# ALGORITHMS AS LEGAL DECISIONS: GENDER GAPS AND CANADIAN EMPLOYMENT LAW IN THE 21ST CENTURY

**Anthony Niblett***

## Introduction

Should judges and arbitrators in Canada use algorithms to assist with their decision making? Could we ever replace the decisions of judges with the assessments of an algorithm? Some legal scholars and futurists have posited the idea that artificially intelligent algorithms could form the basis of legal decisions.[1] This is not merely an issue for the future. Predictive algorithms are already used by lawyers to assist with dispute resolution.[2] And artificially intelligent tools are being used as a basis for legal

* Associate Professor at the University of Toronto Faculty of Law. In the interests of full disclosure, I am also a co-founder of a company called Blue J Legal, a start-up that uses machine learning technology to predict legal outcomes (including reasonable notice awards). The dataset used as the basis of the scholarly analysis here was created, in part, by legal researchers and analysts from Blue J Legal.

[1] In popular media, see e.g. Christopher Markou, "Are We Ready for Robot Judges?", *Discover Magazine* (15 May 2017) online: <www.discovermagazine.com/technology/are-we-ready-for-robot-judges>; Larry Mantle, "Can a Robot Make a Fair Verdict?", online (podcast): *Airtalk Podcast* <scpr.org/programs/airtalk/2019/04/01/64335/can-a-robot-judge-make-a-fair-verdict/>; "What if computers wrote laws? Decisions handed down by data", *The Economist* (16 May 2016) online: <www.economist.com/the-world-if/2016/07/14/decisions-handed-down-by-data>.

In the context of legal scholarship, see Eugune Volokh, "Chief Justice Robots" (2019) Duke LJ 1135; Anthony J Casey & Anthony Niblett, "Will Robot Judges Change Litigation and Settlement Outcomes?" (2020) MIT Computational L Rep (forthcoming); Richard Re & Alicia Solow-Niederman, "Developing Artificially Intelligent Justice" (2019) 22 Stan Tech L Rev 242; Anthony J Casey & Anthony Niblett, "Self-Driving Laws" (2017) 66:4 UTLJ 429; Anthony J Casey & Anthony Niblett, "The Death of Rules and Standards" (2017) 92:4 Ind L Rev 1401. In the context of regulatory decisions, see Benjamin Alarie, Anthony Niblett & Albert H Yoon, "Regulation by Machine" (Paper prepared for workshop and proceedings of the Conference on Neural Information Processing Systems, Barcelona, 8 December 2016), online (pdf): <www.mlandthelaw.org/papers/alarie.pdf>.

[2] See e.g. Drury D Stevenson & Nicholas J Wagoner, "Bargaining in the Shadow of Big Data" (3 April 2014) 66:5 Florida L Rev 1; Benjamin Alarie, Anthony Niblett & Albert H Yoon, "Computational Legal Research and the Advocate of the Future" (2017) 36 Advocates Q 12.

decisions in China,[3] Estonia,[4] and other jurisdictions.[5] The question of how much authority the Canadian legal system decides to delegate to algorithms is, therefore, one of paramount importance in the 21st century.

The use of such algorithmic tools to help make decisions raises a number of potential concerns. Algorithmic bias is frequently high on the list of concerns and examples of such bias are plentiful. In the legal context, studies have shown that racial bias infects algorithms used by judges to assess flight risk in bail decisions or risk of recidivism in sentencing hearings.[6] These algorithms have been found to assess black defendants more harshly than white defendants, even when race is not one of the variables explicitly considered by the algorithm.[7] In other contexts, Amazon recently built an artificially intelligent tool to help with hiring employees, but shut it down after it was discovered to be discriminating against women.[8] The prevalence of such biases should caution us against using algorithms in decision making. This would appear to

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[3] Monisha Pillai, "China Now AI-Powered Judges", *RADII* (19 August 2019), online: <radiichina.com/china-now-has-ai-powered-robot-judges/>; Chris Young, "China has Unveiled an AI Judge that Will 'Help' With Court Proceedings", *Interesting Engineering* (19 August 2019), online: <interestingengineering.com/china-has-unveiled-an-ai-judge-that-will-help-with-court-proceedings>; see also Jingting Deng, "Should the Common Law System Welcome Artificial Intelligence: A Case Study of China's Same-Type Case Reference System" (2019) 3 Geo L Tech 223. Tom Fish, "AI shock: China Unveils 'Cyber Court' Complete with AI Judges and Verdicts via Chat App", *Express* (6 December 2019), online: <www.express.co.uk/news/science/1214019/ai-china-cyber-court-artificial-intelligence-judges-verdicts-chat-app>.

[4] Eric Niler, "Can AI Be a Fair Judge in Courts? Estonia Thinks So", *Wired* (25 March 2019), online: <www.wired.com/story/can-ai-be-fair-judge-court-estonia-thinks-so/>; Victor Tangermann, "Estonia is Building A "Robot Judge to Help Clear Legal Backlog", *Futurism* (25 March 2019), online: <futurism.com/the-byte/estonia-robot-judge>.

[5] Arjay Agrawa, Joshua S Gans & Avi Goldfarb, "Artificial Intelligence: The Ambiguous Labor Market Impact of Automating Prediction" (2019) 33:2, J Econ Perspective 39. See generally Tania Sourdin, "Judge v Robot? Artificial Intelligence and Judicial Decision-Making" (2018) 41 UNSWLJ 1114; Council of Europe, News Release, "Council of Europe Adopts first European Ethical Charter on the Use of Artificial Intelligence in Judicial Systems" (13 September 2019), online: *European Commission for the Efficiency of Justice* <www.coe.int/en/web/cepej/cepej-european-ethical-charter-on-the-use-of-artificial-intelligence-ai-in-judicial-systems-and-their-environment>.

[6] Julia Angwin et al, "Machine Bias", *ProPublica* (23 May 2016), online: <www.propublica.org/article/machine-bias-risk-assessments-in-criminal-sentencing>; Anthony W Flores et al, "False Positives, False Negatives, and False Analyses: A Rejoinder to 'Machine Bias: There's Software Used across the Country to Predict Future Criminals. And It's Biased against Blacks'" (2016) 80 Federal Probation 38. See below in section 3.2, discussing algorithms that can "correct" biases in bail decisions: Seda Fabian, "Artificial Intelligence and the Law: Will Judges Run on Punch Cards" (2020) 16 Common L Rev 4 at 5–6.

[7] Alexandra Chouldechova, "Fair Prediction with Disparate Impact: A Study of Bias in Recidivism Prediction Instruments" (2017) 5:2 Big Data 155. See also Jennifer Skeem & Christopher Lowenkamp, "Using Algorithms to Address Trade-Offs Inherent in Predicting Recidivism" (2020) 38:3 Behaviour Science & L 259.

