{\partial q} \frac{\partial q}{\partial z} + \frac{\partial c_2}{\partial z} = 0
\]  

(2)

Let us now consider the relationship between Blackstonian ratios and the reasonable doubt standard. We introduce two new terms:

- \( \pi = [0, 1] \) is a jury’s certainty that a particular accused individual is guilty.
- \( K \) is the cost of convicting one innocent individual.

The relationship between Blackstonian ratios and the reasonable doubt standard may be derived from the particularized social cost function for a criminal trial:

\[
C'(z) = \begin{cases} 
(1 - \pi)K & \text{if } \pi > z \text{ (conviction)} \\
\pi \beta K & \text{if } \pi \leq z \text{ (acquittal)}
\end{cases}
\]  

(3)

Having obtained the value of \( z^{**} \) from Formula 2 it follows the optimal Blackstonian ratio will be:

\[
\beta^{**} = \frac{1}{z^{**}} - 1
\]  

(4)

To see why this must be the case, note that \((1 - \pi)K\) is decreasing in \( \pi \), and \( \pi \beta K \) is increasing in \( \pi \).\(^{29}\) Thus, the value of \( \beta \) for which \( C'(z^{**}) \) is minimal occurs when the first case is equal to the second case. That is, given that \( z^{**} \) is efficient, then the efficient value of \( \beta \) will satisfy the equation: \((1 - z^{**})K = z^{**}\beta K\). If this were not the case, then \( z^{**} \) would not be the efficient reasonable doubt threshold. Solving for \( \beta \), we get Formula 4.

\(^{29}\) Observe that the payoff from conviction is decreasing in \( \pi \):

\[
\frac{\partial}{\partial \pi}(1 - \pi)K = -K < 0
\]

And the payoff from acquittal is increasing in \( \pi \):

\[
\frac{\partial}{\partial \pi}\pi \beta K = \beta K > 0
\]

Given that \((1 - \pi)K = K\) when \( \pi = 0 \) and \((1 - \pi)K = 0\) when \( \pi = 1 \), and that \( \pi \beta K = 0\) when \( \pi = 0 \) and \( \pi \beta K = \beta K\) when \( \pi = 1 \), there will be at least one intersection point. Also note that both \((1 - \pi)K\) and \( \pi \beta K \) are linear.
Of course, the first order condition for \( z^{**} \) (Formula 2) depends on the values of \( S \) and \( p \), and thus the value of \( \beta^{**} \) depends on the values of \( S \) and \( p \).

2.1 A Misleading Inference About the Relationship Between \( \beta \) and \( z \)

The foregoing analysis begins by considering the social cost of crime, deriving the optimal reasonable doubt standard, and translating that into Blackstonian ratio terms. That is, we proceed from social welfare to the reasonable doubt standard to the Blackstonian ratio. For us, the Blackstonian ratio is simply a way of expressing the optimal reasonable doubt standard, which is determined by minimizing the social cost of crime.

However, legal scholars have frequently proceeded in the other direction, beginning with an estimation of the Blackstonian ratio, and then deriving the reasonable doubt standard from this,\(^{30}\) using the formula:\(^{31}\)

\[
\frac{1}{\beta + 1}
\]

It should be clear why this simplistic derivation of the optimal reasonable doubt threshold should be regarded as misleading and potentially problematic.

First, it is important to note that we may regard either \( \beta \) as a function of \( z \), or \( z \) as a function \( \beta \) without any formal problem. However, by framing the question as a determination of \( z(\beta)^{**} \) rather than \( \beta(z)^{**} \), earlier writers have implicitly conceived of the Blackstonian ratio as being epistemically prior to the optimal reasonable doubt threshold. They write about the Blackstonian ratio as though it justified the high standard of proof in criminal cases, rather than as something entailed by the high standard of proof in criminal cases.

This suggests one of two possible diagnoses. Either the \( \beta \)-first conception must simplistically ignore the complex interaction of deterrent benefits, enforcement costs, and the harm caused by crime (in which case Formula 3 fails as a model), or else these must somehow be accounted for in \( \beta \). But if this were accounted for in \( \beta \), then \( \beta^{**} \) would need to be derived from some social cost function like Formula 1, where it would have been more natural to set \( q \) and \( c_2 \) as a function of \( z \). It seems very roundabout indeed that we would be modeling \( q \) and \( c_2 \) as functions of \( \beta \).

