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Are Judges Influenced by Dollar Amounts? Evidence from Tax Law

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Are Judges Influenced by Dollar Amounts? Evidence from Tax Law

We investigate whether idiosyncratic features of numbers in dollar amounts unconsciously bias judges. If so, appellants' likelihood of success could depend on the dollar amount under dispute. Specifically, we examine the following: whether the first digit in a dollar amount follows the frequency distribution predicted by Benford's Law, and, accordingly, whether the likelihood of appellants' success varies with the first digit of their disputed dollar amount; round number bias, which is the psychological tendency to prefer round numbers (ending in 0) over other numbers; and even-odd number bias, which is the psychological tendency to ascribe different characteristics to even numbers versus odd numbers. We use a sample of tax cases at the Tax Court of Canada (2010–2019) containing 3,811 disputes with dollar amounts for this investigation. Collectively, we find no evidence that these numerical cognition biases influence judicial decision-making. These results suggest that judges are unlikely to be biased by the dollar amount in a dispute. These results clarify circumstances in which numbers can influence judges, as there is empirical evidence that judges are susceptible to numerical anchors and show even-odd number bias when imposing sentence lengths.

Nous cherchons à déterminer si les caractéristiques idiosyncrasiques des chiffres dans les montants en dollars influencent inconsciemment les juges. Si tel est le cas, les chances de succès des appelants pourraient dépendre des montants en litige. Plus précisément, voici ce que nous examinons : l'adéquation du premier chiffre d'un montant en dollars avec la distribution de fréquence prévue par la loi de Benford et, par conséquent, la variation des chances de succès des appelants en fonction du premier chiffre du montant litigieux; le biais des nombres ronds, qui est la tendance psychologique à préférer les nombres ronds (se terminant par 0) aux autres; et le biais des nombres pairs et impairs, qui est la tendance psychologique à attribuer des caractéristiques différentes aux nombres pairs et aux nombres impairs. Nous utilisons, pour notre étude, un échantillon de dossiers fiscaux traités par la Cour canadienne de l'impôt (2010—2019) comprenant 3 811 litiges concernant des montants en dollars. Dans l'ensemble, nous ne trouvons aucune preuve que les biais cognitifs en matière de chiffres influencent la prise de décision judiciaire. Les résultats indiquent qu'il est peu probable que les juges soient influencés par le montant d'un litige. Les résultats clarifient les situations dans lesquelles les chiffres peuvent influencer les juges, car il existe des preuves empiriques montrant que les juges sont sensibles aux ancrages numériques et font preuve d'un biais en faveur des nombres pairs ou impairs lorsqu'ils imposent la durée des peines.

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Introduction

Bias implies "an unreasoned and unfair distortion of judgment in favor or against a person."[1] Although most judges consciously avoid personal biases in their decision-making process, it is possible that judges could nonetheless be influenced by unconscious bias.[2] Unconscious biases are "attitudes and correlations that are formed by one's life experiences and that lurk beneath the surface of the conscious."[3] Unconscious biases are problematic for judicial decision-making because they can impair the ability of judges to reach decisions that are merit-based and ethically

1. Merriam Webster, "Bias" (last visited 17 October 2025), online: <merriam-webster.com> [perma.cc/952M-QSSW].
2. John Irwin & Daniel Real, "Unconscious Influence on Judicial Decision-Making: The Illusion of Objectivity" (2010) 42:1 McGeorge L Rev 1; Anthony Greenwald & Linda Krieger, "Implicit Bias: Scientific Foundations" (2006) 94:4 Cal L Rev 945.
3. Irwin & Real, *supra* note 2 at 4.

correct.[4] Practising lawyers recognize the presence of unconscious bias in arbitration decisions and have recognized that subconscious biases can lead to different outcomes in cases with similar factual and legal backgrounds.[5]

The purpose of this research is to investigate whether unconscious bias, related to numerical cognition, influences judicial outcomes. When information contains numbers (an amount), which is comprised of digits (0 through 9), reasoning with this information pertains to numerical cognition.[6] Moreover, as there are numerical cognition biases, reasoning with numbers can be potentially inaccurate. For instance, a type of numerical bias is the "whole number bias," in which people misapply their understanding of whole numbers to fractions.[7] People can incorrectly state that one quarter (1/4) is larger than one third (1/3) because four is larger than three.[8] Other forms of bias in numbers can arise because humans project nonmathematical meanings onto numbers or because individuals have preferences for favoured numbers.[9]

Legal research to date has investigated how numerical cognition influences judges in two contexts. One context pertains to numerical anchors. Anchoring-and-adjustment occurs when the first number shown to a judge, such as a compensatory award amount or a sentence length, biases their subsequent decision.[10] A meta-analysis of this stream of research is summarized by Bystranowski et al., who concluded that numerical biases relating to anchors influence judicial decision-making.[11] One study about

4. Jeffrey Rachlinski & Sheri L Johnson, "Does Unconscious Racial Bias affect Trial Judges?" (2009) 84:3 Notre Dame L Rev 1195.
5. Alice Stocker, "De-Biasing Counsel: A Call for Agile Minds in Arbitration" (2022) 39:1 J Intl Arb 117; Stepan Puchkov, "Subconscious Bias as a Factor Influencing Arbitral Decision-making" (2018) 84:1 Arbitration: J Intl Arbitration, Mediation & Dispute Management 52.
6. Manoj Thomas & Vicki Morwitz, "Heuristics in Numerical Cognition: Implications for Pricing" in Vithala R Rao, ed, H*andbook of Pricing Research in Marketing* (Cheltenham, UK: Edward Elgar Publishing, 2009) 132. Numerical cognition differs from numeracy, which is "the ability to process basic probability and numerical concepts." See Ellen Peters et al, "Numeracy and Decision Making" (2006) 17:5 Psychological Science 407 at 407. In this research, we are not concerned with how judges process numerical concepts, but how they reason with given numbers.
7. Yujing Ni & Yong-Di Zhou, "Teaching and Learning Fraction and Rational Numbers: The Origins and Implications of Whole Number Bias" (2005) 40:1 Educational Psychologist 27.
8. Zack Hawes, "Whole Number Bias and 3 Misconceptions about Fractions in Junior Math" (26 May 2022), online (blog): <utoronto.ca> [perma.cc/Q4UK-GHYC].
9. Alex Bellos, *The Grapes of Math: How Life Reflects Numbers and Numbers Reflect Life* (New York: Simon & Schuster, 2015); Craig E Jones & Micah B Rankin, "Justice as a Rounding Error? Evidence of Subconscious Bias in Second-Degree Murder Sentences in Canada" (2014) 52:1 Osgoode Hall LJ 109.
10. Amos Tversky & Daniel Kahneman, "Judgment under Uncertainty: Heuristics and Biases" (1974) 185:4157 Science 1124.
11. Piotr Bystranowski et al, "Anchoring Effect in Legal Decision-Making: A Meta-Analysis" (2021) 45:1 L & Human Behavior 1 at 19.