[8] Isobel Asher Hamilton, "Amazon built AI to hire people but had to shut it down because it was discriminating against women", *Business Insider* (10 October 2018), online: <www.businessinsider.com/amazon-built-ai-to-hire-people-discriminated-against-women-2018-10>.

be especially true in the legal context, where decisions can come at the expense of life and liberty.

In this paper, I explore the potential to use one particular type of predictive algorithm in legal decision making. The type of algorithm examined here predicts the "most likely" outcome if a case were to go to court. An algorithm in this mould seeks to predict what would happen if a judge were to decide on the case. The algorithm relies on data generated from previous judicial decisions. It presupposes that the prior decisions of judges provide a good basis for making a prediction in future cases. If the algorithm were to be used by a judge, then the judge is essentially saying that she agrees with the law as decided in previous cases.

Here, I investigate potential bias in these types of algorithms. I focus on one specific legal issue where such algorithms could conceivably be used by judges to assist with decision making in the near future. The legal issue I explore is: what is a *reasonable* notice period to be awarded to an employee who has been dismissed. Under Canadian employment law, there is an implied term in an employment contract that upon dismissal without cause, an employee is entitled to a reasonable notice period, or a payment in lieu of such a notice period. What is reasonable will depend on the circumstances. It will depend on the age of the employee, how long they have worked with the employer, the type of job the employee had, what opportunities for similar employment exist, amongst other factors. This can be a difficult exercise for judges and arbitrators. How are they to weigh up all these different factors to arrive at what is reasonable?

Judges and arbitrators frequently look to past cases for assistance in determining the length of a reasonable notice period. They look at prior decisions to see how previous judges and arbitrators have weighed the factors, and—for the most part—try to come up with a reasonable notice period that is in line with the prior law. This, too, is what the predictive algorithm does. The predictive algorithm uses the data describing relevant precedents and provides a best guess about how a new case would fit into the existing body of case law.

But what if the body of case law is riddled with bias? If judges were to use predictive algorithms that replicate the existing law, then any biases currently found in the case law will merely be reinforced. Thus, it is imperative to ensure that the data upon which the predictive algorithm is based—i.e., existing case law—not only reflects the objectives of the law, but also is free from harmful bias that may entrench discriminatory outcomes.

It is thus necessary to ask whether the existing case law does *indeed* contain biases. Here, I focus on gender bias. I focus on gender bias for two reasons. First, it is relatively easy to determine the gender of plaintiffs in past cases (at least, it is much easier than the determining other characteristics, such as race). Second, there are studies that show there is evidence that legal decisions in reasonable notice cases contain elements of gender bias. Professor Kenneth Thornicroft, for example, has

shown that female plaintiffs are awarded lower reasonable notice awards than male plaintiffs.[9] If women receive lower damages then men for wrongful dismissal, holding all other variables constant, then one questions whether women and men are treated equally under the law. It follows that any algorithm using past decisions as the foundation for future decisions will merely perpetuate the gender bias. This, clearly, would be concerning and completely at odds with the objectives of the law.

Here, I re-examine the statistical evidence that reasonable notice awards in Canada reflect gender bias. I take advantage of the fact that there have been many more judicial decisions since Professor Thornicroft's studies. I also use data from all published decisions, whether they be from arbitrators or judges, over the period 1997 to 2019. My data describe 1,728 legal decisions, over ten times the size of Professor Thornicroft's dataset.[10] Further, my data are more refined, with more variables of interest that enable more detailed description and explanation of the content of the existing law. I perform simple statistical tests to determine whether or not the existing case law reflect a gender gap in reasonable notice awards. If there is correlation between gender and the outcome, holding all other variables of relevance constant, then it would suggest that there may be differences in the way that female and male employees are treated by the legal system.

In short, I find *no direct evidence* of a gender gap in the awards of reasonable notice. In these 1,728 cases, there is no statistically significant correlation between the notice periods awarded to female plaintiffs and to male plaintiffs *once all other relevant factors are held constant.* This is not to dispute the findings of Professor Thornicroft's study. On the contrary, I am for the most part able to replicate Thornicroft's results in the subset of cases he examines and using his methodology. The broader point though is that when all available data are used over a longer period with more refined analysis, direct evidence of differential treatment vanishes.

While these results appear promising, they cannot be the end of the story. Gender differences in the law of reasonable notice can—and do—emerge through other channels, such as job type or compensation.[11] Both the type of job and the level of compensation *are* correlated with judicial outcomes in my dataset; they are also correlated with gender. For example, the data show that clerical workers receive shorter reasonable notice awards than other workers, such as those in management. In the dataset, clerical workers are disproportionately female and management disproportionately male. Thus, gender biases may be baked into the legal test.[12]

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[9] Kenneth W Thornicroft, "Gender Bias in the Judicial Assessment of 'Reasonable Notice' Under Canadian Common Law" (2013) 64:1 Labor LJ 43 at 43–51 [Thornicroft, "Gender Bias"].

[10] The dataset used here is part of a larger dataset that was created for a separate project (and a different purpose) by numerous legal researchers and analysts from Blue J Legal. I am extremely grateful for their hard work and endeavour in putting together these highly detailed data.

[11] Sandra Rollings-Magnusson, "Gender Implications of Wrongful Dismissal Judgments in Canada, 1994–2002" (2009) 41:1 Can Rev Sociology 27.

[12] On this point, see Judith MacFarlane, "Acknowledging the Relationship between Job Status and Gender: A Feminist Critique of *Cronk v. Canadian General Insurance Company* and the Managerial Distinction"

Further, compensation is positively correlated with the outcome. In the dataset of cases, female plaintiffs receive lower compensation than their male counterparts. To the extent that compensation is correlated with both gender and the legal outcome, then it might be that female plaintiffs receive shorter reasonable notice period awards *because* they earn less. This has the effect of compounding any gender wage gap, since the final damages awarded to plaintiffs is the multiple of the reasonable notice award and the plaintiff's compensation.[13]

This paper has two parts. The paper explores one broad issue (should we use algorithms as legal decisions?) by focusing on a narrower one (is there statistical evidence of gender bias in Canadian employment law?). The answer to the narrower question helps inform our views on the broader question. I answer the narrower question first.

In Part 1, I re-examine the statistical evidence on bias against female plaintiffs in reasonable notice awards. I show that the data do not bear out any *direct* evidence of gender bias in the case law. I show that there are, however, other channels through which gender bias has subsisted. In Part 2, I explore the potential for judges to use algorithmic predictions in the decision-making process, arguing that there may be still be concerns about bias, depending on how the algorithm is implemented. In short, great care needs to be taken to ensure that the algorithm does not reinforce hidden biases in the law. I further explore the possibility of alternative types of algorithms that do not rely on judicial decisions as data. A final part concludes.

