PAY TRANSPARENCY AND THE GENDER GAP

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ABSTRACT

We examine the impact of public sector salary disclosure laws on university faculty salaries in Canada. The laws, which enable public access to the salaries of individual faculty if they exceed specified thresholds, were introduced in different provinces at different points in time. Using detailed administrative data covering the universe of faculty in Canada and an event-study research design, we document three key findings. First, the disclosure laws reduced salaries on average. Second, the laws reduced the gender pay gap between men and women. Third, the closure of the gender gap is primarily in universities where faculty are unionized.

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1. Introduction

One of the most persistent and salient features of labor markets around the world is that women earn less than men. For example, in the US, a woman typically earns roughly 77 dollars for every 100 dollars earned by a man (Goldin, 2014). A hypothesis recently gaining traction among academic researchers and policymakers is that the gender gap in earnings persists in part because it is hidden. This is buttressed by a series of policy reforms that mandate the disclosure of salaries broken down by gender.[2] In the US, President Obama passed legislation requiring firms with government contracts to disclose the average wages of employees by gender, although this was subsequently rolled back by President Trump.[3] There have also been calls in the private sector for more transparency about pay differences between male and female workers; for example, technology firms are facing public pressure to disclose salaries broken down by gender.[4]

Outside of the US, transparency laws are increasingly being considered as a policy to reduce the gender gap. Denmark introduced legislation in 2006 requiring large firms to report wage statistics broken down by gender (Bennedsen et al., 2019). Starting in 2017, firms in the United Kingdom with more than 250 employees are required to report salaries and bonuses broken down by gender.[5] Similar reforms are underway in Australia, France, and Germany. In Canada, the recent Pay Transparency Act introduced in Ontario requires all publicly advertised job postings to include a salary range, bars employers from asking about past compensation, and mandates that employers report gender earning gaps to the province.[6]

Despite the growth in transparency legislation, there has been limited academic research that sheds light on whether pay transparency systematically reduces the gender pay gap. This is

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[2] Throughout we will use the terms "pay transparency" and "salary disclosure" interchangeably.
[3] See http://wapo.st/2vMvIph?tid=ss_tw&utm_term=.a21256120472.
[4] See https://www.bloomberg.com/news/articles/2017-04-13/tech-companies-tout-gender-pay-equity-but-balk-at-transparency but also https://www.nytimes.com/2019/03/07/opinion/google-pay-gap.html
[5] See http://www.legislation.gov.uk/uksi/2017/172/pdfs/uksi_20170172_en.pdf
[6] This law was set to come into effect on January 1, 2019, but its implementation has been delayed pending further consultation with employers.

a significant shortcoming because transparency laws presumably impose costs on employers and increase administrative burden. Whether these laws meet the standard of a cost-benefit test depends on whether they create more equality between genders given the efficiency cost.

This paper provides new evidence on the causal effect of pay transparency laws on salaries. We examine the impact of the (staggered) introduction of pay disclosure laws on university faculty salaries across provinces in Canada. In 1996, British Columbia, Manitoba and Ontario were the first to introduce disclosure laws that required universities to report the salaries of each employee earning in excess of $50,000, $50,000 and $100,000, respectively. Disclosure laws in other provinces have passed more recently, and currently only four provinces lack explicit legal means to publicize university faculty salaries.

To evaluate the effect of these laws, we use non-public Statistics Canada administrative data on the salaries of full-time academic employees at Canadian colleges and universities from 1970 onwards. These data have close to 100 percent coverage of full-time faculty at Canadian universities, and almost all universities in Canada are in the public sector. This data set contains a wide set of demographic and job-related variables relevant to identifying and explaining the evolution of the gender pay gap over time. These variables allow us to determine whose salary is "exposed" by the laws at a very detailed level. This is one of the few datasets that jointly provides information on earnings, and demographic characteristics for a comprehensive set of employers within a sector.

Our research design uses variation across Canadian provinces in the rollout of the disclosure laws, and also within-province variation in exposed departments. Since the laws only apply to faculty with salaries above thresholds, lower paying departments were not affected by the disclosure while higher paying departments were affected, thus providing an additional source of variation within province. Thus, we can define treatment and control groups at the

level of an academic unit and control for time-varying trends at the province level in a flexible manner.

The university sector is a good setting for studying the impact of transparency laws on the gender gap for several reasons. First, a gender gap is pervasive at all academic ranks and across all academic institutions in Canada over the period we study.[7] Second, there is consensus on the "output" of academic faculty—classes taught, research publications, administrative service—and it is relatively easy to observe. Therefore, there is a logic for the arguments that could be used for salary redress under a disclosure law. Third, the well-established and widely adopted divisions of faculty by department and rank enable a precise definition of reference groups. Fourth, given the determination of salaries in the academic sector, earnings differentials reflect wage differentials rather than differences in hours worked. Finally, the ease of accessing the information revealed by some of the disclosure laws we study depends on access to the Internet, and universities have been at the forefront of providing Internet access to their employees over the study period.

We establish three key results. First, transparency laws reduce faculty salaries, on average. In particular, transparency laws lead to a statistically significant 1-3 percentage point reduction in salaries. Second, transparency laws reduce the gender gap: we find a statistically significant 2.2 to 2.4 percentage point reduction in the gender wage gap. This represents a roughly 30 percent reduction in the gender gap, off a base of 7-8 percent, which is the gender gap that prevailed at the time of the first series of transparency reforms in Canada. Our estimates indicate that the reduction in the gender gap reflects a slowing in the growth of salaries for male faculty in the treatment group relative to control group. There is also some suggestive evidence of an increase in female faculty salaries, although the estimates are smaller in magnitude. Third,

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[7] For example, previous research has shown that only 36 percent of associate professors and 22 percent of full professors are women, despite the fact that women account for nearly half of all assistant professors (Council of Canadian Academies, 2012). Additionally, when comparing the salaries of men and women at universities, men's salaries are higher at all faculty ranks, controlling for experience (Boyd et al., 2012).

the effects of salary disclosure on average wages and the gender wage gap are more pronounced in unionized workplaces.

Our paper contributes to several strands of the literature on pay transparency. Several studies have examined the effects of transparency on wages. Gomez and Wald (2010) evaluate the impact of pay disclosure in the province of Ontario and found that salaries of university presidents in the province increased relative to the average public sector salary and also led to higher growth in average professorial salaries in Ontario relative to other provinces.[8] Mas (2017) considered the effects of a law change in California that mandated online disclosure of municipal salaries and finds compression in salaries.