sentence lengths shows that judges are susceptible to "number preference," in which judges tend to select numbers as sentence lengths which are easy to process, such as even numbers over odd numbers and whole numbers rather than fractional numbers.[12] The presence of a "number preference" is an example of a heuristic, or decision shortcut, also known as "System 1" processing (in contrast to "System 2" processing, also known as systematic processing, which is slow and deliberate).[13] Sussman states, "[t]here is no question that System 1 is operative and impacts a judge's decision-making as it does for everyone," a conclusion that is reinforced by the empirical legal research referenced above.[14]

What remains to be understood about numerical cognition in judicial decision-making is whether the dollar amount in a dispute may be associated with differential outcomes for appellants. The dollar amount in a dispute should have no bearing on the outcome of a dispute. The numbers in a dollar amount should have no more salience in a tax dispute than the digits of the taxpayer's street address. Nevertheless, research suggests that judges are susceptible to numerical cognition biases and heuristics, which raises the possibility that numerical cognition biases could be operative in cases involving dollar amounts.

To address this gap, we investigate three issues related to numerical cognition in dollar amounts that could unconsciously bias judges. The first is a salience bias pertaining to the first digit in an amount.[15] First digits in a large numerical dataset tend to follow a frequency distribution known as Benford's Law, in which the first digit is likely to be small rather than large. The digit "1" is the most frequently occurring first digit, followed by the digit "2," etc. Judges could pay more attention to numbers whose first digit is a relatively infrequent digit—salience bias—which could lead to more intense scrutiny of a dispute and perhaps lead to inconsistencies in decision-making. The remaining two issues are types of number preferences.[16] One is round number bias, which is a preference for numbers ending in "0"

12. Jones & Rankin, *supra* note 9.
13. Daniel Kahneman, *Thinking, Fast and Slow* (New York: Farrar, Straus and Giroux, 2011); Shelly Chaiken & Alison Ledgerwood, "A Theory of Heuristic and Systematic Information Processing" in Paul Van Lange et al, eds, *Handbook of Theories of Social Psychology: Volume 1* (New York: Sage Publications, 2012) 246.
14. Edna Sussman, "Biases and Heuristics in Arbitrator Decision-Making: Reflections on How to Counteract or Play to Them" in Tony Cole, ed, *The Roles of Psychology in International Arbitration* (Alphen aan den Rijn: Kluwer Law International, 2017) at 47-48.
15. Salience bias means that some features of a decision are often immediately visible and perceptible; see Verena Tiefenbeck et al, "Overcoming Salience Bias: How Real-Time Feedback Fosters Resource Conservation" (2018) 64:3 Management Science at 1458.
16. Number preferences are identified by Jones & Rankin, *supra* note 9.

because round numbers are easiest to process.[17] A round number may serve as a heuristic and may cause a judge to scrutinize case facts differently than if no round number were present, which could result in a source of unconscious bias in their decision-making. We also investigate even-odd number bias, which is a perception that even numbers and odd numbers have different psychological properties.[18] If judges perceive even numbers differently than odd numbers, their decision-making may be unconsciously biased.

We use a tax context for this research because tax cases frequently contain dollar amounts. For this reason, we conduct our investigation in a context in which dollar amounts frequently and naturally occur. Taxpayers' disputes tend to involve a dollar amount pertaining to an income inclusion, deduction, or tax credit. To undertake our investigation, we hand-collected data from the most recent complete decade of tax cases at the Tax Court of Canada (2010–2019). The Tax Court of Canada (TCC) is the only dedicated tax court in Canada. A taxpayer who is unable to resolve a dispute with the Canadian tax authority (the Canada Revenue Agency) can appeal to the TCC. The TCC must decide all cases that are appealed to it. A single judge hears each case.[19] In this entire sample, 46 judges heard 1,517 tax cases. The 1,517 cases contained 4,420 tax disputes, as some cases contained multiple tax issues. Of these cases, 1,266 contain dollar amounts, comprising 3,811 disputed issues. We use these 3,811 disputed issues in our analysis. Our dependent variable is the likelihood of a taxpayer obtaining a successful outcome for each disputed issue.

The disputed dollar amounts in the data follow the first digit frequency of Benford's Law, but we find no evidence of salience bias. The likelihood of a taxpayer obtaining a successful outcome did not vary significantly by the first digit in the dollar amount. We also found no evidence that a taxpayer is more likely to be successful if the dollar amount in dispute is a round number or an even versus odd number, even though the dollar amounts in our sample are disproportionately round numbers. These results are robust when control variables are included, including the identity of the judge as well as the magnitude of the dollar amount. Collectively, these results suggest that judges appear not to be influenced by numerical cognition

17. Hidehito Honda, Rina Kagawa & Masaru Shirasuna, "On the Round Number Bias and Wisdom of Crowds in Different Response Formats for Numerical Estimation" (2022) 12 Scientific Reports, DOI: <10.1038/s41598-022-11900-7>.
18. Marisca Milikowski, *Knowledge of Numbers: A Study of the Psychological Representation of the Numbers 1-100* (PhD thesis, University of Amsterdam Psychology Research Institute, 1995) [unpublished].
19. Tax Court of Canada, "Home," online: <tcc-cci.ca/en/home> [perma.cc/4H8A-QSUN].

biases which could arise naturally in dollar amounts. Thus, judges are unlikely to be biased by the dollar amount in a dispute.

This article begins with a review of relevant literature about judicial decision-making to demonstrate a research gap with regard to numerical cognition. Next in section II we develop our hypotheses. Section III describes our methodology and reports our results. Finally, we conclude with a discussion of the implications of our findings.

I. *Background literature on judicial decision-making*

There is a considerable empirical legal literature on judicial bias. This literature tends to investigate the association between socio-demographic characteristics of judges and judicial outcomes. This literature yields mixed results. There is also a stream of judicial decision-making research pertaining to numerical cognition, which focuses on numerical anchoring as well as number preference in sentence length. What remains to be understood is whether features of numbers in disputed dollar amounts can unconsciously bias judges.