## 1. Gender bias and reasonable notice awards

In this Part of the paper, I examine the evidence as to whether the existing case law on reasonable notice awards reflects gender bias against female plaintiffs. First, I will provide a short background of the legal issue. Next, I discuss the prior literature on gender differences in this area of law. I will describe the dataset of 1,728 cases from 1997 to 2019 and discuss my results. In simple linear regression tests, there is no direct evidence of gender bias. But I also explore other channels through which female plaintiffs may have been treated unfavourably.

### *1.1 The legal background*

Under Canadian employment law, workers dismissed without cause are entitled to a reasonable notice period, or payment in lieu of such a notice period. In the seminal case on this legal issue, *Bardal v The Globe & Mail, Ltd*, McRuer CJHC held that this

(1997) 9:2 CJWL 418 ("[the majority position of the court in *Cronk*] reaffirmed aspects of the managerial/clerical distinction have an adverse effect of working women" at 420).

[13] This point is also noted by MacFarlane. See *ibid*.

reasonableness standard does not lend itself easily to bright line rules. In an oft-cited passage he noted

> [t]here can be no catalogue laid down as to what is reasonable notice in particular classes of cases. The reasonableness of the notice must be decided with reference to each particular case, having regard to the character of the employment, the length of service of the servant, the age of the servant and the availability of similar employment, having regard to the experience, training and qualifications of the servant.[14]

The four factors mentioned in this passage—character of employment, length of service, age of employee, and availability of similar employment—are typically referred to as the *Bardal* factors.

The fact that the leading case provides only vague guidance to what is reasonable has generated an enormous wealth of litigation on this legal issue.[15] Since the *Bardal* decision was handed down, there have been literally thousands of cases that have required judges or arbitrators to determine what is reasonable in the circumstances. This can be distinguished with other jurisdictions, where the determination of notice periods is more rule-like, leading to less litigation on this specific issue.

### *1.2 Prior literature*

Are reasonable notice awards in Canada biased against female plaintiffs? A robust literature in law, business, and economics has sought to answer this question empirically. The evidence is mixed, but scholars have identified some areas where the decisions of judges suggest bias against female employees who bring suit against their former or current employer. In a relatively recent study, Professor Kenneth Thornicroft examined 132 appeal court decisions of reasonable notice cases from 2000 to 2011 from across Canada.[16] Professor Thornicroft found that the 27 female plaintiffs in his sample received lower damages awards than the 105 male plaintiffs, holding constant all other variables of relevance.[17] The magnitude of this difference was in the range of 1.43 months to 1.55 months.[18]

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[14] *Bardal v Globe & Mail Ltd* (1960), 24 DLR (2d) 140, [1960] OWN 253 (Ont HC).

[15] Chenyang Li, "You Can't Fire Me: The Problems with Wrongful Dismissal Damages in Canada" (2017) 1:1 Western J Leg Studies 1.

[16] Thornicroft, "Gender Bias", *supra* note 10.

[17] *Ibid* at 47. See also Kenneth W Thornicroft, "The Assessment of Reasonable Notice by Canadian Appellate Courts from 2000 to 2011" (2013) 17:1 CLELJ 29. Thornicroft found a negative correlation between female gender and size of the award. In this particular study, his results suggested that women received 1.5 to 1.7 months' less notice then their male counterparts.

[18] See Thornicroft, "Gender Bias", *supra* note 10. The coefficient on *female* in Table 3, page 48 in specifications (2) and (4). Depending on the empirical specification, the difference was statistically significant at either the 5% or 10% level. The difference is significant at the 10% level in specification (2) and at the 5% level in specification (4).

This question had been explored before by other scholars in Canada. One other paper—by Professor Sandra Rollings-Magnussen—found evidence of gender bias.[19] The majority of the papers, however, uncover little evidence of a gender gap once other factors are controlled for. Some of these papers investigate cases from earlier time periods, or from a particular jurisdiction, or they focus on one level of court or board.[20] But a common factor in each of these studies is that the number of observations are relatively small. These studies typically have fewer than 200 observations, and almost always have fewer than 300. This is somewhat of a limitation in the prior literature. It is this gap I seek to fill.

There have been other studies of gender bias and reasonable notice that have not used statistics to uncover bias. Judith Macfarlane, for example, notes that the legal test for reasonable notice is biased against women given that judges make distinctions based on job type. In particular, clerical workers are treated differently to managerial workers.[21] More generally, there is, of course, a large and important literature in feminist legal theory exploring and explaining how the effect of law may be to entrench male supremacy. [22] There is a rich literature exploring gender bias in labour and employment law that goes far beyond mere statistical analysis of reasonable notice awards.[23]

### *1.3 The dataset*

I use a novel dataset of 1,728 cases where judges or arbitrators decide the issue of an employees' reasonable notice period over the timeframe 1997 to 2019.[24] These cases

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[19] Rollings-Magnusson, *supra* note 12.

[20] See e.g. Steven L McShane, "Reasonable Notice Criteria in Common Law Wrongful Dismissal Cases" (1983) 38:3 Relations Industrielles 618; Steven L McShane & David C McPhillips, "Predicting Reasonable Notice in Canadian Wrongful Dismissal Cases" (1987) 41:1 Indus & Lab Rel Rev 108; Tim Liznick, "Wrongful Dismissal: Determining Reasonable Notice" (1987) 5:4 Worklife Report 1; Terry H Wagar & Kathy A Jourdain, "The Determination of Reasonable Notice in Canadian Wrongful Dismissal Cases" (1992) 43:1 Labor LJ 58; Terry H Wagar, "Wrongful Dismissal in Small and Medium-Sized Firms: Some Empirical Evidence" (1995) 12:2 J Small Bus Entrepreneurship 94; Terry H Wagar, "Determinants of Just Cause and Reasonable Notice in the Dismissal of Nonunion Employees" (1996) 4:3 Can Bus Economics 36; Terry H Wager & James D Grant, "The Relationship between Plaintiff Gender and Just Cause Determination in Canadian Dismissal Cases" (1996) 34 Sex Roles 534.

[21] MacFarlane, *supra* note 13.

[22] See e.g. Judith A Baer, *Our Lives before the Law: Constructing a Feminist Jurisprudence,* (Princeton: Princeton University Press, 1999); Susan B Boyd & Elizabeth A Sheehy, "Canadian Feminist Perspectives on Law" (1986) 13:3 JL & Soc 283; Ann C Scales, "Towards a feminist jurisprudence" (1980) 56 Indiana LJ 375; Ann C Scales, "The Emergence of Feminist Jurisprudence: An Essay" (1986) 95:7 Yale LJ 1373.

[23] See e.g. Monica Boyd, "Feminizing Paid Work" (1997) 45:2 Current Sociology 49; Joanne Conaghan & Kerry Rittich, *Labour Law, Work, and Family: Critical and Comparative Perspectives* (Oxford: Oxford University Press, 2005).