Closer to our setting, Bennedsen et al. (2019) examine the impact of a law in Denmark that required firms of more than 35 employees to provide salary data by gender to employees through their employee representative.[9] The data is reported for groups that are large enough to protect the anonymity of individuals.[10] Using a difference-in-differences design that compares firms with 35-50 employees to firms with 20-34 employees, Bennedsen et al. (2019) report that the disclosure law led to a reduction in the gender wage gap in treated firms primarily due to a slowing of males' wage growth.[11]

There are a couple of differences between our study and Bennedsen et al. (2019). First, the nature of the transparency law is very different between the two settings. In Denmark, salary gaps are disclosed by firms to an employee representative or firms draft an internal report on pay equity, whereas, in our setting, all salaries above a threshold are disclosed and are accessible directly by all workers. Second, unlike Bennedsen et al. (2019) who focus on private sector

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[8] The latter conclusion is based on a difference in differences analysis using 1991, 1996 and 2001 census data.
[9] There was also an alternative choice available to employers which permitted them to replace the wage statistics broken down by gender with an internal report on equal pay.
[10] Anonymity is preserved by restricting disclosure to 6-digit occupation codes that have at least 10 employees of each gender at the firm level.
[11] Kim (2015) investigates the effect of US state-level laws that ban pay secrecy; that is, employer-level prohibitions on employees sharing salary information. Using a difference-in-differences design, Kim reports that in states with a law prohibiting pay secrecy, the wages of college-educated females are higher leading to a lower gender pay gap.

workers, we study public sector workers, and thus the two papers are complementary in this respect. Nevertheless, the results of our two studies are quite similar – we also find a reduction in the gender pay gap driven in part by lower male salaries.

Other studies have examined the impacts of pay transparency on other outcomes. Cullen and Perez-Truglia (2018) conducted a field experiment at a large corporation that revealed salaries of peers and managers. They find that a higher perceived peer salary lowers effort, output and retention, whereas a higher perceived manager salary increases these outcomes. Card et al. (2012) used a randomized information experiment to show that pay transparency reduced the well-being of university faculty in departments where they earned below median pay in California. Breza, Kaur and Shamdasani (2018) showed that Indian manufacturing workers had lower productivity when they had the ability to learn about peers' salaries. Perez-Truglia (2019) considered how transparency affects well-being by evaluating a reform in Norway that disclosed online tax records for the whole population and also finds a reduction in well-being.

The rest of the paper is organized as follows. Section 2 discusses the mechanisms by which transparency laws might affect the gender wage gap. Section 3 provides an overview of public sector disclosure laws in Canada. Section 4 discusses the data. Section 5 provides evidence of the gender wage gap for all workers in Canada and for professional occupations within the educational services sector. Section 6 describes the event-study specification. Section 7 contains the empirical results and Section 8 concludes.

2. Why Might Pay Transparency Affect the Gender Gap?

One effect of the provision of information on gender-based salary disparities within an organization is that it may lead individuals to privately demand higher pay from their employer. The case of Lilly Ledbetter is illustrative of this. Ledbetter, a supervisor at Goodyear Tire, an American manufacturing company, was unaware that her male counterparts, in similar positions,

were being paid more than she was. Revelation of this fact through an anonymous letter led her to file an employment discrimination lawsuit against her employer. This case proceeded all the way to the US Supreme Court, and subsequently led to the Lilly Ledbetter Fair Pay Act of 2009, which eased the burden of filing a discrimination lawsuit.[12]

The Ledbetter case emphasizes individual action by employees. It is also possible that broad salary disclosure reduces the gender pay gap as a result of an institutional response to wider public attention to pay disparities. In particular, organizations may take institutional action to make salary adjustments, in part to maintain public relations. For example, Mas (2017) found that disclosure of City Manager salaries in California lead to a reduction in average salaries, which is interpreted as an institutional response to public outcry over high levels of compensation.

On the other hand, it is possible that the gender wage gap is unaffected by transparency laws. For example, if there is taste-based discrimination or if the gender wage gap is due to monopsony, there may not be any impact of transparency. Similarly, while learning about co-workers' wages might reveal something about the nature of firm-specific rents, if men and women use this information in a symmetric fashion in bargaining, one should not expect to see any impact on the gender pay gap. If men, but not women, use the information in bargaining, it could exacerbate the gap.[13] In our study of university faculty, both individual and institutional action can lead to redress.

3. **Public Sector Pay Disclosure Laws in Canada**

As noted in the Introduction, the first public sector salary disclosure laws were passed in 1996 in the provinces of British Columbia, Manitoba and Ontario. In each case, the government

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[12] See https://www.congress.gov/bill/111th-congress/senate-bill/181
[13] Leibbrandt and List (2014) present evidence that in some circumstances, men are more likely to negotiate wages than women.

mandated disclosure of all university salaries exceeding a certain threshold—$50,000 in British Columbia, $50,000 in Manitoba, and $100,000 in Ontario.

In panel A of Table 1 we outline the timing, disclosure thresholds and coverage of university faculty of the disclosure laws and legislation in provinces providing access to public salaries.[14] A number of additional features of these laws are noteworthy. First, most provinces with a salary disclosure law publish the salary data online.[15] The first publication of salaries online by the governments of Ontario, Nova Scotia, Alberta, and Newfoundland and Labrador was directly followed by news coverage in the media with wide dissemination. However, in other provinces, disclosure laws do not require the province to make these data accessible online. In British Columbia, online access to faculty salaries was made possible only after a freedom of information request by journalists from the Vancouver Sun, a provincial newspaper, in 2008. The newspaper maintained an online, searchable data bank of public sector salaries from 2008 to 2015, including faculty salaries.

Second, the initial reporting threshold for disclosure has remained fixed throughout time in most provinces but has been adjusted for inflation in others. For example, in Alberta, several years following legislation on salary disclosure of government employees, a separate act that applied more broadly to the public sector, including university faculty, was passed in 2012 with a threshold of $125,000 adjusted annually to Alberta's Consumer Price Index.