1. *Empirical legal literature about judicial decision-making generally*

There is a considerable body of empirical legal research investigating the association between "legally irrelevant characteristics of judges"[20] or "observable, personal characteristics of judges,"[21] such as race or political ideology, on the decision outcomes of judges. Harris & Sen provide a relatively recent review of this literature and conclude that a judge's political ideology, more than any other personal characteristic, is important in predicting judicial outcomes, although even this finding is not conclusive.[22] There are mixed findings about the extent to which other personal characteristics of judges bias their judicial decisions.[23] As noted by Sisk et al, "'mixed results' is the phrase researchers most commonly select to describe prior attempts to connect social or experiential attributes of judges to their voting behaviour."[24]

20. Eric A Posner, "Does Political Bias in the Judiciary Matter? Implications of Judicial Bias Studies for Legal and Constitutional Reform" (2008) 75:2 U Chicago L Rev 853 at 853.
21. Thomas J Miles & Cass R Sunstein, "The New Legal Realism" (2008) 75:2 U Chicago L Rev 831 at 835.
22. Allison P Harris & Maya Sen, "Bias and Judging" (2019) 22 Annual Rev Political Science 241; other authors did not find that the political party of the judge's appointing president was a significant predictor of successful judicial outcomes (see Orly Ashenfelter, Theodore Eisenberg & Stewart J Schwab, "Politics and the Judiciary: The Influence of Judicial Background on Case Outcomes" (1995) 24:2 J Leg Stud 257).
23. Harris & Sen, *supra* note 22; Brian M Barry, *How Judges Judge: Empirical Insights into Judicial Decision-Making* (New York: Routledge, 2021).
24. Gregory C Sisk, Michael Heise & Andrew P Morriss, "Charting the Influences on the Judicial Mind: An Empirical Study of Judicial Reasoning" (1998) 73:5 NYUL Rev 1377 at 1385-1386.

Little legal scholarship about judicial decision-making pertains to factors other than personal characteristics of judges. Exceptions are Brennan et al and Oren-Kolbinger, who examined whether economic conditions biased judges.[25] Both studies examined whether case timing in economic cycles may have led to differences in judicial decision-making. Both studies found evidence that judges ruled in favor of taxpayers significantly more during economic upturns but not economic downturns. There is also experimental evidence, with judges as subjects, that emotions, such as sympathy, can bias judges.[26]

2. *Empirical legal literature about numerical biases in judicial decision-making*

Pioneering research on cognitive biases and heuristics (mental shortcuts) was done by Tversky & Kahneman, who identified three heuristics that individuals can use when making judgments in uncertain situations, including an "anchor."[27] According to Tversky & Kahneman, anchoring occurs when people make initial estimates using a number. The initial number serves as an anchor or reference point for subsequent adjustments. An example of numerical anchoring is initial real estate prices. Empirical research shows that higher starting prices are associated with higher selling prices.[28]

Bystranowski et al conduct a meta-analysis of numerical anchors in legal decision-making across 29 studies.[29] In this context, whenever a numeric demand is made, such as sentence length or punitive damages, the anchoring effect seems to be robust, as the overall effect size was of medium strength. Bystranowski et al's meta-analysis included eight studies specific to decision-making by judges, each of which was an experimental study using judges as subjects. The experiments used hypothetical vignettes and asked the judges to make a numerical decision relating to sentence length,[30]

25. Thomas Brennan, Lee Epstein & Nancy Staudt, "Economics Trends and Judicial Outcomes: A Macrotheory of the Court" (2009) 58:7 Duke LJ 1191; Orli Oren-Kolbinger, "Do Tax Judges Think about the Economy?" (2021) 52:2 Loy U Chicago LJ 437.
26. Jeffrey Rachlinski & Andrew Wistrich, "Judging the Judiciary by the Numbers: Empirical Research on Judges" (2017) 13 Annual Rev L & Soc Science 203.
27. Tversky & Kahneman, *supra* note 10.
28. Grace Bucchianeri & Julia Minson, "A Homeowner's Dilemma: Anchoring in Residential Real Estate Transactions" (2013) 89 J Econ Behavior & Organization 76.
29. Bystranowski et al, *supra* note 11.
30. Birte Englich & Thomas Mussweiler, "Sentencing Under Uncertainty: Anchoring Effects in the Courtroom" (2001) 31:7 J Applied Soc Psychology 1535; Birte Englich, "'Give Him Five Years!': Influences of Partisan Hecklers on Judges' Sentencing Decisions" (2005) 36:4 Zeitschrift für Sozialpsychologie 215.

plaintiff damages,[31] and interest rates on a loan in a bankruptcy situation.[32] In all of these experiments, an anchoring effect was found: higher initial amounts resulted in significantly longer sentences, greater compensation, and higher interest rates compared to lower initial amounts. This body of research shows that judges are prone to a numerical anchoring bias, and more generally, that numbers can influence judges.

Jones & Rankin investigated whether sentence lengths in second-degree murder sentences in Canada over a 22-year period showed any evidence of number preference, which they define as "a human tendency to select favoured numbers."[33] Their findings showed that sentence lengths tended to be whole numbers rather than numbers with decimal points (e.g. 3 years rather than 3.5 years); that judges tended to award sentence lengths that were even numbers rather than odd numbers; and that judges showed preferences for sentence lengths which were multiples of five (e.g. 15 or 20 years).[34] This research suggests that judges are prone to heuristic processing with idiosyncratic features of numbers.

3. *Empirical legal literature about judicial decision-making in tax cases*

Although we use tax law as the legal context for our analysis given its propensity to contain dollar amounts, the focus of our research is not on tax law per se. Notwithstanding, there is a subset of empirical judicial decision-making research specific to tax cases. This research has investigated how tax decisions made at tax courts differ from other non-specialized courts,[35] how different tax rules are judged cross-nationally,[36] which tax cases go to trial,[37] and which dimensions of fairness are associated with favourable

31. Chris Guthrie, Jeffrey Rachlinski & Andrew Wistrich, "Inside the Judicial Mind" (2001) 86:4 Cornell L Rev 777; Chris Guthrie, Jeffrey Rachlinski & Andrew Wistrich, "The 'Hidden Judiciary': An Empirical Examination of Executive Branch Justice" (2009) 58:7 Duke LJ 1477; Jeffrey Rachlinski, Andrew Wistrich & Chris Guthrie, "Can Judges Make Reliable Numeric Judgments? Distorted Damages and Skewed Sentences" (2015) 90:2 Ind LJ 695; Mark Schweizer, *Kognitive Täuschungen vor Gericht: eine empirische Studie* [(2005) Faculty of Law, University of Zurich unpublished manuscript]; Andrew Wistrich, Chris Guthrie & Jeffrey Rachlinski, "Can Judges Ignore Inadmissible Information? The Difficulty of Deliberately Disregarding" (2005) 153:4 U Pa L Rev 1251.
32. Jeffrey Rachlinski, Chris Guthrie & Andrew Wistrich, "Inside the Bankruptcy Judge's Mind" (2006) 86:5 BUL Rev 1227.
33. Jones & Rankin, *supra* note 9 at 113.
34. *Ibid*.
35. Robert Howard, "Comparing the Decision Making of Specialized Courts and General Courts: An Exploration of Tax Decisions" (2005) 26:2 Justice System J 135.
36. Thaddeus Hwong & Jinyan Li, "GAAR in Action: An Empirical Study of Transaction Types and Judicial Attributes in Australia, Canada, and New Zealand" (2020) 68:2 Can Tax J 539.
37. Leandra Lederman, "Which Cases go to Trial? An Empirical Study of Predictors of Failure to Settle" (1999) 49:2 Case W Res L Rev 315.

outcomes for taxpayers.[38] There is also a stream of empirical legal tax literature investigating how socio-demographic characteristics of judges may impact their decision-making.[39] Like the broader stream of non-tax research which investigates socio-demographic characteristics of judges, these tax-specific studies provide mixed results. Missing from this stream of research, as well as the broader stream of judicial decision-making research, is an investigation of numerical cognition bias which could arise in disputed dollar amounts.