[24] These 1,728 cases include 157 employment cases from Québec. Readers may argue that these 157 cases should not be included in the analysis, given that they do not follow the common law of reasonable notice.

represent all legal decisions found on this issue on CanLII or other databases, such as WestLaw, in this time period. Of these 1,728 cases, 562 of the plaintiffs (32.52%) are female. While cases with male plaintiffs make up the majority of the dataset, this imbalance is smaller than in previous studies of reasonable notice award that contain fewer observations. In those studies, the proportion of female plaintiffs ranged from 10% to 24%.

For each decision, coders track the outcome of the case: how long was the awarded reasonable notice period? This variable is normalized such that it is measured in terms of the number of months' notice given.[25] Data are also collected on many other independent variables of interest that may be explaining variation in these outcomes. Data are carefully extracted from each case. These data are rich and refined.

First, data are collected on the *Bardal* factors. I have information on the character of employment, the length of employment (measured in years), the age of the employee, and the availability of similar employment. For character of employment, I can determine the type of job (level of management, professional, sales, etc.), whether the employee was a supervisor or not, and whether the position was deemed to be unique or specialized. Information about whether the decision maker thought that employment opportunities were limited due to travel or economic reasons are included. Data on the plaintiff includes the level of experience in the industry, education levels, whether they were actively seeking other employment before they were dismissed, and whether they suffer from illness or disability that will limit employment opportunities.

Second, factors other than the *Bardal* factors are included. These factors include compensation, performance on the job, whether the worker was induced away from another job to work for the employer, and whether the employer was in financial difficulty. Further information of legal relevance, such as which province the case was heard and whether the *Canada Labour Code* is referenced, is also included. Cases from Ontario and British Columbia make up more than half the dataset. 617 cases (35.71%) are from Ontario, while 405 (23.44%) are from British Columbia.

None of my results turn on the inclusion or exclusion of Québec from the data. If I run the specifications on the 1,571 cases from outside of Québec, the results do not change.

[25] One important point to note here is that courts after 1997 but before 2008 awarded additional damages called *Wallace* damages, following the Supreme Court of Canada's decision in *Wallace v Union Grain Growers, Ltd,* [1997] 3 SCR 701, [1999] 4 WWR 86. In my dataset, I explicitly do not include Wallace damages. In each case, I merely note the number of months that the court or tribunal held was a reasonable notice period. This practice of awarding *Wallace* damages largely stopped after the Supreme Court's decision in *Honda Canada, Inc v Keays*, 2008 SCC 39.

### *1.4 Tests and results*

#### *1.4.1 Differences between female plaintiffs and male plaintiffs*

Table 1 shows the mean averages for some of the more important variables in the dataset. On average, across the 1,728 cases, the average reasonable notice award given is 10.15 months. I break down the summary statistics by gender. There are strong statistical differences between male plaintiffs and female plaintiffs. Female plaintiffs receive shorter notice periods than male plaintiffs on average. This difference, simply taking the average of the male plaintiffs' notice periods and the average of female plaintiffs' notice periods, is a little over one-and-a-half months. This difference is statistically significant.[26] This means that there is little chance that the difference between female and male plaintiffs is attributable to chance alone.

Obviously, this observation by itself does not provide evidence that female plaintiffs are treated differently to male plaintiffs. Other variables that affect the legal outcome need to be considered. Importantly, Table 1 also shows that variables such as length of service, age, and compensation are all different in the two subsets of the data. Female plaintiffs in the sample have shorter tenures with the employers than male plaintiffs (10.16 years, compared to 11.59 years), are typically younger than their male counterparts (44.33 years old, compared to 47.56 years), and earn less significantly less in terms of annual compensation ($62,521, compared to $102,292 in 2010 dollars). These differences could help explain the differences in the outcomes of the cases involving female and male plaintiffs.

| | Female n = 562 | Male n = 1,196 | All plaintiffs n = 1,728 |
|---|---|---|---|
| Notice period awarded (months) | 9.22 | 10.68 | 10.21 |
| Age of employee (years) | 44.43 | 47.14 | 46.26 |
| Tenure of employee (years) | 10.16 | 11.59 | 11.09 |
| Compensation (2010 dollars) | $62,521 | $102,292 | $89,357 |

Table 1: Mean average of key variables in the dataset

#### *1.4.2 Results*

To test whether or not there is a statistically significant difference between the awards given to female plaintiffs and male plaintiffs, I run a simple linear regression model that looks at the correlation between reasonable notice awards and all relevant explanatory variables. Table 2 reports the results. This table may appear to be difficult to read for those without training in economics or statistics, but the overall conclusions are easily interpretable. Put simply, once I take other factors into account, I find no

[26] A statistical test known as a t-test reveals that the difference is significant at the 1% level ($t$ = -3.05).

direct evidence of gender differences in the dataset. That is, if you take two plaintiffs—one male, one female—*with the same employment profile and characteristics*, there would be no statistical difference between the reasonable notice awards given.

Specification (1) simply tests the correlation between the outcome of each case—the notice period awarded by the judge or arbitrator—and the gender of the plaintiff. Here, the coefficient on the variable *female* is -1.456. The coefficient can be interpreted as meaning that female plaintiffs receive, on average, notice periods that are about one-and-a-half months shorter than male plaintiffs in our dataset. This reflects difference between female and male plaintiffs in Table 1 above. But, as noted above, these differences between the notice awards of female and male plaintiffs are correlated with other variables that do a better job of explaining the variation in notice periods. I include these variables in specifications (2) through (5).

| | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| | *Notice period* (All data) | *Notice period* (All data) | *Notice period* (All data) | *Notice period* (Omit Quebec) | *Notice period* (All data) |
| *Female* | -1.456*** | 0.165 | 0.144 | 0.104 | -0.027 |
| | (0.319) | (0.178) | (0.161) | (0.159) | (0.143) |
| *Age of employee (years)* | | 0.033*** | 0.031*** | 0.033*** | 0.031*** |
| | | (0.010) | (0.010) | (0.010) | (0.009) |
| *Tenure of employee (years)* | | 0.510*** | 0.505*** | 0.523*** | 0.860*** |
| | | (0.014) | (0.022) | (0.014) | (0.034) |
| *Tenure squared* | | | | | -0.012*** |
| | | | | | (0.001) |
| *Occupation -- sales* | | -0.021 | -0.114 | 0.131 | -0.015 |
| | | (0.315) | (0.366) | (0.338) | (0.258) |
| *Occupation -- clerical work* | | -0.531 | -0.697* | -0.442 | -0.761** |
| | | (0.366) | (0.367) | (0.353) | (0.336) |
| *Occupation -- labourer* | | -0.868*** | -0.944** | -0.725* | -1.065*** |
| | | (0.277) | (0.363) | (0.338) | (0.302) |
| *Occupation -- professional* | | 0.287 | 0.463 | 0.719*** | 0.629* |
| | | (0.335) | (0.307) | (0.163) | (0.313) |
| *Occupation -- lower management* | | 0.547** | 0.547 | 0.776* | 0.430 |
| | | (0.276) | (0.445) | (0.414) | (0.306) |
| *Occupation -- middle management* | | 0.651** | 0.752* | 1.094*** | 0.891** |
| | | (0.290) | (0.373) | (0.141) | (0.310) |
| *Occupation -- upper management* | | 0.941** | 1.231*** | 1.183*** | 1.505*** |
| | | (0.378) | (0.293) | (0.335) | (0.272) |
| *ln(compensation) (2010 dollars)* | | 1.316*** | 1.280*** | 1.194*** | 1.115*** |
| | | (0.159) | (0.263) | (0.250) | (0.228) |
| *Controls for education and experience* | No | Yes | Yes | Yes | Yes |
| *Control for illness or disability* | No | Yes | Yes | Yes | Yes |
| *Controls for economic conditions* | No | Yes | Yes | Yes | Yes |
| *Control for inducement of worker* | No | Yes | Yes | Yes | Yes |
| *Control for uniqueness of position* | No | Yes | Yes | Yes | Yes |
| *Controls for worker performance* | No | Yes | Yes | Yes | Yes |
| *Conttrol for province* | No | Yes | Yes | Yes (no QC) | Yes |
| *Observations* | 1,728 | 1,728 | 1,728 | 1,571 | 1,728 |
| *R-squared* | 0.011 | 0.747 | 0.764 | 0.788 | 0.794 |