\(^{30}\) This derivation of the reasonable doubt standard appears throughout the literature. E.g., Pardo (2010), and Levy (2013). It is implicit whenever it is claimed that the reasonable doubt threshold should be set at 91% or 90.9% certainty of guilt. This figure is the result of calculating the ten-to-one odds articulated in Blackstone (1769), \( 10 : 1 = \frac{10}{11} = .90 \), or equivalently plugging \( \beta = 1/10 \) into Formula 5.

\(^{31}\) This is simply Formula 4, solving for \( z \). See, e.g., Kaplan (1968), Cullison (1969).
What is most likely going on is that Blackstone (1769), Hale (1736), Fortescue (1616), and Justice Harlan (concurring in *In re Winship*) are simply eyeballing the social cost function (Formula 1) and estimating an upper bound of possible values of $\beta^{**}$ (i.e., a lower bound on $z^{**}$). The most charitable interpretation is that they were, in effect, saying, “I do not know what $\beta$ is, but it is at most $1/x$." It should be observed that, while a useful guide when $x$ is large, it is an otiose statement when $x = 1$, as in *In re Winship* and most U.S. states. Declaring that $\beta \leq 1$ amounts to saying little more than that the reasonable doubt standard is more stringent than preponderance. Though anyone accused of a crime should be thankful for this, we think it not unreasonable to expect the bar for criminal punishment to be rather a great deal higher.\textsuperscript{32}

### 2.2 Implications

Formula 2 states the condition for an efficient reasonable doubt standard. Unfortunately, absent empirical data on crime rates, the social cost of enforcement and punishment, and the magnitude of harms suffered due to criminal activity, we cannot supply hard numbers for $z^{**}$ here. Determining values for these metrics are, however, active areas of research in criminology and empirical legal studies, and we are hopeful that useful values may be estimated to plug into the formula.

Regardless, the abstract result already tells us much. First, with respect to the conflicting rhetoric of courts and legal scholars on whether sanction severity should affect the value of optimal $z$, we have shown that it does. This was not apparent in the naïve derivation (Formula 5), where the $K$ terms from Formula 3 cancelled out.\textsuperscript{33} Second, our analysis finds that policing levels should also have an effect on the optimal value of $z$. We find no prior suggestions that this would be the case. Yet upon reflection, we think this to be plausible: suppose that the rate of detection were extraordinarily low, and suppose further that the marginal effectiveness of convictions were diminishing, then it follows that the marginal value of convicting a guilty defendant (and correspondingly the cost of acquitting a guilty defendant) would be greater than if the rate of detection were extraordinarily high. Ergo, since the cost of type-II errors changes with $p$, it follows that the optimal value of $z$ will change with $p$.

More than this, we are also able to make inferences about the relationship between optimal $z$, $p$, and $S$ from the model. Assuming that there is diminishing

\textsuperscript{32} Though it is interesting and certainly meaningful, if alarming, that Kansas courts have declared a $\beta > 1$. See Table 1, infra.

\textsuperscript{33} To the extent that the cost of acquitting guilty defendants acts as a proxy for sanction severity (on the reasoning that sanction severity is proportional to the harm imposed, and the harm imposed is proportional to the forgone benefit of convicting the guilty), it cancels out when we derive optimal $z$ from Formula 3, given $\beta$.
marginal value in punishing guilty individuals,\(^{34}\) it follows from Formula 2 that as \(p\) and \(S\) increase, \(q^{**}\) will tend to decrease. In other words, as criminals are more frequently caught and more harshly punished, the standard of proof will tend to increase. Conversely, as criminals are less frequently captured and punishments are less harsh, the optimal standard of proof will tend to decrease.

To fully cash out this insight, we may conclude from the dependence of \(z^{**}\) on \(p\) and \(S\) that, among other things, the standard of proof in criminal cases should be tailored to the offense type. This follows from the assumption that in general, \(p\) and \(S\) will tend be the similar for crimes falling within the same offense type. This conclusion resolves another controversy in the criminal law literature—whether there is (or should be) one reasonable doubt standard. The foregoing implies that “reasonable doubt” should denote not a single threshold of epistemic certainty, but rather a range, within which there exist a panoply of reasonable doubt thresholds, which vary depending upon the type of crime committed.\(^{35}\)

We will consider to what extent these results already obtain in the real world practice of law in Section 3 below. However, before proceeding, it bears defending the inferential move from Formula 1 to Formula 2. It might be argued that the relevant factor in determining the Blackstonian ratio is the morality of punishing the guilty and immorality of punishing the innocent.\(^{36}\) We do not find this view persuasive (at least not a deontological interpretation of it), though it is worth mentioning in passing that a utilitarian motivation, such as we have assumed here, seems clearly evident in Justice Harlan’s concurrence in \textit{In re Winship}:

> Because the standard of proof affects the comparative frequency of these two types of erroneous outcomes, the choice of the standard to be applied in [criminal or civil cases] should, in a rational world, reflect an assessment of the comparative social disutility of each.\(^{37}\)

And two paragraphs later:

> In a criminal case . . . we do not view the social disutility of convicting an innocent man as equivalent to the disutility of acquitting someone who is guilty.\(^{38}\)

\(^{34}\) That is, assuming that \(\frac{\partial^2 H}{\partial p^2} < 0, \frac{\partial^2 H}{\partial s^2} < 0,\) and \(\frac{\partial^2 H}{\partial p \partial s} < 0\)

\(^{35}\) The desirability of having more than one standard of proof, contingent upon \(S\) has been discussed frequently in the literature. See, e.g., Sand and Rose (2003), Lillquist (2002) (advocating a reasonable doubt standard contingent upon sanction severity and evidence distribution), and Bradley (1996) (proposing a “no lingering doubt” standard in death penalty cases), and DeKay (1996).

\(^{36}\) Certainly, there is historical support for the notion that “reasonable doubt,” often used interchangeably with “moral certainty” in older legal texts, was motivated by moral considerations foremost. See generally Shapiro (1991).

\(^{37}\) \textit{In re Winship} at 371.

\(^{38}\) \textit{In re Winship} at 372.
Thus, if we are to take Justice Harlan’s utilitarian framing of the problem seriously, it behooves us to do more than has been done to develop an efficient standard, which accounts for the social costs and benefits of conviction. Our contribution, we hope, nudges us a bit further toward that goal.

3 Judicial Articulations of $\beta$

In this section, we survey judicial articulations of the value of $\beta$ in all 50 states and the U.S. Supreme Court. In a similar survey of Blackstonian ratios across all U.S. jurisdictions, Volokh (1997) suggested that the value of $\beta \approx \frac{1}{60}$ nationally as of 1997. We find an average of $\beta \approx \frac{1}{12.5}$.

In Table 1, we update the now more than decade-old work of Volokh (1997) with recent cases articulating Blackstonian ratios by jurisdiction.

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<th>JURISDICTION</th>
<th>LOWER BOUND</th>
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<tr>
<td>Alabama$^{39}$</td>
<td>$\beta \leq \frac{1}{5}$</td>
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<td>Alaska$^{40}$</td>
<td>$\beta \leq 1$</td>
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<td>Arizona$^{41}$</td>
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<tr>
<td>Arkansas$^{42}$</td>
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<tr>
<td>California$^{43}$</td>
<td>$\beta \leq \frac{1}{10}$</td>
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39. Ex parte Mauricio, 523 So.2d 87,92 (Ala. 1987) (quoting Judge Cardozo in People v. Galbo, 112 N.E. 1041, 1044 (1916), who in turn cites Hale (1736)). However, Alabama law has not historically been clear on this point. See Volokh (1997) for a discussion of Alabama’s historical treatment of the Blackstonian ratio. We might also mention Morris v. State, 60 So.3d 326, 373 (Ala. Crim. App. 2010) (holding that failure to include a statement of $\beta \leq \frac{1}{100}$ in a jury instruction was not error, citing Jackson v. State, 432 So.2d 504 (1983), which held the Blackstonian formulation to be “merely” an abstract principle of law without connection to the case).


42. Jones v. State, 320 S.W.2d 645, 649 (1959) (citing Coffin v. United States, 156 U.S. 432 and possibly making a distinction in cases of double jeopardy, when “some” is used) and Dunaway v. Troutt, 232 Ark. 615, 626 (1960) (stating “several”).

43. California courts have given a variety of mixed signals with respect to the Blackstonian ratio. For example, Salisbury v. County of Orange, 31 Cal.Rptr.3d 831, 836 (Cal. Ct. App. 2010) states $\beta \leq 1$, but In re Sodersten, 146 Cal.App.4th 1163, 1219 n.35 (Cal. Ct. App. 2007) quotes Blackstone approvingly with $\beta \leq \frac{1}{10}$. A number of cases mention Blackstonian ratios disapprovingly in cases of pedophilia, e.g., In re Kailee B., 18 Cal.App.4th 719, 727 (Cal. Ct. App. 1993), In re Carmen O., 28 Cal.App.4th 908 (Cal. Ct. App. 1994) (citing In re Kailee B.), In re April C., 131 Cal.App.4th 599, 611 (Cal. Ct. App. 2005) (citing both In re Kailee B. and
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<th>Jurisdiction</th>
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<td>Florida</td>
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<td>Idaho</td>
<td>$\beta \leq \frac{1}{10}$ &quot;Many&quot;</td>
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<td>Indiana</td>
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In re Carmen O.), though these seem to be carve out an exception rather than repudiating the formulation (“While one may accept [Blackstone’s ratio] in a criminal setting, though its exact statistical basis has not been precisely defined nor universally accepted, we trust that few, if any, would agree it is better that 10 pedophiles be permitted to continue molesting children than that 1 innocent parent be required to attend therapy sessions in order to discover why his infant daughter was falsely making such appalling accusations against him." In re Kailee B. at 727). We think the articulation in In re Sodersten to be most authoritative for present purposes.