II. *Hypotheses*

In this section, we identify three sources of bias related to numerical cognition and develop hypotheses about how each issue could influence judicial decision-making.

1. *Benford's Law and salience bias*

Benford's Law, also known as the law of first digits, refers to the statistical tendency for the first digits in a numerical dataset to be configured such that the lowest digit—"1"—appears most frequently (30.1 per cent), followed by "2" (17.6 per cent), etc. The digit "9" appears least frequently (4.6 per cent).[40] Thus, a number is roughly 6.5 times more likely to have "1" as

38. Jonathan Farrar & Harjot Mehmi, "The Association Between Fairness and Judicial Decision-Making: Evidence from Tax Law" (2024) 27:2 Fla Tax Rev 586.

39. Benjamin Alarie & Andrew J Green, "Policy Preferences and Expertise in Canadian Tax Adjudication" (2014) 62:4 Can Tax J 985; Jinyan Li & Thaddeus Hwong, "GAAR in Action: An Empirical Exploration of Tax Court of Canada Cases (1997-2009) and Judicial Decision Making" (2013) 61:2 Can Tax J 321; Bradley Lindsey, Sophie McDonnell & William Moser, "Do United States Tax Court Judge Attributes Influence the Resolution of Corporate Tax Disputes?" (2023) 42:6 J Accounting & Pub Pol'y; James Maule, "Instant Replay, Weak Teams, and Disputed Calls: An Empirical Study of Alleged Tax Court Judge Bias" (1999) 66:2 Tenn L Rev 351; Thaddeus Hwong, "An Exploration of Influences of Sociodemographic Characteristics of Supreme Court Justices in Judicial Decision-Making in Income Tax Cases, 1920–2003" (2009) 33:1 Man LJ 151; Orli Oren-Kolbinger, "Measuring the Effect of Social Background on Judicial Decision-Making in Tax Cases" (2019) 22:2 Fla Tax Rev 579; Cynthia Ostberg & Matthew Wetstein, "Attitudinal Conflict in Economic Cases" in Cynthia Ostberg & Matthew Wetstein, eds, *Attitudinal Decision Making in the Supreme Court of Canada* (Vancouver: UBC Press, 2007) 154; Daniel M Schneider, "Empirical Research on Judicial Reasoning: Statutory Interpretation in Federal Tax Cases" (2001) 31:2 NML Rev 325; Daniel M Schneider, "Assessing and Predicting who Wins Federal Tax Trial Decisions" (2002) 37:2 Wake Forest L Rev 473; Daniel M Schneider, "Statutory Construction in Federal Appellate Tax Cases: The Effect of Judges' Social Backgrounds and of Other Aspects of Litigation" (2003) 13 Wash UJL & Pol'y 257; Daniel M Schneider, "Using the Social Background Model to Explain Who Wins Federal Appellate Tax Decisions: Do Less Traditional Judges Favor the Taxpayer?" (2005) 25:1 Va Tax Rev 201.

40. Frank Benford, "The Law of Anomalous Numbers" (1938) 78:4 Proceedings Am Philosophical Society 551; Rachel Fewster, "A Simple Explanation of Benford's Law" (2009) 63:1 Am Statistician 26.

a first digit than "9." The frequency of first digits follows a logarithmic distribution.[41]

If the first digits in a number had an equal probability of occurring, they would be expected to each occur about one-ninth of the time in empirical settings. However, large numerical datasets such as stock prices, census tables, and tax return information instead conform to Benford's Law.[42] Benford's Law is used to identify fraud in financial records, as amounts in which the leading digits do not follow the distribution predicted by Benford's Law can be an indicator of fraud.[43] Because Benford's Law is so cross-contextually robust, it can be used to detect anomalous data.[44]

Given the empirical robustness of Benford's Law, we believe it will also apply to a dataset containing dollar amounts in a sample of tax cases. Accordingly, we make the following prediction:

> Hypothesis 1a. The disputed dollar amounts in tax cases will follow the first-digit distribution predicted by Benford's Law.

According to Benford's Law, since there should be an unequal distribution of first digits in the dollar amounts in tax cases, this phenomenon could lead to a salience bias. Salience bias is a psychological phenomenon in which some features of a decision are more vivid and perceptible than others, which creates a bias in favor of the elements that are salient.[45] Salience bias can lead to discrepancies between individuals' aspirations and their decisions at the moment of decision-making. Salience bias has been found to influence individuals in contexts as diverse as crowdsourcing[46] and object recognition.[47]

Extending salience bias to a judicial decision-making context, if some first digits are less common than others, it is possible that judges will tend to pay more attention to less commonly occurring digits. In turn, that salience bias could distort judge's decision-making, perhaps by

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41. The distribution of first digits follows the distribution according to the following formula: P(d) = log_10(1 + 1/d).
42. Steven J Miller, *Benford's Law: Theory and Applications* (Princeton: Princeton University Press, 2015).
43. See e.g. Mark Nigrini, "Adding Value with Digital Analysis" (1999) 56:1 Internal Auditor 21.
44. See e.g. Andreas Diekmann, "Not the First Digit! Using Benford's Law to Detect Fraudulent Scientific Data" (2007) 34:3 J Applied Statistics 321; George Judge & Laura Schechter, "Detecting Problems in Survey Data using Benford's Law" (2009) 44:1 J Human Resources 1.
45. Tversky & Kahneman, *supra* note 10; Verena Tiefenbeck et al, *supra* note 15.
46. Ho Cheung Brian Lee et al, "Salience Bias in Crowdsourcing Contests" (2018) 29:2 Information Systems Research 401.
47. Matthew Langley & Michael McBeath, "Vertical Attention Bias for Tops of Objects and Bottoms of Scenes" (2023) 49:10 J Experimental Psychology: Human Perception & Performance 1281.

unconsciously attenuating their attention on case facts due to heuristic processing. We therefore make the following prediction:

> Hypothesis 1b. The likelihood of a taxpayer obtaining a successful outcome in a tax court will differ according to the first digit in the disputed amount.