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 2: Factors that are correlated with reasonable notice awards in Canada (1997-2019)

Specification (2) includes a number of explanatory variables that are likely to correlate with the length of the notice period awarded. Importantly, I include variables that measure the *Bardal* factors: the age of the employee, the length of the employee's tenure with the employer, the education and experience of the employee, as well as a number of factors that describe both the character of the employment and the

availability of other work. I also include other (non-Bardal) factors that judges have mentioned in their written opinions, and are hypothesized to correlate with the outcome.

The results are highly intuitive. The variables, for the most part, correlate with notice period as one might expect. For example, the employee's length of tenure with the employer is strongly correlated with the outcome. Holding all other factors fixed, an increase of one year in tenure suggests an increase in the notice period awarded of just over half a month (the coefficient on *tenure* is 0.51). The length of tenure is, *by far*, the most important factor in terms of explanatory power. Age of employee, experience in the industry, and education are all positively correlated with the outcome, as are factors that suggest it will make it difficult for the employee to find new work. If the employee was actively seeking work at the time of dismissal, this is correlated with a reduction in the notice period. If the employee was induced to join the employer, the notice period is longer by over 1.14 months. The more compensation the worker receives, the longer the notice period. All these variables are statistically significant, meaning that there is low likelihood that these differences are attributable to chance alone.

The type of job is also correlated with the outcome. Upper and middle management jobs are strongly correlated with the length of a notice period. Being in upper management, for example, is associated with notice periods that are 0.94 months longer than workers in jobs not covered by the categories mentioned. In this specification, clerical workers are not statistically different from other jobs not specifically included in the data. But in specifications (3) through (5), clerical workers do receive significantly shorter notice awards. These data confirm that a managerial-clerical distinction persists in reasonable notice awards.[27]

Most importantly for the analysis presented here, notice period awards are not correlated with gender. In fact, the coefficient on *female* is no longer negative in this specification (= +0.165). The positive coefficient does not mean much, however, as it is not statistically different to zero. I am unable to reject the hypothesis that any putative difference between female plaintiffs and male plaintiffs is not explainable by chance alone.

Specification (3) includes the province in which the case was heard. Provinces vary in their willingness to award reasonable notice.[28] New Brunswick, Ontario, and British Columbia are among the more generous to employees; while Québec is less generous. In specification (4), I remove all Québec cases. This does not affect the result regarding gender. There is still no gender gap.

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[27] See e.g. *Cronk v Canadian General Insurance* Co (1995), 128 DLR (4th) 147, 25 OR (3d) 505, (CA) where the Ontario Court of Appeal retained the "managerial/clerical" distinction in accessing reasonable notice damages for wrongful dismissal cases.

[28] Specifications (3), (4), and (5) also cluster standard errors at the provincial level. This does not significantly impact upon the results, particularly the results on gender.

In specification (5), I include a variable called *tenure squared,* that is the number of years the employee worked for the employer multiplied by itself. Based on visual inspection of the data, the relationship between tenure and the outcome appears to have a concave shape. This means that an extra year when tenure is short is associated with a greater marginal increase in the notice period than an extra year when the tenure is long. The significant negative coefficient on *tenure squared* confirms this concavity. This suggests that this may be a better fit than specification (3). While the coefficient on *female* in this specification is now negative (-0.28 months), it is still not statistically significant at any reasonable level of significance.

The main takeaway from Table 2 is that there does not appear to be a statistically significant relationship between the gender of the plaintiff and the length of the notice period awarded. Controlling for other variables of interest, female and male plaintiffs are not treated differently.

### *1.4.3 Relationship to prior literature*

My empirical findings on gender are broadly consistent with studies of reasonable notice awards from the last century. The findings do, however, differ from those of Professor Thornicroft, who finds a statistical difference between female and male plaintiffs. What can account for the difference between the two findings. Why does Thornicroft find evidence of gender bias, but I do not? The answer lies in the amount of data available in my study and the refinement of independent variables this volume of data allows me to include in my analysis. Thornicroft's study is limited to 132 appeals cases, whereas I have access to data from 1,728 court and tribunal decisions. This not only gives me a more complete picture of the legal landscape, it also provides a more recent investigation, and the number of observations gives greater degrees of freedom to include a greater number of relevant independent variables. None of this is to say Professor Thornicroft's study is not correct. Indeed, if I restrict my analysis to appeals courts and the time frame used in Professor Thornicroft's study, I am able to largely replicate his important findings, using his empirical methodology.[29]

Three observations are important here:

First, as noted above, the independent variable that explains variation in reasonable notice awards better than any other is the length of the employee's service. The correlation between *tenure* and the outcome is very strong. In my dataset, *tenure* is represented as a continuous variable. This builds on the assumption that employees who have worked at a firm for 2 years will be treated differently to those who have worked 3 years (or even 2.5 years), and workers with 11 years of service are treated differently those with 12 years of service. For each additional year of service, the reasonable notice award is correlated with longer reasonable notice awards. Professor

[29] Restricting my dataset to appeals in courts that were heard between 2000 and 2011, I find 133 cases. Professor Thornicroft's study has 132 observations. This difference is not important to the findings.

Thornicroft, on the other hand, uses categorical variables for *tenure*, putting workers into groups of less than 5 years of service, 5–15 years of service, and more than 15 years of service. Given the size of the dataset, this is completely understandable. My data, however, allow for greater precision; it allows for greater explanatory power.

Second, there are a number of variables that are not statistically significant in Professor Thornicroft's study that are correlated with the outcome in my dataset. For example, there are provincial differences that come alive when seen in the broader and longer dataset.