45. Connecticut is very consistent in following $\beta \leq 1$ articulated in In re Winship. Wiseman v. Armstrong, 989 A.2d 1027, 1041 (Conn. 2010), State v. Valinski, 731 A.2d 311, 321 (Conn. App. Ct. 1999), State v. Gerard, 677 A.2d 937, 941 (Conn. 1996). Curiously, Miller v. Commissioner of Correction, 700 A.2d 1108, 1141 (concurrence) (Conn. 1997) cites both In re Winship’s $\beta \leq 1$ and Blackstone (1769)’s $\beta \leq \frac{1}{5}$ approvingly.

46. Sadly, there does not seem to exist any clear articulation of the Blackstonian ratio in Delaware. The nearest Delaware courts have come seems to be in Hughes v. State, 437 A.2d 559 (1981), quoting from Berger v. United States, 295 U.S. 78, 88 (1935) (“[The prosecutor] is in a peculiar and very definite sense the servant of the law, the twofold aim of which is that guilt shall not escape or innocence suffer.”), implying $\beta \leq 1$.

47. Florida courts have vacillated between $\beta \leq 1$ and $\beta \leq \frac{1}{10}$. See, e.g., Adjmi v. State, 154 So.2d 812, 819 n.3 (Fla. 1963) (citing Voltaire (1749, Ch. 6) in support of $\beta \leq 1$), Nixon v. Singletary, 758 So.2d 618, 626 (Fla. 2000) (concurrence) (citing both In re Winship, which states $\beta \leq 1$, and Furman v. Georgia, 408 U.S. 238, 367 n. 158 (1972) (Marshall, J., concurring), which states $\beta \leq \frac{1}{10}$), Nixon v. State, 857 So.2d 172, 178 (Fla. 2003) (special concurrence) (approving of the language in Nixon v. Singletary), and State v. Adkins, 96 So.3d 412, 434 (Fla. 2012) (dissent) (citing Coffin v. United States, 156 U.S. 432, 456 (1895) in support of $\beta \leq \frac{1}{10}$). On balance, we think the balance of opinion seems to favor $\beta \leq \frac{1}{10}$, though Adjmi v. State was the last majority statement by the Florida Supreme Court.


50. State v. Hester, 760 P.2d 27, 41 (1988). Note however that older cases have repudiated such formulations. E.g., State v. Crump, 47 P. 814, 818 (1897) (calling a variant of Blackstone’s statement, where $\beta \leq \frac{1}{50}$ a “heresy”) and State v. Reed, 113 P. 721 (1911) (calling $\beta \leq \frac{1}{90}$ “correct” as an abstract principle of the law, while declining to find error in the trial court’s refusal to allow it as a jury instruction).


52. Indiana courts have been very consistent in stating $\beta \leq 1$. Tucker v. Marion County De-
<table>
<thead>
<tr>
<th>Jurisdiction</th>
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<tr>
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<td>( \beta &gt; 1 )</td>
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<tr>
<td>Kentucky</td>
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<td>No Ruling</td>
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<tr>
<td>Massachusetts</td>
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<tr>
<td>Michigan</td>
<td>( \beta \leq 1/10 )</td>
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<tr>
<td>Minnesota</td>
<td>( \beta \leq 1 )</td>
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54. In State v. Hoel, 243 P. 280 (1926), the Supreme Court of Kansas rejected a jury instruction to the effect that \( \beta \leq 1 \), not because it is a “mere abstract principle” (the rationale often given in other states refusing such instructions), but more forcefully writing, “There is no such principle in the law of this state.”

55. Brown v. Com., 226 S.W.3d 74, 88 (Ky. 2007) (citing In re Winship). Historically, Kentucky has gone through several different standards. E.g., Lehrer v. Elmore, 37 S.W. 292, 293 (1896) (stating \( \beta \leq 1/99 \)), Fyffe v. Commonwealth, 190 S.W.2d 674, 680 (App. 1945) (stating \( \beta \leq 1/\text{Many} \)).