Finally, in some provinces, legislation affecting salary disclosure was passed prior to the legislation cited in the table, but did not require public disclosure of university faculty whom we study. For example, preceding the legislation in Ontario, the salaries of government employees earning in excess of $40,000 were published in the Public Accounts. This disclosure, however,

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[14] The laws covering salary disclosure in Saskatchewan are targeted at employees in crown corporations and have not been expanded to include other public employees, such as university faculty. However, the pressure of having some salaries disclosed in this province is leading the University of Saskatchewan to undertake its own transparency initiative. See https://thestarphoenix.com/news/local-news/u-of-s-online-salary-disclosure-a-step-in-the-right-direction-expert accessed March 6, 2019

[15] For example, see Ontario's salary disclosure here: https://www.ontario.ca/page/public-sector-salary-disclosure.

did not cover university faculty and access was limited as it required obtaining a hard copy of the Public Accounts document.[16]

4. Data

This study is based on an analysis of Statistics Canada's University and College Academic Staff System (UCASS) dataset, from 1970 to 2017. This is an annual nationally-representative survey that collects data on full-time teaching staff at degree-granting Canadian universities and their affiliated colleges, as of October 1 of each year. The survey includes all teachers within faculties, academic staff in teaching hospitals, visiting academic staff, and research staff who have academic rank and salary similar to teaching staff, for all those whose term of appointment is not less than twelve months. It excludes administrative and support staff, librarians, and research and teaching assistants.

UCASS is administered directly to institutions, for which participation is mandatory. The unit of observation in the data is the individual but the survey unit is the institution, and information on the socio-economic characteristics of staff—including pay—are obtained directly from payroll records. Statistics Canada works closely with institutions to maintain consistent reporting each year and to ensure the data are comparable across institutions. A limitation of this dataset is that it was discontinued from 2011 to 2015. During this period, data were collected independently by participating institutions in association with the National Vice President's Academic Council leading to the construction of the National Faculty Data Pool (NFPD), with the goal of emulating UCASS as closely as possible for longitudinal consistency. Through a

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[16] Starting in 1996 the Financial Information Act was in force in BC which requires public bodies to prepare a statement documenting the salaries of employees making $75,000 or more (threshold starting in 2002). We are unable to uncover any evidence that these statements were ever made public. Since 1996, public employees earning $25,000 or more in Nova Scotia are published in the Public Accounts, but university faculty are excluded. New Brunswick has a similar requirement starting in 2008, excluding university faculty and with a $60,000 threshold.

recent collaborative effort between Statistics Canada and the university consortium, the NFDP has been integrated with UCASS to fill in the missing years.

The NFDP has two limitations that are important to note. First, participation in the survey was voluntary. From 2010 to 2012, the sample size decreased from approximately 35,450 workers to 27,000 and the number of institutions observed decreased from 113 to 56. The loss of institutions is proportionately larger as the withdrawal of a given university from the survey will also lead to the loss of all of its (small) satellite colleges. Second, for confidentiality reasons or ease of reporting, several institutions did not maintain consistent reporting of their employees' personal identifiers moving from UCASS to the NFDP in 2011 and/or back to UCASS in 2016. To overcome this issue, we match on observables to generate longitudinally-consistent identifiers for institutions where a break is observed. This is done by matching within institutions and departments based on year of birth, gender, year appointed to the institution, and year of highest degree. Placebo checks for institutions and years where no break occurred indicate that the success rate exceeds 99 percent.

The following sample restrictions are imposed throughout this analysis. Individuals are included only if they hold appointments at the rank of Assistant, Associate or Full Professor; they are not employed in the faculty of medicine or dentistry; and they are assigned to a specific department. We make these restrictions since we have a clearer understanding of salary determination for the faculty that are included. For example, salary determination in medicine and dentistry may be affected by activities beyond research and teaching, including medical practice. We restrict to faculty with a non-missing department since our empirical specification below requires assigning a peer group based on department, and this is not possible for those not assigned to a department.[17] Lastly, the analysis sample is restricted to institutions that are observed in the 2012 wave of the NFDP and that finalized their data with or submitted back

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[17] Prior to 2008, the department variable is not well-reported. Thus, we proxy for department using a variable for subject taught, which uses the same classification system as the department variable.

information to Statistics Canada. This restriction on institutions is made to balance the panel around the years that the survey was discontinued.

In panel B of Table 1, we present descriptive statistics for the full sample used in this study and separately for men and women. There are 101,103 individual university employees across Canada in our sample. On balance, individuals are approximately 48 years old and one-quarter of them are women. This masks the fact that, in the 1970s, less than 15 percent of faculty were women but this has climbed to about 40 percent in recent years and about 45 percent of new hires during the 2010s were women. In addition, about 80 percent of faculty hold a PhD and 70 percent belong to institutions that are unionized. Interestingly, women are nearly 10 percent more likely to be unionized than men, although this may be driven by two factors: (1) women being more likely to work at institutions represented by unions or faculty associations; and (2) the proportion of women in the industry has risen over time alongside the gradual increase in unionization from the 1970s to 1990s.

5. **Context**

Female workers in Canada earn less than their male counterparts as they do in most developed economies. In Appendix Figure A1 we document the gender hourly wage ratio for full time workers over the period of this study.[18] We report the ratio for all workers and for professional occupations within the educational services sector. The ratio for all workers rises from a low of just over 0.82 to almost 0.89 over the period. The ratio for education workers is more volatile reflecting smaller sample sizes. It begins the period just over 0.88 and rises above 0.90, except for an abrupt decline in 2018. Throughout almost all of the period female educational professionals faced a smaller wage gap than their counterparts in the wider labor market.

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[18] See also Baker and Drolet (2010) and Morrisette et al. (2013).

While it has become commonplace to measure gender pay disparities with hourly wages in Canada, earnings are the norm in many other countries and we focus on the annual earnings of faculty in our analysis. Using earnings to document gender differences of course may conflate both differences in hours worked (e.g., part-time vs full-time) and differences in hourly wages. This is less of a concern in the present context, as we restrict our sample to full time appointments and faculty salaries in Canada are typically a fixed amount paid on a 12-month basis.

The gender earnings gap in our sample of faculty is reported in Figure 1. We present this gap over time both unconditionally and conditional on controls (institution, department, year of birth and highest degree attained). The gap was around 15 percent at the beginning of the sample and has closed to roughly 4-5 percent in recent years. This is consistent with Warman, Woolley and Worswick (2010) who use similar data to document a narrowing in male-female earnings differentials between 1970 and 2001.