2. *Round number bias*

Round number bias is the tendency to prefer to make decisions using round numbers.[48] Round numbers are easier to process than non-round numbers, perhaps because individuals can conserve memory and attention.[49] For this reason, individual decisions often use round numbers as cognitive reference points, in contexts as diverse as baseball batting averages,[50] stock traders' trading times,[51] and marathon running times.[52]

In a dispute, a judge may find it easier to conserve memory and attention when a dollar amount is round versus non-round. Thus, a judge could more carefully attend to case facts when a number is round versus non-round. In turn, the consistency of judicial decision-making could be impaired. We therefore predict the following:

> Hypothesis 2. The likelihood of a taxpayer obtaining a successful outcome in a tax court will differ if the disputed amount is a round number versus a non-round number.

3. *Even-odd number bias*

Even-odd number bias is the tendency for individuals to prefer even numbers over odd numbers.[53] Mathematical parity (even and odd grouping) is part of numerical cognition because even numbers are categorized more quickly and accurately than odd numbers.[54] Furthermore, the parity of numbers is perceived differently, which has psychological implications.[55]

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48. Honda et al, *supra* note 17.
49. King & Janieszewski, *supra* note 17; Gabrielle A Brenner & Reuven Brenner, "Memory and Markets, or Why are you Paying $2.99 for a Widget?" (1982) 55:1 J Bus 147.
50. Devin Pope & Uri Simonsohn, "Round Numbers as Goals: Evidence from Baseball, SAT Takers, and the Lab" (2011) 22:1 Psychological Science 71.
51. Tao Chen, "Round-Number Biases on Trading Time: Evidence from International Markets" (2021) 44:3 J Financial Research 469.
52. Eric J Allen et al, "Reference-Dependent Preferences: Evidence from Marathon Runners" (2017) 63:6 Management Science 1657.
53. Milikowski, *supra* note 18.
54. Terence M Hines, "An Odd Effect: Lengthened Reaction Times for Judgments about Odd Digits" (1990) 18:1 Memory & Cognition 40.
55. Daniel B Berch et al, "Extracting Parity and Magnitude from Arabic Numerals: Developmental Changes in Number Processing and Mental Representation" (1999) 74:4 J Experimental Child Psychology 286.

Milikowski & Elshout provide empirical evidence of this assertion.[56] They categorized numbers on three scales (bad-good, heavy-light, and excitable-calm), and found that even numbers were significantly more likely to be perceived as good, light, and calm versus odd numbers. Thus, there may be psychological properties of the parity of numbers that can bias decision makers.

Judicial research by Jones & Rankin demonstrates that judges prefer to impose sentences which are even rather than odd.[57] This finding also suggests that judges may perceive odd and even numbers differently. If so, their decision-making may be biased. We therefore predict the following:

> Hypothesis 3. The likelihood of a taxpayer obtaining a successful outcome in a tax court will differ according to whether the disputed amount is an even versus odd number.

III. *Methodology & results*

To address each hypothesis, we used data hand-collected from the TCC from the most recent complete decade (2010–2019). One judge hears each case. Any taxpayer can appeal a disagreement with the Canadian tax authority to the Court, and the Court must hear the appeal, regardless of the issue(s) or dollar amount(s) at stake. Our sample consists of 3,811 unique disputes containing a dollar amount from 1,266 unique tax cases decided by 45 judges.

Data collection was carried out primarily by one of the co-authors using an online database provided by the Canadian Legal Information Institute (CanLII).[58] The co-authors used these publicly available TCC judgements to extract from them the necessary variables to carry out this study. Judgements with missing variables were excluded from the analysis. Several variables and observations in the dataset were checked for coding accuracy by two of the co-authors to ensure quality control. There were minimal coding discrepancies, which were resolved following discussions amongst the author team.

Our unit of analysis is at the issue or dispute level, rather than the case level, as some cases contain multiple disputes, each with different dollar amounts. Furthermore, in cases with multiple disputes, the disputes can be decided differently, making it possible for a taxpayer to be successful

56. Marisca Milikowski & Jan J Elshout, "Numbers as Friends and Villains" (1996), online (pdf): <rekencentrale.nl> [perma.cc/PS9R-VPU4].
57. Jones & Rankin, *supra* note 9.
58. Canadian Legal Information Institute, "What is CanLII" (last visited 27 October 2025), online: <canlii.org> [perma.cc/DT2H-FYJH].

on one dispute and unsuccessful on another. Thus, we collected data pertaining to the dispute-level outcome (successful or unsuccessful), dollar amount in dispute, type of taxpayer (individuals and corporations were the only types of taxpayers in our sample), year of decision, number of appellants, the type of issue (income inclusion, deduction, tax credit or other), the number of court judgments cited by the judge, and the identity of the judge.

Our dependent variable is whether a taxpayer obtains a successful outcome for a given dispute. We consider a successful outcome to be a binary variable. We acknowledge that a taxpayer can be partially or completely successful, but for this research we consider success to be anything other than entirely unsuccessful. Our focus is on the association between numerical biases and successful outcomes, regardless of the degree of success. Our key independent variable is the dollar amount. The other variables cited in the preceding paragraph we use as control variables when conducting logistic regression to test each hypothesis.

Statistical analysis was conducted using R statistical software, a free software environment for statistical computing and graphics.[59] The Benford Analysis R package of Cinelli was also used.[60]

1. *Testing Benford's Law and salience bias*

To test Hypothesis 1a, which predicts that the dollar amounts in the tax cases in the sample will follow a first-digit pattern consistent with Benford's Law, we first compared the expected percentages of first digits according to Benford's Law with the actual percentages of first digits in our sample. This comparison is tabulated below in Table 1, Panel A. Panel B of Table 1 provides a graph of the frequencies of first digits in our sample.

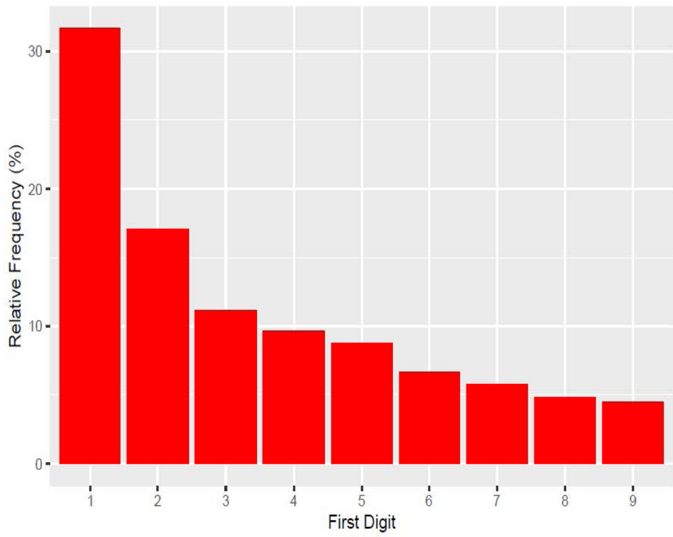
59. See The R Foundation, "The R Project for Statistical Computing" (last visited 27 October 2025), online: <r-project.org> [perma.cc/U2P4-AUG9].
60. Carlos Cinelli, "Benford.analysis: Benford Analysis for Data Validation and Forensic Analytics" (21 December 2018), online: <CRAN.R-project.org> [perma.cc/6ETQ-MABY].