56. State v. Hughes, 900 So.2d 168, 174 (2005) (citing In re Winship). Louisiana has been fairly consistent in describing \( \beta \leq 1 \). See, e.g., State v. Mouton, 653 So.2d 1360, 1362 (1995), State v. Cage, 583 So.2d 1125, 1135 (1991) (dissent) (though this opinion also forcefully states that the reasonable doubt standard must be more stringent than preponderance, implying that \( B \ll 1 \)). State v. Mussall, 523 So.2d 1305, 1308 (1988) (citing In re Winship). However, there are some exceptions. E.g., State v. Williams, 591 So.2d 404, 409 (1991) (concurrence) (stating \( \beta \leq 1/100 \), as well as older cases such State v. Furco, 51 La. Ann. 1082, 1088 (1899) (stating \( \beta \leq 1/10 \)).

57. Goddard v. Grand Trunk Ry., 57 Me. 202, 247 (Me. 1869) (possibly quoting Blackstone, but without citation). This case, more than a century old, appears to be the only discussion in Maine’s courts about the relative value of type-I and type-II errors. Unfortunately, it states the principle In reference to punitive damages in a civil—not criminal—proceeding. It is therefore admittedly not quite on point.


59. People v. Watkins, 438 Mich. 627, 647 n.12 (1991) (referring to \( \beta \leq 1/10 \) as a “historical principle” of the legal system), People v. Allen, 420 N.W.2d 499 n.26 (1986) (referring to \( \beta \leq 1/10 \) as a “hallowed principle”).

60. State v. Clausen, 493 N.W.2d 113, 116 (Minn. 1992) (citing In re Winship), replacing the \( \beta \leq 1/\text{Some} \) statement in State v. Butenhoff, 155 N.W.2d 894, 900 (1968).
<table>
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<tr>
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<tr>
<td>Missouri</td>
<td>$\beta \leq \frac{1}{\text{Some}}$</td>
</tr>
<tr>
<td>Montana</td>
<td>$\beta \leq 1$</td>
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<tr>
<td>Nebraska</td>
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<td>No Ruling</td>
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<tr>
<td>New Hampshire</td>
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<tr>
<td>New Jersey</td>
<td>$\beta \leq 1$</td>
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<tr>
<td>New Mexico</td>
<td>$\beta \leq \frac{1}{99}$</td>
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<tr>
<td>New York</td>
<td>$\beta \leq \frac{1}{5^*}$</td>
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61. McMillian v. State, 218 Miss. 264, 268 (1953). Earlier cases show a wide variety of values. E.g., Jesse v. State, 28 Miss. 100, 103 (Miss. Err. & App. 1854) (stating $\beta \leq \frac{1}{99}$), Jones v. State, 79 Miss. 309 (1901) (stating $\beta \leq 1$ In reference to a prosecutor’s responsibility to the law), and Herring v. State, 122 Miss. 647 (1920) (concurring) (referring to $\beta \leq \frac{1}{\text{Many}}$ as a “policy of the law”).

62. It is somewhat difficult to determine $\beta$ in Missouri. The best authoritative recent case seems to be State v. Waller, 163 S.W.3d 593, 597 (Mo. Ct. App. 2005) (“We accept the reality that sometimes the guilty will go free because of our great care to insure that the innocent are not unjustly convicted”). However, the history is complicated. See, e.g., State v. Mayfield, 879 S.W.2d 561, 565 (Mo. Ct. App. 1994) (citing State v. Grim, 854 S.W.2d 403, 425 (1993) (dissent), which refers to $\beta \leq 1$ as a rule of law), State v. Perkins, 11 Mo. App. 82 (1881) (disapproving of the inverse $\beta \leq \frac{99}{1}$), State v. Benson, 110 Mo. 18 (1892) (endorsing $\beta \leq \frac{1}{99}$), Town of Glenwood v. Roberts, 59 Mo. App. 167, 171 (1894) (arguing for $\beta \leq \frac{1}{10}$ to be applied equally between felonies and misdemeanors), State v. Bonuchi, 636 S.W.2d 338, 342 (Mo. 1982) (concurring) (strongly disapproving of $\beta \leq \frac{1}{99}$).

63. Montana courts are consistent in stating $\beta \leq 1$, though the cases are now quite old. State v. Ebel, 15 P.2d 233, 237 (1932), State v. Riggs, 201 P. 272, 282 (1921), and State v. Rolla, 55 P. 523, 526 (1898).