A potential concern using pay in the university sector is that salaries may be set according to a statutory formula; for example, they may be entirely determined on the basis of Institution, Department and Rank. To gauge whether there is discretion in pay and scope for transparency laws to impact the gender wage gap, we predict salaries by regressing them on the interaction of Institution-Department-Rank-Tenure-Year fixed effects, age fixed effects and highest degree obtained fixed effects. If salaries are set in a formulaic way, then there should be very little residual variance between actual salaries and predicted salaries. Appendix Figure A2 shows that this is not the case, as we observe substantial residual variation for both men and women. The R^2 for both models is roughly 70 percent. Additionally, the fact that the conditional gender gap is roughly 7-8 percent at the time the first disclosure laws were introduced suggests that there is scope for disclosure to affect the gap.

6. Econometric Specification

The Canadian setting is unique to evaluate the causal effect of transparency as there are three separate sources of variation in transparency – provincial, time and baseline salary. For example, as discussed above, salary disclosure in Ontario was introduced in 1996 but only individuals whose salaries were above the $100,000 threshold were included.[19] Our baseline definition of treatment takes advantage of all of these sources of variation. Specifically, we define an individual as treated in a given year if, during that year, they work in a province where there is a salary disclosure in place and they work in a department where a faculty member was revealed by the disclosure policy in the year of the reform.[20] Our main definition of peer group consists of all faculty in the same *Institution* and *Department*. We also report results from another definition based on *Institution, Department* and *Rank*. The two definitions of the treatment are conceptually distinct; the former may capture "vertical comparisons" whereas the latter definition is limited to "horizontal comparisons" (see Cullen and Perez-Truglia (2018)).

To formalize our approach, we consider a panel of $i = 1, ..., N$ individuals in which salary Y_{it} is observed for $t = 1, ..., T$ years or for some, a subset thereof. We also observe a binary treatment variable $D_{it} \in \{0,1\}$: $D_{it} = 0$ if i has not been treated by year t and $D_{it} = 1$ if i has been treated by year t. In our setting, treatment is an absorbing state and the treatment path $\{D_{i,t}\}_{t=0}^{T}$ is a sequence of zeros and then ones. In this case, the treatment path is uniquely characterized by the time period of the initial treatment, which we denote by $E_i = \min\{t: D_{i,t} = 1\}$. This is typically referred to as the "event time" and we denote $K_{it} = t - E_i$ as the "relative time". We let F_i be an indicator variable that takes on a value of 1 if individual i is female. We consider the following standard dynamic specification:

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[19] In Ontario, the median salary in 1996 was $74,950, thus indicating that many faculty were not necessarily "treated" by the transparency law despite living in Ontario.

[20] According to our definition of treatment, an individual can be untreated if his or her salary is above the threshold but no peers have a salary above the threshold. Our results are virtually unchanged if we instead consider this individual as being treated.

$$log(Y_{it}) = \alpha_i + \beta_t^M + \beta_t^F$$

$$+ \sum_{k=-A}^{B-1} \gamma_k 1\{K_{it} = k\} + \gamma_{B+} 1\{K_{it} \geq B\} + \sum_{k=-A}^{B-1} \delta_k 1\{K_{it} = k\} \times F_i$$

$$+ \delta_{B+} 1\{K_{it} \geq B\} \times F_i + \varepsilon_{it}$$

where $A \geq 0$ leads of the treatment are included together with $B \geq 0$ terms that capture the short-run effects and a single parameter to capture longer-run effects. In our specification, we set $A = 10$ and $B = 6$. Thus, our model controls for an individual fixed effect (α_i) and gender-specific year effects (β_t^M, β_t^F) (*M*=male, *F*=female). In some specifications, we also control flexibly for a year-by-province-by-gender fixed effects. Thus, this controls for time-varying, province-specific shocks that might differentially affect male and female salaries and are correlated with the event time. Our identifying assumption is that there are no shocks correlated with the introduction of transparency laws that *differentially* affect the salaries of men and women within peer groups. The coefficients of interest are the parameters $\{\delta_k\}_{k=-A}^{B-1}$ and δ_{B+}. These indicate the causal effect of transparency on the gender wage gap in the short-run and long-run, respectively. We can also test for the presence of pre-trends by plotting the $\hat{\delta}_k$ for $k < 0$ and examining whether $\hat{\delta}_k = 0$.

Finally, to quantify the magnitude of the effect and to increase precision of our estimates, we adopt the "static" or canonical specification by setting $A = B = 0$:

$$log(Y_{it}) = \alpha_i + \beta_t^M + \beta_t^F + \gamma_{0+} D_{it} + \delta_{0+} D_{it} \times F_i + \varepsilon_{it}$$

where γ_{0+} is the causal effect of transparency on average wages for male faculty and $\gamma_{0+} + \delta_{0+}$ is the causal effect for female faculty. Compared to the dynamic model, this specification imposes no pre-trends and assumes constant treatment effects for all k. The standard errors are clustered at the level of institution and department, as this is the level at which the treatment is defined.

7. Empirical Results

We begin by presenting a series of non-parametric event-study plots to visually examine the effects of transparency on the gender wage gap. Next, we turn to regression models to quantify the precise impact.

Figure 2 contains our main event-study figure showing the impact of pay disclosure laws on the gender wage gap.[21] Panel A splits the sample into male and female faculty members, the red (blue) dots displaying female (male) log salaries. The blue dots correspond to γ_k while the red dots correspond to $\gamma_k + \delta_k$. Year '0' is the reform year. We see that prior to the reform, the blue dots are above the red dots. However, after the reform, the reverse is true indicating that the disclosure laws reduced the gender wage gap. The figure shows that male salaries fell on average while female salaries increased. This can also be seen in panel B in which we graph the gender gap δ_k. In terms of pre-trends, while we see a slight increase in the gender gap in the several years prior to reforms, the visual evidence indicates a clear and noticeable jump around the event year providing some degree of confidence that we are not merely detecting differential pre-trends. Finally, the figure also shows that salaries for both men and women tend to be reduced in the long-run (e.g., $\gamma_{0+} + \delta_{0+}$ and γ_{0+} are quite low relative to their short-run effects).