Third, even when I use Professor Thornicroft's empirical specification—using a reduced number of independent variables and converting continuous variables into categorical variables[30]—across all courts and tribunals and across the broader dataset, I find no evidence of gender differences.[31] This can be viewed as a positive story. This finding suggests that the spectre of gender bias found in Thornicroft's study is not present in the broader adjudication system[32] and has dissipated since 2011.[33]

### *1.4.4 Other evidence of gender bias*

My data suggest that there is no direct evidence that courts and tribunals treat female plaintiffs systematically different to male plaintiffs in awarding reasonable notice. But this, by itself, is not evidence that there may be bias or discrimination. It may be, for example, that there are other explanatory variables that are correlated with reasonable notice awards that mask bias. I explore three such channels here. The first is the type of job; the second is the level of compensation received by the employee; and the third is the willingness to litigate.

The type of job is correlated with reasonable notice awards (see Table 2). Upper level management, for example, consistently receive higher awards, holding fixed all other variables. The more senior management position held by the worker, the longer the reasonable notice award. On the other hand, clerical workers receive, on average, less than other workers. Clerical workers are disproportionately female in the dataset (110 of the 127 clerical workers in my dataset are female (86.61%)).

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[30] The key specification in Thornicroft's study that I recreate is specification (2) in the table on page 48. This empirical specification includes a constant, *age* > 50 years, *tenure* < 5 years, *tenure* > 15 years, *compensation*, and *female*.

[31] If I recreate specification (2) of Thornicroft's study for all 1,728 cases, the coefficient on *female* is 0.10. It is not statistically significant.

[32] Looking at all 871 cases over the period 2000 to 2011 in courts and tribunals, using Professor Thornicroft's methodology, I find no statistical relationship between gender and reasonable notice outcomes.

[33] If I use data to appeals courts over the entire period 1997 to 2019 ($n$ = 248) and use Professor Thornicroft's methodology, there is no significant relationship between gender and outcomes. Looking at the 78 appeals cases since 2011 reveals no significant relationship.

So, while there may not be any direct findings that female plaintiffs are treated differently to male plaintiffs holding fixed the type of job, there is evidence to suggest that the types of job that female plaintiffs have disproportionately held are awarded shorter reasonable notice periods. All this is to suggest that the legal test itself contains gender bias. The case law reflects deeper problems in gender benefit disparity in the broader Canadian labour market that gets reproduced in the case law. As Judith Macfarlane states: "work that is viewed as 'women's work' is undervalued and underpaid compared to that commonly done by men, and there are distinct barriers for women who attempt to leave the more traditional female occupations" and "the managerial/clerical distinction is based on society's biased viewed about the value of different jobs—bias that harms women."[34]

The level of compensation is positively correlated with reasonable notice awards (see Table 2). The higher the salary of the worker, the longer the reasonable notice awards. This correlation may be capturing unobservable relevant factors about the nature of the work that increase the reasonable notice award that I cannot capture in the data. Further, the difference in compensation between female and male plaintiffs, in terms of compensation, is stark (see Table 1). Here, female plaintiffs earn less than male plaintiffs, a pattern that is still observed in the broader society.[35] To the extent that reasonable notice awards mirror compensation, female plaintiffs will receive shorter reasonable notice periods if they earn less than their male counterparts.

A third channel is the willingness to litigate and insist upon legal rights. All the empirical studies exploring gender bias and reasonable notice awards have noted that male plaintiffs make up the majority of the cases. My dataset is no exception. If male plaintiffs are more willing to take legal action in wrongful dismissal cases, this too may influence ultimate outcomes.[36]

### *1.5 Conclusions on the empirical evidence*

The data tell an important story. I find no direct evidence that gender and outcome are correlated *once other factors are taken into account*. Of course, those *other factors* could indeed—and historically have been—correlated with gender. The findings here cannot be taken to suggest there is no gender bias in the law of reasonable notice.

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[34] See MacFarlane, *supra* note 13 at 420. MacFarlane also notes that women "make up a disproportionate percentage of workers in lower status jobs compared to the male workforce" at 420. See also: Rollings-Magnusson*, supra* note 12; Terry H Wager & James D Grant, "The Relationship between Plaintiff Gender and Just Cause Determination in Canadian Dismissal Cases" (1996) 34 Sex Roles 534.

[35] See e.g. Statistics Canada, *The gender wage gap in Canada: 1998 to 2018* by Rachelle Pelletier, Martha Patterson & Melissa Moyser, Catalogue No 75-004-M (Ottawa: Statistics Canada, 11 October 2019); Nicole M Fortin, "Increasing Earnings Inequality and the Gender Pay Gap in Canada: Prospects for Convergence" (2019) 52:2 Can J Econ 407.

[36] See also James D Grant & Terry H Wagar, "Willingness to Take Legal Action in Wrongful Dismissal Cases: Perceptual Differences between Men and Women" (1992) 74:3 Perceptual & Motor Skills 1073 at 1073–74 (146 business students with full-time work experience participated in a study of dismissal from employment. Men were more likely than women to favour court action in the event of dismissal).

Indeed, the empirical evidence suggests gender differences have likely manifested themselves through other channels such as job type and compensation.

## 2. Use of algorithms by judges and arbitrators in reasonable notice cases

### *2.1 Algorithms based on prior decisions of judges and arbitrators*

Can algorithms be used to assist judges and arbitrators in making determinations of reasonable notice awards in the near future?[37] Here, I focus on one type of predictive algorithm: one that seeks to replicate what the existing law is. In this way, the algorithm takes all existing case data and make a best prediction about how a court would decide this case.[38]

An example may prove helpful. Sam has been recently dismissed from a job as a middle manager in Ontario. Sam is 49 years old and has been working at the same firm for 12 years. Sam earned $100,000 last year and received no reports of poor performance. There are few indications that Sam will find it more difficult to find work than somebody else in the same situation. What is a reasonable notice period for Sam? The firm that has recently dismissed Sam says that 4 months is reasonable. Sam seeks 18 months. In order to determine what is reasonable, a court may look to prior decisions. Human judges and arbitrators are limited in their capacity to read thousands of cases and absorb all the relevant information in a short period of time. An algorithm that is based on all prior decisions, however, could essentially provide a distillation of how much weight to put on each relevant factor.[39] The algorithm essentially provides a prediction of how previous courts would have decided. For example, in Sam's case it might provide a predicted reasonable notice period of 12 months. In some sense, it is as if the prediction is the result of a survey, asking *every* judge who has decided a previous case what the law should be in Sam's case.

The potential benefits of such an algorithm are clear. Suppose, hypothetically, that in the future, decision makers delegate decision making authority to the algorithm. That is, the algorithm provides the content of the legal decision. In the example above, the prediction of 12 months' notice becomes the legal decision.

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[37] See generally Sourdin, *supra* note 6 on the recent developments in AI and its profound impact on judges and judging the future.