64. McKay v. State, 132 N.W. 741, 745 (1911) (in discussing prosecutor’s duty to the law), Rogers v. State, 149 N.W. 318, 319 (1914) (citing McKay). Also, interesting is Parrish v. State, 15 N.W. 357, 358 (1883) (holding that a jury instruction of $\beta \leq \frac{1}{99}$ was properly refused, puzzlingly on the rationale that it would “confuse” jurors, with the caveat that it is a “maxim” that should inform judges in discharging their duties).


66. State v. Jimenez, 908 A.2d 181, 193 (2006). New Jersey Courts are fairly consistent about $\beta \leq 1$, but see State v. Hill, 267 N.J. Super. 223, 234 (1993) (citing Blackstone (1769) in support of $\beta \leq \frac{1}{10}$) and State v. Haines, 120 A.2d 118, 124 (1956) (approvingly referring to $\beta \leq \frac{1}{\text{Many}}$ as an “ancient view”).


68. New York courts have declared a large range of values for $\beta$. Ruloff v. People, 18 N.Y. 179 (1858) (confusingly stating several values, $\beta \leq \frac{1}{\text{Many}}$ at 184, $\beta \leq \frac{1}{5}$ at 185 citing Hale (1736), and $\beta \leq \frac{1}{10}$ at 187 citing Blackstone (1769)), People v. Lipsky, 84 A.D.2d 42, 47 (1981) (stating $\beta \leq \frac{1}{\text{Many}}$), quoting the language in Ruloff, the relevant language pertaining to the Blackstonian ratio being overruled by People v. Lipsky, 57 N.Y.2d 560 (1982), People v. Bennett, 4 Sickels 137, 143 (1872) (also stating $\beta \leq \frac{1}{\text{Many}}$), People v. Galbo, 218 N.Y. 283, 291 (1916) (stating
<table>
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<tr>
<td>North Carolina&lt;sup&gt;69&lt;/sup&gt;</td>
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<td>North Dakota</td>
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<tr>
<td>Ohio&lt;sup&gt;70&lt;/sup&gt;</td>
<td>( \beta \leq \frac{1}{99} )</td>
</tr>
<tr>
<td>Oklahoma&lt;sup&gt;71&lt;/sup&gt;</td>
<td>( \beta \leq \frac{1}{10^*} )</td>
</tr>
<tr>
<td>Oregon&lt;sup&gt;72&lt;/sup&gt;</td>
<td>( \beta \leq 1 )</td>
</tr>
<tr>
<td>Pennsylvania&lt;sup&gt;73&lt;/sup&gt;</td>
<td>( \beta \leq 1 )</td>
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\( \beta \leq \frac{1}{5} \), citing Hale (1736)), People v. Larkman, 259 A.D. 959, 962 (1940) (dissent) (stating \( \beta \leq \frac{1}{5} \), citing Hale (1736)), People v. Cohen, 191 N.Y.S. 831, 842 (1921) (calling \( \beta \leq \frac{1}{10} \) “a working principle which will probably abide with us as long as crime itself”), In re X, Y and Z, 43 N.Y.W.2d 361, 365 (1943) (calling \( \beta \leq \frac{1}{99} \) an “old adage in the law which has become embedded in our theory of jurisprudence”), People v. Edwards, 18 A.D.2d 721 (1962) (finding error in a trial court judge’s description of \( \beta \leq \frac{1}{99} \) as “bunk” and “pious platitude of some old maid sop”), Onderdonk v. State, 648 N.Y.S.2d 214, 219 (1996) (identifying \( \beta \leq \frac{1}{100} \) as a due process guarantee), and Matter of Ralph M., 417 N.Y.S.2d 608, 611 (1979) (stating \( \beta \leq 1 \), citing In re Winship). We think it fair to infer \( \beta \leq \frac{1}{5} \) as it was stated in Galbo, the most recent Court of Appeals ruling, though we must admit the wide range of statements about the value of \( \beta \), despite language purporting to take it seriously, somewhat undermines our hope that courts have taken the precise value seriously.

69. North Carolina courts are reasonably consistent. In re Spier, 12 N.C. 491, 503 (1828) (referring to \( \beta \leq \frac{1}{10} \) as “the law”), State v. Hendrick, 12 N.C. 491, 503 (1950) (apparently quoting Blackstone (1769) without citation), and State v. Smith, 236 N.C. 748, 751 (1953) (citing both Blackstone (1769) and Hendrick). But see State v. Smith, 24 N.C. 402, 407 (1842) (stating \( \beta \leq \frac{1}{5} \), citing Hale (1736)).