The regression results are presented in Table 2. Panel A reports the results for the full sample combining men and women. Columns (1) and (3) include individual fixed effects and province-by-year fixed effects, while columns (2) and (4) control additionally for number of years since appointed to institution, years since highest degree obtained, and an indicator for having senior administrative responsibilities. Columns (1) and (2) consider the peer group to be institution and department while columns (3) and (4) consider the peer group to be institution, department and rank.[22] Appendix Table A1 reproduces Table 2 clustering on institution.

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[21] Treatment is defined based on the year the laws were implemented. Results using year that the salaries were disclosed are very similar and are available upon request.

[22] For the peer group specification by institution, department and rank, we assume that individuals compare themselves to peers as follows: (1) assistant professors compare themselves to assistant and associate professors; (2)

Across all of these specifications, we consistently find that transparency laws reduce average wages. All estimates are statistically significant at the 1 percent level.[23] The point estimates range between 1.4 and 1.5 percentage points in the institution and department peer group specification and between 2.5 and 2.6 percentage points in the institution, department and rank peer group specification, where conditioning on the "additional controls" in columns (2) and (4) increases the magnitude of the estimates by 0.1 percentage points.

Panel B presents the estimates for the gender gap, breaking down the impact of the treatment by gender. In all specifications, we control for year-by-province-by-gender fixed effects. Across the specifications, the estimates indicate a statistically significant reduction in the gender wage gap by 2.2 to 2.4 percentage points. Relative to a mean gender gap of 7 to 8 percent at the time of the initial reforms in 1996 (see Figure 1), this represents an effect of roughly 30 percent. In columns (1) and (2), the narrowing of the gender gap stems *both* from a decline in the growth of male wages and an increase in female wages, consistent with the evidence in the event-study in Figure 2. However, in columns (3) and (4), the change in the gap stems mostly from changes in male wages.

That growth in male salaries fell in the treatment group relative to control suggests that there may have been, in part, an institutional response to disclosure. An important institutional mediator in the Canadian higher education setting are unions, as a large share of faculty are unionized (see Table 1). Unions may play an important role in the response to disclosure since universities must participate in, and respond to, the formal grievance procedures of unionized workplaces.[24] In contrast, the request for higher pay in a non-unionized environment is more

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associate professors compare themselves to all ranks; and (3) full professors compare themselves to associate and full professors.

[23] When the standard errors are clustered only on institution, the estimates in columns (1) and (2) of panel A fall out of significance at conventional levels for the institution × department specification and remain significant for the institution × department × rank comparison. The estimates in panel B are significant in all specifications, clustering on institution × department and at the institution level.

[24] Another possibility is that unions directly bargain for redress for female faculty, separate from the institutional responses we document in Table A2.

likely to occur through an informal meeting with a department chair, which may be difficult absent an external competing offer from a peer institution. The availability of a formal grievance procedure might particularly benefit females in an environment in which the majority of chairs and senior faculty are male.

In Table 3, we present estimates of the effect of the treatment separately based on whether faculty were unionized or non-unionized in the year. In panel B, the estimates by gender reveal that the primary effect of the law on the gender pay gap is in unionized workplaces. Female wages increased by roughly 1 percentage point in response to the introduction of a disclosure law. In non-union universities the change in female wages is close to zero. While we cannot be sure that this is the result of the mechanisms unions provide discussed above, this does suggest that the efficacy of the transparency laws turns on something that is different across, rather than common among, union and non-union universities.

Finally, a number of the universities in our sample undertook campus-wide studies of gender differences in compensation over our sample period. While we do not have direct evidence that these studies were in response to transparency laws, to our knowledge they have all occurred within provinces after a law has come into effect. The analysis in these studies typically involves the use of regression analysis to estimate the gender pay gap, controlling for factors such as field and experience (years since highest degree and years at institution). In many of these cases, the studies have revealed evidence of a gender gap which has led the university to make a onetime across the board adjustment to female faculty salaries. In other cases, a pool of money has been established to grant anomalies to faculty who fall below the regression line. A list of these initiatives, their relevant dates, and the amount and timing of any resulting salary adjustment is presented in Table A2 of the appendix. These studies may be a mechanism by which disclosure affected compensation at the institution level.

8. Conclusion

This paper examines the effect of transparency laws on the gender pay gap. While we focus on public sector salaries, the ongoing efforts of governments around the world to increase transparency of wages in the private sector may allow researchers to determine if the effects we document hold in other sectors of the economy.

There are several directions for future research. First, our estimates are informative about the partial equilibrium impacts of transparency. It is possible that transparency laws have spillover effects through broader changes in social norms and, thus, the general equilibrium effects of these laws may be different. Second, transparency laws are complex and vary in their nature. One can distinguish between "active" disclosure whereby salaries are easily accessible online or "passive" disclosure in which salaries are only available upon request. These two forms of disclosure may not have the same equilibrium effects on salaries. For example, salaries that are available online may garner significantly more media attention and public pressure for adjustment. Additionally, the lower cost of access means that they are more likely to be used to a greater extent in bargaining with employers.

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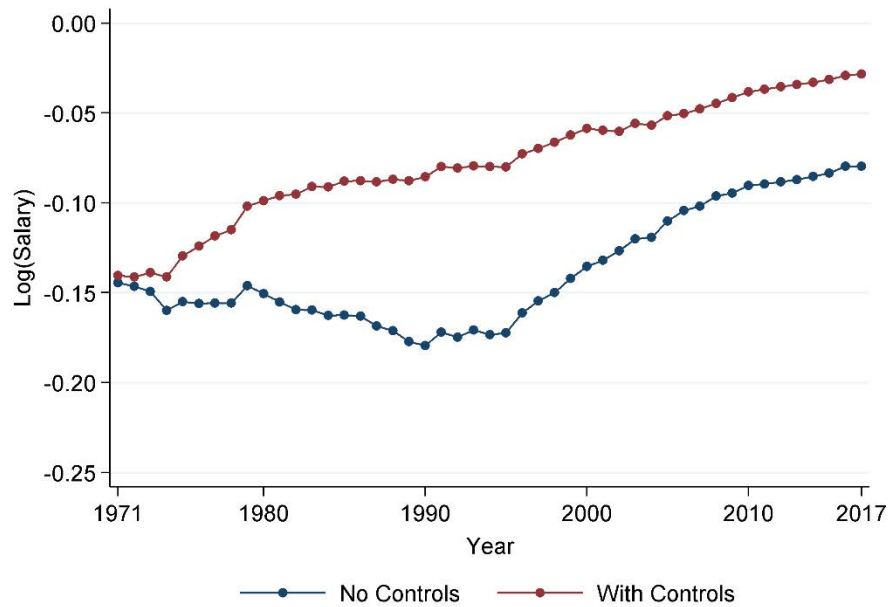
Figure 1: Gender Wage Gap with versus without Controls by Year