[38] See Andrew Stranieri & John Zeleznikow, *Knowledge Discovery from Legal Databases* (Dordrecht, NL: Springer, 2005) at 211–26 discussing the prediction of outcomes in ordinary cases that depend on judicial discretion—especially discovering patterns of judicial reasoning—provided that the data collected reflects the reasoning processes. See also Johnathan Jenkins, "What Can Information Technology Do for Law" (2008) 21:2 Harv JL & Tech 589; Naomi Burstyner et al, "Using Technology to Discover More about the Justice System" (2018) 44:1 Rutgers Computer & Tech LJ 1.

[39] Stranieri & John Zeleznikow, *supra* note 39 at 224.

This decision is one that best accords with the decisions in previous cases. This type of algorithm takes the doctrine of precedent very seriously.

The idea of such an algorithm would run contrary to the assertion of McRuer CJHC in *Bardal* who held that there "can be no catalogue laid down as to what is reasonable." Indeed, using the experience of hundreds of judges over thousands of cases, the law can better provide a clearer answer as to what is reasonable. This is in line with Justice Oliver Wendell Holmes's proclamations about how legal cases provide more information and the law evolves from standards (such as "reasonable" notice) towards clearer rules.[40] The reduction in uncertainty is potentially enormously beneficial to society.

There are also important benefits from the viewpoint of the rule of law. The algorithm provides consistent answers.[41] The algorithm's results do not change depending on the identity of a human judge. The algorithm can wash out biases that currently prevail across different judges and arbitrators, by making the law more consistent. No longer will reasonable notice awards be a function of which particular judge you are randomly assigned to or the whims of what the judge had for breakfast.[42] Like cases will be treated alike. Moreover, if all parties know the content of the algorithm there will be no dispute on substance.[43] The litigants will realign their expectations. Sam will not seek 18 months. The firm will not provide a mere 4 months. The litigants will not be litigants.

But this certainty and consistency will, obviously, come at a cost. First, there is a concern that the law is something uniquely human.[44] These concerns contain less force with regards to the types of algorithms discussed here, since these algorithms are based on the previous decisions of human judges. But perhaps there is something uniquely human about deciding a new case, that factors in special factors that an

[40] Strict application of the doctrine of precedent also introduces economies of scale for standards, but it does so in a way that turns the standard into a rule: see Oliver Wendell Holmes Jr, "The Path of the Law", (1897) 10 Harv L Rev 457; Anthony Niblett, "Case-by-Case Adjudication and the Path of the Law" (2013) 42:2 J Leg Studies 303.

[41] See John Zeleznikow, "Building Decision Support Systems in Discretionary Legal Domains" (2000) 14:3 Intl Rev L, Computers & Technology 341 ("the construction of intelligent legal decision support systems in discretionary domains will enhance consistent decision-making leading to increased confidence in the justice system and provide support for alternative dispute resolution" at 341).

[42] Okzan Eren & Naci Mocan "Emotional Judges and Unlucky Juveniles" (2018) 10:3 American Economics J: Applied Economics 171 (finding that unexpected losses in football games increase sentence lengths by judges during the week following the loss); Fabian, *supra* note 7.

[43] Stranieri & Zeleznikow, *supra* note 39 at 222 (claiming that the development of legal decision support systems would lead to users being aware of the outcome of litigation and therefore, encouraged to avoid the costs and emotional stress of the legal proceedings).

[44] W Bradley Wendel, "The Promise and Limitations of Artificial Intelligence in the Practice of Law" (2019) 72:1 Okla L Rev 21 ("[t]he capacity of legal rules and principles to furnish reasons, create obligations, and possess authority all depends on the shared standpoint of mutual respect adopted by free and equal persons" at 48).

algorithm cannot.[45] Second, the law will be less dynamic. The decisions of past decisions are concretized. There is little room for evolution. If what we, as a society, view as "reasonable" changes, the law will not change. Third, and relatedly, the law will continue to replicate any biases that are already in the content of the law. To the extent that individual judges' have biases, these can be largely washed away by the algorithm, but systemic biases in the way judges have decided cases will continue. All this is to say, if we are uncomfortable mechanically applying the past law to future cases, then one should put less weight on the use of algorithm.

The question of bias is obviously of central importance. For the purposes of the narrow focus of this paper, will the recommendations or predictions be biased against female plaintiffs? In the context of the above example: *Will the reasonable notice award be different if "Sam" is a female plaintiff or a male plaintiff?* The empirical analysis in Part 1 suggests that there is no evidence of direct gender bias in the reasonable notice cases in Canada.

But, to be very clear, this *does not* mean that a predictive algorithm will not systematically entrench gender differences. Indeed, the use of such algorithms to provide legal decisions needs to be done with care, to ensure that these biases are not baked in. Consider three reasons why we cannot simply take the evidence in Part 1 to suggest that algorithmic decision making will not be gender biased.

First, an algorithm that expressly includes gender as one of the variables *may* adversely affect female plaintiffs. Let's suppose that the predictive algorithm is based on a simple linear prediction model in specification (5). Here, the coefficient on *female* is -0.28. This means that the model will provide females with a notice period that is shorter than male plaintiffs by about one week. Even though the coefficient is not statistically significant, a predictive model that uses specification (5) would still factor in the negative coefficient and provide for a shorter reasonable notice award. Note, however, if any of the specifications (2), (3), or (4) are used, female plaintiffs would receive slightly longer notice periods. One takeaway here, to potentially reduce the differential treatment, is to not include gender as a variable in the model.

Second, even if gender were simply removed from the algorithm, *in practice* the outcomes may still reflect gender differences. "Gender blind" algorithms will not necessarily solve the problem because the law may factor in variables that are correlated with gender. As discussed above, the law awards shorter reasonable notice periods to employees of certain jobs disproportionately held by females (e.g., clerical positions) and awards longer notice periods to employees of job disproportionately held by males (e.g., upper management). The law reflects the gender gap in society. This categorical problem of the law treating jobs differently will continue if we use the predictive algorithm. That is, the algorithm will only reinforce the bias by

[45] Frank Pasquale, "A Rule of Persons, Not Machines: The Limits of Legal Automation" (2019) 87:1 Geo Wash L Rev 1.

replicating the biases of, say, the managerial/clerical distinction.[46] But the potential concern would be less corrosive *if* the male-female proportion in management positions, for example, equalizes across job types over time. The same concern is true of differences in compensation. If the algorithm awards longer reasonable notice periods to workers who earn more, then any differences in compensation across gender will be reflected in reasonable notice awards. Again, this will be less of a concern *if* gender differences in compensation wash away over time.

Third, the linear regression model presented here is overly simple. The model in Part 1 treats each variable as linear relationship to reasonable notice awards.[47] But law is not linear. More complex predictive models perform much better at predicting out-of-sample reasonable notice awards (i.e., predicting reasonable notice awards that the algorithm has not seen before). Supervised machine learning models are more flexible than the linear prediction models. They provide additional predictive power. An algorithm that use boosted decision trees, for example, provides predictions that more accurately reflect how judges have decided previous cases.[48] But, in order to generate this additional predictive power, the algorithm may find patterns in the data that cannot be captured by a simple linear model. This may uncover additional relationships that are further correlated with gender.