70. Ohio courts have been consistent that \( \beta \leq \frac{1}{99} \). Silver v. State, 17 Ohio 365, 369 (1848), Jones Stranathan & Co. v. Greaves, 26 Ohio St. 2, 4 (1874) (calling it a “humane principle”), Lamprecht v. State, 84 Ohio St. 32, 49 (1911) (calling it an “ancient and merciful rule of the common law”). But note that State v. Wing, 66 Ohio St. 407, 425 (1902) refers to \( \beta \leq \frac{1}{99} \) skeptically as an “old maxim, sometimes abused,” and that subsequent cases (though from lower courts) have used looser language. E.g., Bixler v. State, 18 Ohio Law Abs. 117, 120 (Ohio Ct. App. 1934) (stating \( \beta \leq \frac{1}{99} \)) (stating \( \beta \leq \frac{1}{99} \)) (stating \( \beta \leq \frac{1}{99} \)) (stating \( \beta \leq \frac{1}{99} \)) (stating \( \beta \leq \frac{1}{99} \)) (stating \( \beta \leq \frac{1}{99} \)) (stating \( \beta \leq \frac{1}{99} \)) (stating \( \beta \leq \frac{1}{99} \)) (stating \( \beta \leq \frac{1}{99} \)) (stating \( \beta \leq \frac{1}{99} \)) (stating \( \beta \leq \frac{1}{99} \)) (stating \( \beta \leq \frac{1}{99} \)).

71. Oklahoma Courts are inconsistent on the value of \( \beta \). Stout v. State, 130 P. 553, 554 (1913) (mentioning \( \beta \leq \frac{1}{5} \) as a “maxim of English law”) and Abbott v. Territory, 20 Okl. 119 (1908) (stating \( \beta \leq \frac{1}{5} \), citing Hale (1736)). Also from lower courts, Brower v. State, 221 P. 1050, 1052 (1924) (stating \( \beta \leq 1 \) in reference to prosecutor’s duties to the law) and Pruitt v. State, 270 P.2d 351, 362 (Okla. Crim. App. 1954) (stating \( \beta \leq \frac{1}{100} \)). With reservations, we regard Stout, the most recent Oklahoma Supreme Court case, as authoritative.


73. Com. v. Deitrick, 221 Pa. 7, 21 (1908) and Appeal of Nicely, 130 Pa. 261, 270 (1889). But subsequent lower court rulings have diverged widely. E.g., In re Myers & Brei, 83 Pa. Super. 383, 394 (1924) (stating \( \beta \leq \frac{1}{99} \), Alberts v. Bradley, 11 Pa. D. & C.2d 107, 114 (Pa. Com. Pl. 1958) (calling \( \beta \leq \frac{1}{99} \) a “fundamental concept”), In re McMullins, 315 Pa. Super. 531, 542 (1983) (approvingly referring to \( \beta \leq \frac{1}{10} \) an “ancient maxim of the criminal law”), and Butler v. Flo-Ron Vending Co., 383 Pa. Super. 633, 657 (1989) (approvingly referring to \( \beta \leq \frac{1}{99} \) as a “proverb become principle”).
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<th>Jurisdiction</th>
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<tbody>
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<td>Rhode Island</td>
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<tr>
<td>South Carolina</td>
<td>( \beta \leq \frac{1}{\text{Many}} )</td>
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<tr>
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<td>( \beta \leq \frac{1}{\text{Many}} )</td>
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<td>( \beta \leq 1^* )</td>
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<tr>
<td>Texas</td>
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<td>Vermont</td>
<td>No Ruling</td>
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<tr>
<td>Virginia</td>
<td>( \beta \leq 1 )</td>
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76. State v. Brown, 165 N.W. 987, 988 (1917) (the court is somewhat ambiguous in approving of \( \beta \leq \frac{1}{\text{Many}} \)).

77. State v. Bishop, 431 S.W.3d 22, 53 (Tenn. 2014) (stating \( \beta \leq 1 \), citing In re Winship). But see In re Benjamin M., 310 S.W.3d 844, 849 (Tenn. Ct. App. 2009) (stating \( \beta \leq \frac{1}{\text{Several}} \), citing Schlup v. Delo, 513 U.S. 298, 325 (1995)), and the confusing language in a much older case, Rea v. State, 76 Tenn. 356, 360 (1881) (stating “it is better that ninety-nine guilty men out of a hundred should escape than that one innocent man should be convicted” (emphasis added)).