Notes: Results are based on a regression of the log of salary on year fixed effects (FEs) and their interactions with an indicator for being female. To control for outliers, observations with salaries below the 0.5th percentile or above the 99.5th percentile (in 2017 constant dollars) are dropped. The coefficients of the interaction variables are reported, where 1970 serves as the reference year, after being scaled down by the estimated unconditional gender wage gap from the coefficient for the female indicator. Control variables include institution, department, year of birth and highest degree attained.
Source: Statistics Canada, University and College Academic Staff System, 1970 to 2017.
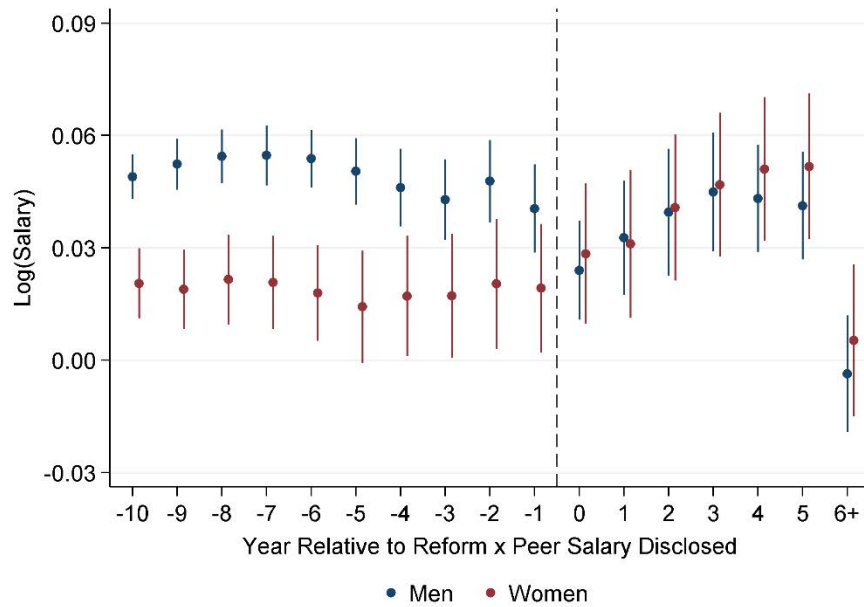
(a) Average Wages of Men and Women
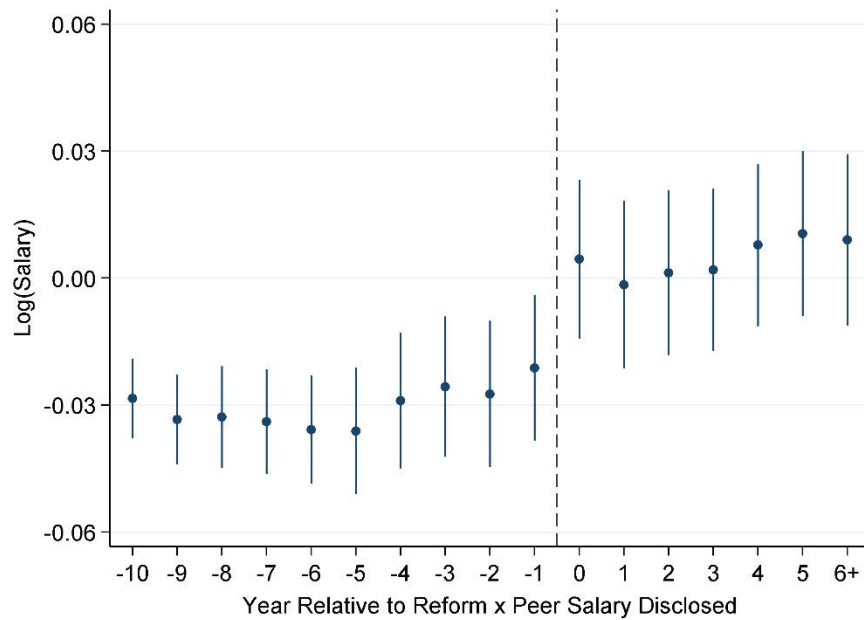
(b) Gender Wage Gap

Figure 2: Event Study of the Effect of Pay Transparency on Average Wages of Men and Women and Gender Wage Gap, Peer Group Specification by Institution and Department

Notes: The analysis controls for fixed effects by individual and province-year-gender. The 95% confidence intervals shown are based on standard errors clustered by institution and department. See notes in Table 2 for more information.
Source: Statistics Canada, University and College Academic Staff System, 1970 to 2017.

Table 1: Disclosure Laws and Descriptive Statistics

	Panel A: University Salaries Disclosure Laws		
	Year of Implementation (1)	Disclosure Threshold (2)	Online Government Publication (3)
British Columbia	1996/2002	$50,000/$75,000	No
Manitoba	1996	$50,000	No
Ontario	1996	$100,000	Yes
Nova Scotia	2012	$100,000	Yes
Alberta	2015	$125,000*	Yes
Newfoundland and Labrador	2016	$100,000	Yes
New Brunswick	N/A		
Prince Edward Island	N/A		
Quebec	N/A		
Saskatchewan	N/A		