The takeaway, here, is that even though the data do not necessarily indicate direct evidence of gender bias in reasonable notice awards, one would need to be very careful in tailoring an algorithm to ensure that the law does not treat female employees differently to male plaintiffs. But this Part, so far, has only explored algorithms that describe what the law has been. Are there alternative types of algorithms that can reduce bias of human decision makers? Are there algorithms that can improve the content of the law? I seek to address these questions in the next section.

### *2.2 Algorithms that correct biases and improve the content of the law*

Recent research suggests that algorithms can help reduce bias in the law.[49] In bail decisions, for example, research from the United States shows that machine learning algorithms that seek to predict flight risk not only do much better than human judges, but they also mitigate racial bias inherent in the decisions in human judges.[50] The

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[46] See e.g. MacFarlane, *supra* note 13.

[47] One exception to this rule is *tenure* in specification (5) of Table 2, where a quadratic relationship between *tenure* and reasonable notice is specified.

[48] J Ross Quinlan, "Simplifying Decision Trees" (1987) 27:1 Intl J of Man-Machine Studies 221.

[49] See Cass R Sunstein, "Algorithms, Correcting Biases" (2019) 86:2 Soc Research: An Int Q 499. See also *Skeem & Lowenkamp*, *supra* note 8; Robert P Bartlett et al, "Algorithmic Accountability: A Legal and Economic Framework" (2020) online, (pdf): *Berkeley School of Law* <faculty.haas.berkeley.edu/morse/research/papers/AlgorithmicAccountability_BartlettMorseStantonWallace.pdf>.

[50] Sunstein's work builds off of Jon Kleinberg, Jens Ludwig, Sendhil Mullainathan & Ziad Obermeyer (2015), "Prediction Policy Problems" 105:5 American Economic Rev 491. See also Jon Kleinberg,

decisions of human judges in these bail decisions have been found to place excessive emphasis on particular factors that are correlated with race.[51] The machine learning algorithms are less likely to suffer from such biases.

The key to these findings is that the algorithms are not replicating the decisions of human judges. Instead, the algorithms are seeking to achieve a different objective. In bail, the algorithms are seeking to predict flight risk. Human judges make two types of errors: they grant bail to high-risk defendants on bail and they deny bail to low-risk defendants.[52] An algorithm that uses hundreds of thousands of real-life observations about the flight risk of defendant is able to reduce both types of error. That is, better information will lead to better predictions, which—in theory—can lead to an improvement in the law.

Could we imagine using a similar type of algorithm in reasonable notice cases? Suppose, instead of seeking to replicate how previous judges have decided what is reasonable, the algorithm seeks to achieve some other objective. In this way, the algorithm can be better tailored to achieve particular goals in the law. For example, suppose that we, as a society, decide that notice periods should accurately reflect the length of time that it takes a dismissed employee to find a similar position. Here, one might imagine an algorithm that uses data on how long it takes a given worker to find a new position. Algorithms of this type could use far more data than an algorithm based on case law. The algorithm could draw from the experiences of literally millions of Canadian workers who have been dismissed. How long did it take each worker to find a new position that was similar to the previous employment?

Returning to our example of Sam above, this type of algorithm would predict how long it *usually* takes 49-year-old managers to find a similar job, given the state of the economy and other relevant factors. The answer would better reflect the realities of the employment market, rather than relying on the subjective judgments of human judges to determine what is "reasonable" in a given context.

While these algorithms may offer great promise, they are, of course, not perfect. They are not a panacea. There are, for example, still problems with the "objectivity" of the data. Most problematically for this example, the length of time that it takes workers to find a similar job is a function of our law on reasonable notice. That is, workers who receive a long reasonable notice period are more likely to take longer to find a similar new job. Workers who receive shorter notice periods are more incentivized to take new jobs after a shorter period of time. That is, there is great deal of endogeneity in the algorithm. The data will reflect the current state of the law.

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Himabindu Lakkaraju, Jure Leskovec, Jens Ludwig & Sendhil Mullainathan, "Human Decisions and Machine Predictions" (2018) 133:1 Q J Economics 241 [Kleinberg, "Human Decisions"].

[51] David Arnold, Will Dobbie & Crystal S Yang, "Racial Bias in Bail Decision" (2018) 133:4 Quarterly J Economics 1885; Meghan Sacks, Vincenzo A Sainato, & Alissa R Ackerman, "Sentenced to Pre-trial Detention: A Study of Bail Decision and Outcomes" (2014) 40 American J Crim Justice 661.

[52] Kleinberg, "Human Decisions", *supra* note 51 at 240–66.

Further, there may be great difficulty in determining what a "similar" job is. This may require subjective assessments of what counts as a similar job.

Finally, the discussion here presumes that the objective of the law on reasonable notice is to provide notice periods that accurately reflect how long it takes for a worker to find a similar job after dismissal. But what if decision makers have different objectives? What if a judge believes that the law should be more employer friendly, perhaps allowing employers greater incentive to dismiss workers? An algorithm seeking to meet this objective would provide much shorter notice periods. The objective of the algorithm needs to be agreed upon in advance. To the extent that different decision makers cannot agree on objective, this may counsel in favour of greater flexibility in the law, rather than concretizing one specific goal.

## Conclusion

If legal decisions in the 21st century are ever to be based on algorithms that rely on past legal decisions, we, as a society, must be overwhelmingly satisfied with the content of the existing case law. If judicial decisions reflect biases—such as gender biases—then using an algorithm based on past decisions to decide future cases would run counter to the rule of law. It goes without saying that we would not want to use an algorithm that reinforces and entrenches such bias in future decisions.

In this paper, I showed that there is no direct evidence of a gender gap in reasonable notice awards in Canada. That is, if you took two employees with the same job type, same characteristics, and same employment opportunities, there appears to be no statistical difference between a male plaintiff and a female plaintiff. Unearthing statistical evidence of gender gaps in other areas of law *should* be a fertile source of academic research in the near future, particularly if Canada follows other jurisdictions and starts using such algorithms to assist with legal decision making.

But just because gender gaps are not *directly observable* in the area of law under observation does not mean that we can simply turn to an algorithm to help decide all reasonable notice cases in Canada. Gender bias can manifest itself through other channels. Indeed, the legal test used by courts treats different job types differently. And these distinctions have, historically, reflected gender bias, Further, gender bias is only one type of bias with which we may be concerned. Important questions will remain about the degree to which the law reflects the societal values we wish employment law to reflect. And broader questions about how "human" the law should be and how much authority we, as a society, wish to delegate to an algorithm will need to be answered. These are questions that we can no longer leave as hypotheticals or to the realm of science fiction.