Table 1. Bedford's Law frequencies

Panel A: Comparison of Benford's law first-digit frequencies with Tax Court of Canada (TCC) dollar amount first-digit frequencies (2010-2019)

First digit	Frequency per Benford's law	Actual frequency in TCC data (2010-2019)	
1	30.10%	1,207	31.67%
2	17.60%	653	17.14%
3	12.49%	426	11.18%
4	9.69%	368	9.66%
5	7.91%	334	8.76%
6	6.69%	252	6.61%
7	5.79%	219	5.75%
8	5.11%	182	4.80%
9	4.57%	170	4.43%
		Total: 3,811	

Panel B: Frequency histogram of first digits in TCC cases (2010-2019)



A comparison of the percentage of any sample with first digit frequencies according to Benford's Law with the percentage of the TCC sample shows a striking similarity. Furthermore, to specifically test Hypothesis 1a, we conducted a Pearson chi-squared goodness-of-fit test. The result is not significant (p=0.098), which indicates that the first-digit frequencies observed in the sample are not significantly different from the expected frequencies per Benford's Law. That is, the pattern of first-digit frequencies in our sample is similar to the pattern of first-digit frequencies per Benford's Law. Thus, we find support for Hypothesis 1a.

Next, to test Hypothesis 1b, which predicts that the likelihood of a taxpayer obtaining a successful outcome varies by the first digit of the amount due to a salience bias, we used a binary logistic regression model. The dependent variable is whether the taxpayer was successful or unsuccessful. The key independent variable of interest is the first digit of the dollar amount (a categorical variable with 9 categories). When we initially regressed this dependent variable on the independent variable, we found no significant results. That is, for each first digit from 2 through 9, when compared with the likelihood of success when the first digit is 1, there are no significant differences. The coefficients of this regression are reported below in Table 3, Panel A.[61]

For robustness, we conducted another regression to include control variables (taxpayer type, year of decision, number of appellants, type of issue, number of court judgments cited, and the identity of the judge). We also controlled for the dollar magnitude, as there is empirical evidence that individuals process larger versus smaller numbers differently.[62] We controlled for dollar magnitude using the base-10 logarithm of the actual dollar amount. This transformation is necessary to improve the model fit due to the presence of outliers in the dollar amount. When we ran a regression with the control variables and included the dollar magnitude as the logarithm of the amount, the results as presented in Table 3, Panel A do not change significantly (see Table 3, Panel B).[63] Therefore, we reject Hypothesis 1b and conclude that the likelihood of a taxpayer obtaining a successful outcome does not vary with the first digit of the dollar amount, notwithstanding that the frequency of first digits in our sample conforms to an unequal Benford's Law distribution pattern. We did not find evidence of a numerical salience bias for first digits.

As further robustness checks, we considered the degrees-of-freedom-adjusted generalized variance inflation factor (GVIF) to check for evidence of multicollinearity among the predictors. No evidence of serious multicollinearity was detected.[64] Noting that the clustering of cases within the judges who ruled on them could compromise the

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61. As a robustness check, when we reperform this regression with a binary independent variable (i.e. for amounts where the first digit is "1" versus "2" to "9" inclusive), the p-value is 0.359.
62. Daniel Hyde & Elizabeth Spelke, "All Numbers are not Equal: An Electrophysical Investigation of Small and Large Number Representations" (2009) 21:6 J Cognitive Neuroscience 1039; John N Towse, Tobias Loetscher & Peter Brugger, "Not All Numbers are Equal: Preferences and Biases among Children and Adults when Generating Random Sequences" (2014) 5 Frontiers in Psychology 1.
63. As a robustness check, when we reperform this regression with a binary independent variable (i.e. for amounts where the first digit is "1" versus "2" to "9" inclusive), and include these same control variables, the p-value is 0.257.
64. The adjusted GVIFs were all below 2, a threshold widely used in the literature (see Jenine K Harris, "Primer on Binary Logistic Regression" (2021) 9:1 Family Medicine & Community Health), with the exception of those of interaction effects.

assumption of independence of observations, we fitted the models using generalized estimating equations (GEEs), a method more flexible than logistic regression in that it can account for nonzero covariance between observations within the same cluster.[65] Generally, these results agreed with those of the logistic regression models; hence, they are not reported.[66]

2. *Testing for round number bias*

Recall that Hypothesis 2 tests for the likelihood of a taxpayer obtaining a successful outcome if a disputed amount is round versus not round. To initially test this hypothesis, we first regressed the likelihood of obtaining a successful outcome on a binary independent variable (whether the last digit ends in "0" or not). This result is statistically significant (p=0.002), as shown on Table 4, Panel A.

However, the significant main effect may occur because larger numbers are more likely than smaller numbers to end in "0." Therefore, we ran the same regression but now include the log of the dollar amount as another independent variable, with an interaction effect between the log of the dollar amount and the binary independent variable (whether the last digit ends in "0" or not). As shown on Table 4, Panel B, the results of this regression are now different: the main effect of the binary independent variable is no longer significant (p=0.071); the main effect of the log of the dollar amount is significant (p<0.001); and the interaction effect is not significant (p=0.295). Thus, we have initial evidence to reject Hypothesis 2.

For robustness, we conducted another regression to include the other control variables as before, in addition to controlling for dollar magnitude. The results of this regression are presented in Table 4, Panel C, and show that the main effect of the key binary independent variable is not significant (p=0.765). Thus, we are unable to support Hypothesis 2 and conclude that there is no evidence of round number bias.

65. See Mitchell H Katz, *Multivariable Analysis: A Practical Guide for Clinicians*, 2nd ed (Cambridge, UK: Cambridge University Press, 2006) at 164-166. The covariance structure within clusters was assumed to follow the exchangeability assumption, whereby any two cases seen by the same judge were assumed to have the same correlation.

66. All effects found to be statistically significant in the logistic regression analyses were also statistically significant in the GEE analyses, except that the effect of the number ending in 0, significant at 10 per cent level in the logistic regression, is no longer significant at 10 per cent level in the GEE. Some control variables were significant in the GEE but not in logistic regression, such as taxpayer type, number of appellants, and number of court judgments in the GEE version of the results in Table 3, Panel B and Table 4, Panel C. However, this may be due to confounding with the effect of the judge, because judge could not be included as a predictor in the GEE versions of these models due to judge serving as the cluster identifier.