	Panel B: Descriptive Statistics					
	Full Sample		Men		Women	
	Mean (1)	Standard Deviation (2)	Mean (3)	Standard Deviation (4)	Mean (5)	Standard Deviation (6)
Demographics						
Age (in Years)	47.5	9.7	47.7	9.8	47.1	9.4
Female (Percent)	24.5	43.0	0.0	0.0	100.0	0.0
Highest Degree (Percent)						
PhD	81.6	38.7	83.0	37.5	77.3	41.9
Professional	0.5	7.4	0.5	7.2	0.6	7.9
Master's	14.2	34.9	13.0	33.7	18.0	38.4
Below Master's	3.6	18.6	3.4	18.2	4.1	19.8
Rank (Percent)						
Assistant Professor	24.0	42.7	20.4	40.3	35.2	47.8
Associate Professor	39.7	48.9	38.4	48.6	43.7	49.6
Full Professor	36.3	48.1	41.2	49.2	21.1	40.8
Other Job Traits (Percent)						
Unionized	69.6	46.0	67.4	46.9	76.6	42.3
Has Responsibilities	11.6	32.0	12.1	32.6	10.1	30.2
Compensation						
Salary (Dollars)						
Full Sample	116,750	29,750	118,750	29,750	110,700	28,850
Assistant Professor	89,350	19,000	89,200	19,050	89,600	18,900
Associate Professor	111,900	21,100	111,350	20,650	113,350	22,250
Full Professor	140,250	25,150	140,250	24,950	140,300	26,350
Salary Growth (Percent)						
Full Sample	2.7	5.6	2.5	5.6	3.3	5.5
Assistant Professor	3.4	4.8	3.3	4.8	3.7	4.8
Associate Professor	2.8	5.3	2.6	5.3	3.3	5.3
Full Professor	2.2	6.1	2.0	6.0	3.0	6.6
Number of individuals	101,103		72,823		28,280	
Number of observations	1,002,081		756,312		245,769	

Notes: *Panel A*—In British Columbia, the initial salary reporting threshold of $50,000 was amended to $75,000 in 2002. * Alberta's threshold is adjusted to the province's consumer price index. There are no pay transparency laws in Prince Edward Island, Quebec, New Brunswick, or Saskatchewan that require universities to disclose non-executive salaries to the province or respond to freedom of information requests for non-anonymized faculty salaries. N/A = Not applicable. *Panel B*—Responsibilities are defined as appointments to senior administrative roles, including: dean; assistant, associate, or vice dean; director whose responsibility and salary is equivalent to dean; department head or coordinator; and chairperson. To control for outliers, observations with salaries below the 0.5th percentile or above the 99.5th percentile (in 2017 constant dollars) are dropped. The currency values are rounded to the nearest $50 and are expressed in 2017 constant dollars.
Source: Statistics Canada, University and College Academic Staff System, 1970 to 2017.

Table 2: Effect of Pay Transparency on the Average Wage and Gender Wage Gap

	Peer Group Specification			
	Institution and Department		Institution, Department and Rank	
	(1)	(2)	(3)	(4)
	Panel A: Effect on the Average Wage			
Treated	-0.014	-0.015	-0.025	-0.026
	(0.005)	(0.005)	(0.005)	(0.005)
R-squared	0.923	0.926	0.923	0.926
Number of Observations	982,543	948,691	982,543	948,691
Number of Clusters	1,262	1,239	1,262	1,239
Individual FEs	✓	✓	✓	✓
Province-Year FEs	✓	✓	✓	✓
Additional Controls		✓		✓
	Panel B: Effect on the Gender Wage Gap			
Treated	-0.014	-0.017	-0.025	-0.026
	(0.006)	(0.005)	(0.005)	(0.005)
Female × Treated	0.022	0.023	0.023	0.024
	(0.007)	(0.007)	(0.007)	(0.006)
R-squared	0.924	0.927	0.925	0.927
Number of Observations	982,543	948,691	982,543	948,691
Number of Clusters	1,262	1,239	1,262	1,239
Individual FEs	✓	✓	✓	✓
Province-Year-Gender FEs	✓	✓	✓	✓
Additional Controls		✓		✓

Notes: Additional controls include number of years since appointed to institution, years since highest degree obtained, and an indicator for having senior administrative responsibilities (see the notes in Table 1 for the list of senior responsibilities). Models are estimated using the Stata command 'reghdfe,' which calculates degrees of freedom lost due to FEs and iteratively removes singleton groups to avoid biasing standard errors. For the peer group specification by institution, department and rank, individuals compare themselves to peers as follows: (1) assistant professors compare themselves to assistant and associate professors; (2) associate professors compare themselves to all ranks; and (3) full professors compare themselves to associate and full professors. Standard errors (in parentheses) are clustered by institution and department. ✓ denotes included in the regression.
Source: Statistics Canada, University and College Academic Staff System, 1970 to 2017.

Table 3: Effects of Pay Transparency by Union Status

	Peer Group Specification			
	Institution and Department		Institution, Department and Rank	
	Unionized	Not Unionized	Unionized	Not Unionized
	(1)	(2)	(3)	(4)
	Panel A: Effect on the Average Wage			
Treated	-0.009	-0.008	-0.017	-0.030
	(0.006)	(0.007)	(0.006)	(0.008)
R-squared	0.926	0.936	0.926	0.936
Number of Observations	686,692	294,003	686,692	294,003
Number of Clusters	943	781	943	781
Individual FEs	✓	✓	✓	✓
Province-Year FEs	✓	✓	✓	✓
	Panel B: Effect on the Gender Wage Gap			
Treated	-0.013	-0.008	-0.021	-0.027
	(0.007)	(0.008)	(0.006)	(0.009)
Female × Treated	0.025	0.013	0.032	0.007
	(0.008)	(0.013)	(0.007)	(0.013)
R-squared	0.928	0.938	0.928	0.938
Number of Observations	686,692	293,992	686,692	293,992
Number of Clusters	943	781	943	781
Individual FEs	✓	✓	✓	✓
Province-Year-Gender FEs	✓	✓	✓	✓