78. Texas courts have been somewhat self-contradictory on the value of \( \beta \). Courts have disapproved of various formulations. E.g., Hudson Insurance Company v. McKnight, 58 S.W.2d 1088, 1091 (1933) (referring to \( \beta \leq \frac{1}{99} \) as an “erroneous proposition of law”), Patterson v. State, 598 S.W.2d 265, 272 (1980) (finding no error in forbidding a voir dire inquiry about jurors’ beliefs about \( \beta \leq \frac{1}{10} \)), Delao v. State, No. 10-05-00323-CR, 2006 WL 3317718, at *5-6 (Tex.App.-Waco Nov. 15, 2006) (finding no error in forbidding a voir dire inquiry about jurors’ beliefs about \( \beta \leq 1 \)). Cases that positively articulate a value of \( \beta \) seem to favor \( \beta \leq 1 \). Pena v. State, 226 S.W.3d 634, 651 (2007) (citing Schlup v. Delo, 513 U.S. 298, 325 and In re Winship). Morrison v. State, 845 S.W.2d 882 n.7 (1992), Kelly v. State, 483 S.W.2d 467, 480 (1972) (stating \( \beta \leq 1 \), citing In re Winship).

79. State v. Reyes, 116 P.3d 305, 309 (Utah 2005) (citing Blackstone (1769)), State v. Sullivan, 6 Utah 2d 110, 114 (1957) (referring to \( \beta \leq \frac{1}{10} \) as an “ancient and honored adage of our law”), State v. Weldon, 6 Utah 2d 372, 376 (1957) (referring to \( \beta \leq \frac{1}{10} \) as a “time honored and important precept of our law”). Utah courts have been fairly consistent, although there are a couple of exceptions. State v. Long, 721 P.2d 483, 491 (Utah 1986) (stating \( \beta \leq 1 \), citing In re Winship) and State v. Kourbelas, 621 P.2d 1238, 1240 (Utah 1980) (stating “some,” but citing Sullivan, which prescribes \( \beta \leq \frac{1}{10} \)).

80. Virginia has undergone a change in the articulation of \( \beta \). Early cases advocated \( \beta \leq \frac{1}{99} \). E.g., Cluverius v. Com. 81 Va. 787, 788 (1886), Finchim v. Com. 3 S.E. 343, 344-45 (1887), McDaniel v. Com. 165 Va. 709, 718-19 (1935). But note McCue v. Com. 49 S.E. 623, 630 (1905) (“We have no fault to find with the [\( \beta \leq \frac{1}{99} \] as a rhetorical phrase, but as a guide to a jury In reaching a conclusion it is of no value”), subsequent cases have favored \( \beta \leq 1 \). E.g., Mohler v. Com., 132 Va. 713 (1922) (on a prosecutor’s duty to the law), Fitzpatrick v. Com., 115 S.E. 522 (1923) (citing Mohler), Dingus v. Com., 149 S.E. 414, 416 (1929) (citing Mohler), Bateman v. Com., 183 Va. 253, 256 (1944) (citing Mohler), Reedy v. Wright, 60 Va. Cir. 18 (2002) (citing In re Winship), Tuma v. Com., 60 Va.App. 273, 286 (2012) (citing Appeal of Nicely, 18 A. 737,
Table 1: Table of Judicial Articulations of the Blackstonian Ratio

<table>
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<tr>
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<tr>
<td>U.S. Supreme Court</td>
<td>$\beta \leq 1$</td>
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</table>

4 Discussion and Conclusions

References


738 (1889) on a prosecutor’s duty to the law).


82. State v. Johnson, 140 S.E. 532, 533 (1927) (referring to $\beta \leq \frac{1}{99}$ as a “shibboleth of our criminal jurisprudence”), Weeks v. Chesapeake & O. Ry. Co., 69 S.E. 805, 808 (1910) (dissent) (stating $\beta \leq \frac{1}{99}$), and Varner v. Martin, 21 W. Va. 534, 542 (1883) (contrasting the rights of a criminal defendant from the “right” of a legislature). But see State v. Michael, 16 S.E. 803, 804 (1893) (stating $\beta \leq 1$).

83. Recent cases state $\beta \leq \frac{1}{10}$. State v. Dubose, 285 Wis. 2d 143, 180 (2005) (concurrency) (citing Blackstone (1769) and Furman v. Georgia, 408 U.S. 238, 367 n. 158), In re Torrance P., Jr., 298 Wis. 2d 1, 30 (2006) (concurrency) (citing Blackstone (1769)). However, earlier cases suggested $\beta \leq 1$. State ex rel. Fitas v. Milwaukee Cnty., 65 Wis. 2d 130, 134 (1974).

84. State v. Peterson, 194 P. 342 (1920) (referring to $\beta \leq \frac{1}{100}$ as an “almost universal doctrine” to contrast it with another proposition). This is tenuous, but the only apparent statement of $\beta$ in Wyoming courts.


Hale, Matthew. 1736. The History of the Pleas of the Crown.