We also checked the frequency of the last digit of the numbers in the sample. We find that numbers having a last digit of "0" have a disproportionately large frequency relative to numbers having non-zero last digits: 1,163 of 3,811 observations (30.5 per cent) end in "0." The frequency of last digit of amount for the remaining digits 1 through 9 varies between 7.0 per cent and 8.6 per cent of the overall sample. Thus, numbers ending in "0" comprise a disproportionately large share in this sample relative to numbers ending in any other digit and may be indicative of round number bias from the perspective of taxpayers. However, despite a dollar amount ending in "0" being much more common than a dollar amount ending in any other digit, we do not find that the presence of a round number increases the likelihood that taxpayers will achieve a successful outcome at tax court, once we control for the magnitude of the dollar amount and other variables. Thus, we conclude that a preference for round numbers, which seems to exist in our sample, does not significantly influence taxpayers' outcomes vis-à-vis non-round numbers.

3. *Testing for even-odd number bias*

Hypothesis 3 predicts that judges will decide cases differently if the amount in dispute is even versus odd. For this analysis, we excluded any number ending with a "0", despite such a number being an even number, due to possible round number bias (see Section 4.2). We believe excluding numbers ending in "0" is a cleaner way to test Hypothesis 3. Excluding round numbers from the sample leaves 2,648 observations, consisting of numbers ending in digits from "1" through "9."

Next, we regressed the dependent variable (likelihood of a taxpayer obtaining a successful outcome) on a binary independent variable (whether an amount with a last digit from 1 to 9 is even or odd). The results of this regression, presented in Table 5, Panel A, show a main effect that is not significant (p=0.737).

To further assess the robustness of this initial result, we conducted another regression to include control variables (taxpayer type, year of decision, number of appellants, type of issue, number of court judgments cited, identity of the judge, and dollar magnitude). The results of this regression, presented in Table 5, Panel B, again show a main effect that is not significant (p=0.146).[67]

Overall, we do not find evidence to support Hypothesis 3. Thus, we reject Hypothesis 3 and conclude that there is nothing about the

67. When we repeat these regressions without and with control variables using a trichotomous independent variable to include numbers ending in "0" (in addition to even and odd numbers), these two regressions remain non-significant.

psychological properties of number parity that influences judicial decision-making.

Conclusion

Psychology research suggests that there are biases which could be present because of idiosyncratic features in numbers. We investigate three such biases in the context of disputes containing dollar amounts: salience bias (because of unequal distributions of first-digit frequencies); round number bias; and even-odd number bias. Prior judicial decision-making research shows evidence that numbers influence judges in anchoring contexts as well as when determining sentence lengths. It is possible that cognitive biases relating to disputed amounts could also influence judges.

We use a sample of tax court cases because tax disputes frequently contain dollar amounts. Although we find evidence that first-digit frequencies in dollar amounts in tax cases conform to Benford's Law, we do not find evidence that taxpayers with a dollar amount containing the most frequently occurring first digit ("1") are any more or less likely to obtain a favorable outcome than a taxpayer with a dollar amount containing any other first digit. Thus, despite the unequal distribution of first digits in our sample, this inequality does not bias judges.

We also find no evidence of round number bias influencing judicial outcomes despite our sampling containing a preponderance of round numbers. As well, we find no evidence of even-odd number bias influencing judicial outcomes. Collectively, these findings suggest that key psychological properties of numbers do not seem to bias judges in a setting with dollar amounts in a dispute. None of these results change significantly when we control for the magnitude of the dollar amount and the identity of the judge, among other control variables.

These results clarify circumstances in which numerical biases seem to influence judges. Existing research shows that numerical anchoring bias influences judges and that even-odd number bias can influence judges when imposing sentence lengths. However, the results of the current investigation suggest that numerical cognition bias is likely context-dependent, as we did not find evidence for any numerical biases related to disputed amounts. Our primary contribution is to show that numerical cognition biases do not seem to operate in judicial decision-making in a tax dispute with dollar amounts. Thus, taxpayers should not be concerned that the dollar amount(s) in their dispute(s) will somehow affect their decision outcomes.

Overall, the results of this research are encouraging, as they rule out the possibility of hidden biases relating to dollar amounts in a tax dispute.

The dollar amount under dispute does not seem to influence the final outcome for a taxpayer.

Although this research was conducted using data from a Canadian tax court, we have no reason to believe that the results would differ if a different jurisdiction were used or if a different type of court were used. However, we encourage extensions of this research to other jurisdictions and other types of courts.

Our research makes several contributions. We extend existing research on numerical bias in decision-making by considering whether aspects of numerical cognition bias judges. By showing that numerical cognition bias in disputed amounts does not seem to affect judicial decision-making, we clarify circumstances in which numbers do and do not influence judges, as past research has shown that numerical anchors bias judges as well as number preferences in sentence lengths. By considering numerical cognition bias in a judicial decision-making context, we also extend broader empirical research on numerical cognition, which has examined contexts such as consumer pricing and financial analysts' recommendations.[68] Our findings that psychological biases relating to idiosyncratic features of disputed numbers do not affect judges' decision-making clarify contexts in which these biases may or may not operate. Finally, we contribute to the empirical literature on Benford's Law, as we find evidence that the frequency of first digits conforms to this law, thereby providing the first evidence in a legal setting for this phenomenon.

68. For numerical cognition research about consumer pricing, see Ana Ortega & Felipe Tabares, "Psychological Pricing: Myth or Reality? The Impact of Nine-Ending Prices on Purchasing Attitudes and Brand Revenue" (2023) 71 J Retailing & Consumer Services. See also Tatiana Sokolova, Satheesh Seenivasan & Manoj Thomas, "The Left-Digit Bias: When and Why are Consumers Penny Wise and Pound Foolish?" (2020) 57:4 J Marketing Research 771. For numerical cognition research about financial analysts' recommendations, see Tristan Roger, Patrick Roger & Alain Schatt, "Behavioral Bias in Number Processing: Evidence from Analysts' Expectations" (2018) 149:1 J Econ Behavior & Organization 315.

Table 2. Descriptive Statistics

PANEL A – DEPENDENT VARIABLE

Variable	N	Variable=1	Variable=0	Mean	Median	Std. Dev.	Min.	Max.
Outcome	3,811	1,269	2,542	0.333	0	0.471	0	1

PANEL B – EXPLANATORY VARIABLES

Variable	N	Variable=1	Variable=0	Mean	Median	Std. Dev.	Min.	Max.
FirstDigit1	3,811	1,207	2,604	0.317	0	0.465	0	1
FirstDigit2	3,811	653	3,158	0.171	0	0.377	0	1
FirstDigit3	3,811	426	3,385	0.112	0	0.315	0	1
FirstDigit4	3,811	368	3,443	0.097	0	0.295	0	1
FirstDigit5	3,811	334	3,477	0.088	0	0.282	0	1
FirstDigit6	3,811	252	3,559	0.066	0	0.249	0	1
FirstDigit7	3,811	219	3,592	0.057	0	0.233	0	1
FirstDigit8	3,811	182	3,629	0.048	0	0.214	0	1
FirstDigit9	3,811	170	3,641	0.044	0	0.206	0	1
LastDigit0	3,811	1,162	2,649	0.305	0	0.461	0	1

PANEL C – CONTROL VARIABLES

(Only continuous and binary control variables are included in this table.)