Notes: Standard errors (in parentheses) are clustered by institution and department. Union status is assigned on a yearly basis. The number of clusters obtained by summing across the unionized and non-unionized regressions exceeds the total number reported in Table 2 because some institutions switched union status over the period of study. Most of these switches occurred during the 1970s and 1980s, well before the first pay transparency laws came into effect. See the notes in Table 2 for more information. ✓ denotes included in the regression.
Source: Statistics Canada, University and College Academic Staff System, 1970 to 2017.
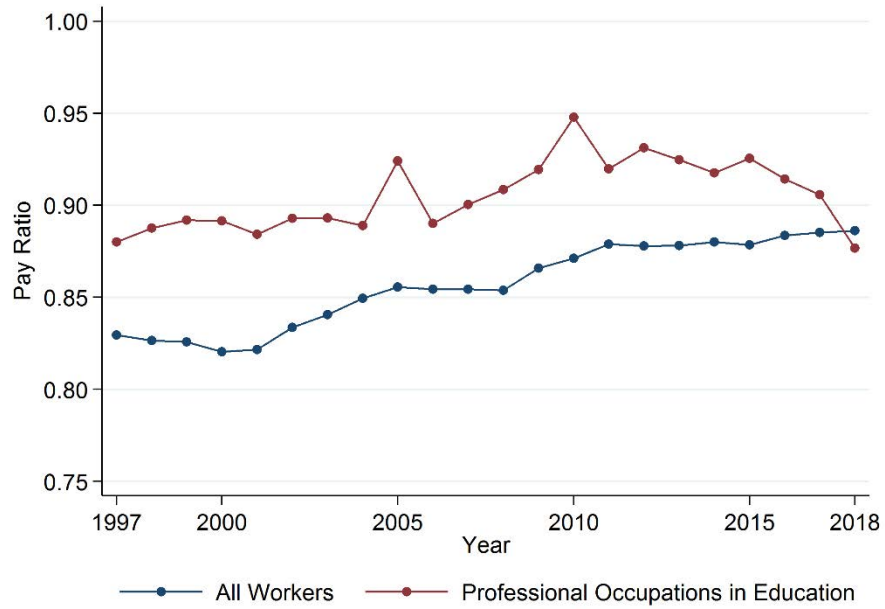
Figure A1: The Female-to-Male Wage Ratio for Full-Time Workers in the Canadian Labor Market by Year

Notes: The reported statistics are the ratios of average female hourly wages to average male hourly wages among full-time workers, in the indicated industries.
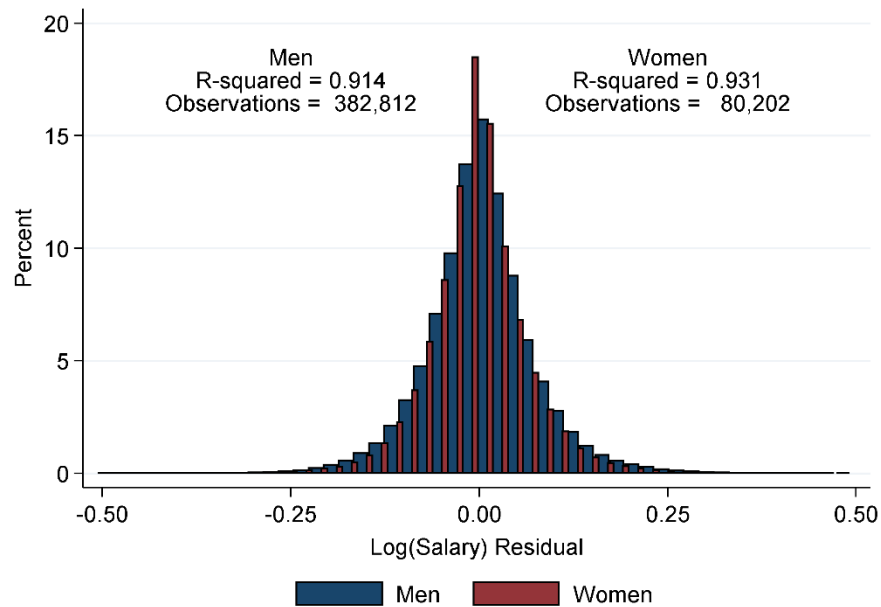**Source:** Statistics Canada.

Figure A2: Distribution of the Residuals from Salary Regressions, by Gender

Notes: The distributions are plotted of the residuals from regressions of the log of salary on fixed effects (FEs) for the interaction of institution, department, rank, years since appointed to institution, and year; and FEs for year of birth and highest educational attainment. Observations that are perfectly predicted by the FEs of the interaction variable are dropped. The analysis is carried out separately for men and women; the number of observations reported reflects the number after dropping all uniquely identified observations.
Source: Statistics Canada, University and College Academic Staff System, 1970 to 2017.

Table A1: Effects of Pay Transparency with Standard Errors Clustered by Institution

	Peer Group Specification			
	Institution and Department		Institution, Department and Rank	
	(1)	(2)	(3)	(4)
	Panel A: Effect on the Average Wage			
Treated	-0.014	-0.015	-0.025	-0.026
	(0.010)	(0.009)	(0.009)	(0.009)
R-squared	0.923	0.926	0.923	0.926
Number of Observations	982,543	948,691	982,543	948,691
Number of Clusters	56	55	56	55
Individual FEs	✓	✓	✓	✓
Province-Year FEs	✓	✓	✓	✓
Additional Controls		✓		✓
	Panel B: Effect on the Gender Wage Gap			
Treated	-0.014	-0.017	-0.025	-0.026
	(0.010)	(0.009)	(0.009)	(0.008)
Female × Treated	0.022	0.023	0.023	0.024
	(0.007)	(0.007)	(0.007)	(0.007)
R-squared	0.924	0.927	0.925	0.927
Number of Observations	982,543	948,691	982,543	948,691
Number of Clusters	56	55	56	55
Individual FEs	✓	✓	✓	✓
Province-Year-Gender FEs	✓	✓	✓	✓
Additional Controls		✓		✓

Notes: Standard errors (in parentheses) are clustered by institution. See the notes in Table 2 for more information. ✓ denotes included in the regression.
Source: Statistics Canada, University and College Academic Staff System, 1970 to 2017.

Table A2: Known Examples of Institutional Studies into Gender Pay Equity and Women's Pay Adjustments

	Year(s) of Study	Date of Pay Adjustment	Size of Adjustment
Western Ontario University	2005, 2009	N/A	N/A
University of British Columbia	2010	February 28, 2013	2.0%
University of Victoria	2014	Unknown	Unknown
McMaster University	2015	July 1, 2015	$3,515
Simon Fraser University	2015	September 3, 2016	1.7%
University of Waterloo	2016	September 1, 2016	$2,905
Wilfrid Laurier University	2017	22 June, 2017	3.0%
Guelph University	2018	June 1, 2018	$2,050
University of Toronto	2019	July 1, 2019	1.3%

Notes: At Simon Fraser University, a fund of $4.0 million was established to provide some retroactive compensation. The adjustment at University of British Columbia was retroactive to July 1, 2010. At Western Ontario University, a 'below-the-line' rather than across-the-board or group award was implemented; the salary adjustments were administered by the university's salary anomaly committee. The stated adjustment at Wilfred Laurier University was for associate professors, and for full professors it was 3.9%; those adjustments were retroactive to July 1, 2016.