Variable	N	Variable=1	Variable=0	Mean	Median	Std. Dev.	Min.	Max.
TaxpayerType	3,811	522	3,289	0.137	0.000	0.344	0.00	1.000
NumberAppellants	3,811	N/A		1.343	1.000	0.943	1.00	16.00
NumberCourtJudgments	3,811	N/A		4.288	2.000	5.97	0.00	76.00
Log10Amount	3,811	N/A		4.222	4.160	1.012	1.30	9.49

Table 3. Coefficients from Logistic Regression Analysis to test for salience bias

Dependent variable = 1 if outcome was partially or totally successful and 0 otherwise (n=3,811)

PANEL A – BASELINE REGRESSION (WITHOUT CONTROL VARIABLES)

Independent Variable	Odds Ratio	Lower 95% Confidence Limit	Upper 95% Confidence Limit	*p*-value
Constant	0.522	0.463	0.588	***
FirstDigit2	0.980	0.801	1.197	
FirstDigit3	0.879	0.693	1.112	
FirstDigit4	0.893	0.694	1.144	
FirstDigit5	0.891	0.685	1.152	
FirstDigit6	1.010	0.757	1.341	
FirstDigit7	0.919	0.673	1.245	
FirstDigit8	1.081	0.778	1.490	
FirstDigit9	0.851	0.597	1.199	

*** $p \leq 0.01$, ** $p \leq 0.05$, * $p \leq 0.1$

PANEL B – BASELINE REGRESSION (WITH CONTROL VARIABLES)

Independent Variable	Odds Ratio	Lower 95% Confidence Limit	Upper 95% Confidence Limit	*p*-value
Constant	0.202	0.074	0.512	***
FirstDigit2	0.911	0.733	1.131	
FirstDigit3	0.852	0.660	1.096	
FirstDigit4	0.916	0.669	1.194	
FirstDigit5	0.864	0.653	1.138	
FirstDigit6	0.952	0.694	1.299	
FirstDigit7	0.884	0.633	1.227	
FirstDigit8	1.240	0.871	1.754	
FirstDigit9	0.859	0.585	1.246	
TaxpayerType	1.217	0.961	1.537	
Year	10 years; statistics not reported to streamline reporting of results			
NumberAppellants	0.935	0.853	1.019	
TaxIssue				
• Income Inclusion				
• Tax Deduction	0.666	0.558	0.794	***
• Tax Credit	0.311	0.234	0.409	***
• Other	0.896	0.644	1.241	
NumberCourtJudgments	1.007	0.993	1.022	
JudgeIdentity	45 judges; statistics not presented to streamline reporting of results			
Log10Amount	0.984	0.901	1.074	

Notes

FirstDigit1 is the reference category for the other FirstDigit variables

Taxpayer type; 0=individual and 1=corporation

TaxIssue; reference category is Income Inclusion

Table 4. Coefficients from Logistic Regression Analysis to test for round number bias

Dependent variable = 1 if outcome was partially or totally successful and 0 otherwise (n=3,811)

PANEL A – BASELINE REGRESSION (WITHOUT CONTROL VARIABLES)

Independent Variable	Odds Ratio	Lower 95% Confidence Limit	Upper 95% Confidence Limit	*p*-value
Constant	0.535	0.494	0.579	***
LastDigit0	0.788	0.679	0.914	***

PANEL B – BASELINE REGRESSION CONTROLLING FOR AMOUNT

Independent Variable	Odds Ratio	Lower 95% Confidence Limit	Upper 95% Confidence Limit	*p*-value
Constant	0.265	0.185	0.377	***
LastDigit0	0.561	0.299	1.049	*
Log10Amount	1.181	1.089	1.281	***
LastDigit0 × Log10Amount	1.078	0.937	1.242	

PANEL C – BASELINE REGRESSION CONTROLLING FOR AMOUNT AND OTHER VARIABLES

Independent Variable	Odds Ratio	Lower 95% Confidence Limit	Upper 95% Confidence Limit	*p*-value
Constant	0.183	0.066	0.471	***
LastDigit0	0.898	0.441	1.825	
Log10Amount	1.000	0.906	1.104	
TaxpayerType	1.207	0.954	1.524	
Year	10 years; statistics not reported to streamline reporting of results			
NumberAppellants	0.941	0.859	1.025	
TaxIssue				
• Income Inclusion				
• Tax Deduction	0.680	0.570	0.811	***
• Tax Credit	0.329	0.248	0.434	***
• Other	0.897	0.645	1.242	
NumberCourtJudgments	1.007	0.992	1.021	
JudgeIdentity	45 judges; statistics not presented to streamline reporting of results			

Notes
LastDigit0; 0=amount does not end in zero and 1=Amount ends in zero
Taxpayer type; 0=individual and 1=corporation
TaxIssue; reference category is Income Inclusion

Table 5. Coefficients from Logistic Regression Analysis to test for even–odd number bias

Dependent variable = 1 if outcome was partially or totally successful and 0 otherwise (n=2,648)

PANEL A – BASELINE REGRESSION (WITHOUT CONTROL VARIABLES)

Independent Variable	Odds Ratio	Lower 95% Confidence Limit	Upper 95% Confidence Limit	*p*-value
Constant	0.527	0.467	0.594	***
EvenOdd	1.028	0.875	1.207	

PANEL B – BASELINE REGRESSION (WITH CONTROL VARIABLES)

Independent Variable	Odds Ratio	Lower 95% Confidence Limit	Upper 95% Confidence Limit	*p*-value
Constant	0.155	0.043	0.508	***
EvenOdd	0.565	0.261	1.220	
Log10Amount	0.938	0.811	1.083	
TaxpayerType	1.119	0.845	1.479	
Year	10 years; statistics not reported to streamline reporting of results			
NumberAppellants	0.911	0.810	1.021	
TaxIssue				
• Income Inclusion				
• Tax Deduction	0.745	0.603	0.919	***
• Tax Credit	0.380	0.266	0.537	***
• Other	0.952	0.651	1.385	
NumberCourtJudgments	1.007	0.990	1.024	
JudgeIdentity	45 judges; statistics not presented to streamline reporting of results			

Notes
EvenOdd; 0=even and 1=odd
LastDigit0; 0=amount does not end in zero and 1=Amount ends in zero
Taxpayer type; 0=individual and 1=corporation
TaxIssue; reference category is Income Inclusion