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## Research Paper

## COVID-19 and gender disparities: Labour market outcomes

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## ABSTRACT

The study explores the effect of COVID-19 on labour market outcomes for women in the major urban areas in Canada. Using data from the Labour Force Statistics, we find the pandemic has had a disproportionately negative impact on the employment and income of women, worsening gender inequalities. Sectors more likely to employ women faced immense negative pressures, leading to dismal employment numbers. The effects of continued lockdowns and future potential inflation suggest that gender wage disparity continues to increase, worsening the economic health of women and making them even more vulnerable to future event risks.

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## 1. Introduction

The COVID-19 pandemic has profoundly impacted the global economy, displacing 20–25% of all jobs.<sup>1</sup> However, the effects have been uneven, affecting the most vulnerable and increasing societal inequalities (UN, 2020). A growing body of research indicates that the adverse effects were much more profound for frontline workers who were unlikely to transition to remote work along with those younger, women, unmarried, and with less education – leading to employment and wage disparities (Beland et al., 2020a, 2020b; Rojas et al., 2020; Yassenov, 2020). The pandemic severely affected specific sectors, such as accommodation, travel, and retail, which led to a profound reduction in employment along with an increase in wage disparity (Singh et al., 2022). These sectors predominantly employed part-time and female workers offering lower wages (Antonie et al., 2020). Due to these industries' rigidity and inflexibility in providing meaningful, reliable, and consistent remote work opportunities, women are more likely to be unable to find consistent employment because of pandemic-related disruptions (Singh et al., 2022).

Furthermore, the impact of the pandemic was much more disproportionate on female employment, as they left the labour market in more significant numbers than men because of job losses and familial responsibilities (Alon et al., 2020; Reichelt et al., 2021). These factors increased the employment gap and worsened gender pay equity<sup>2</sup> with a further decline in average female wages than their male counterparts (Blundell et al., 2020). Because of the evolving nature of the pandemic, there is a scarcity of studies that measure the pandemic's effect on labour market outcomes, particularly the gender

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inequities, which our study aims to fulfil. We use a logit model to estimate the effect of the pandemic on employment and labour wage outcomes in Canada. In particular, we answer the following research questions: *How did COVID-19 impact the employment and wage outcomes for women? Do they vary according to the industrial sectors?*

The motivation to study the pandemic's disproportionate effects is due to the immense welfare implications, particularly on the most vulnerable segments of the population. In addition, the study provides several contributions. First, to our knowledge, this is the first study that incorporates gender dynamics in addressing labour market outcomes and thus fills a critical research gap. Second, the results can facilitate informed policymaking to address gender imbalances in pay equity and employment access as the economy and labour market emerge from the pandemic. The insights can spark strategic conversations about potential interventions needed to change the current fiscal revenue tools and policy frameworks in the post-pandemic era.

The rest of the paper is organized as follows: [Section 2](#) focuses on reviewing relevant literature that shows the gap in research. [Section 3](#) describes the methodology, including data collection and statistical models. [Section 4](#) discusses the results, while [Section 5](#) presents our conclusions.

## 2. Literature review

The literature has consistently identified socioeconomic status as a critical driver of employment outcomes, including job status and remote work during the pandemic. We provide a brief literature review, starting with the theoretical framework of human capital investment that explains the disparity in gender-based labour outcomes. We then explore studies that focus on social factors behind the displacement of female employment. Finally, we discuss the evidence of societal inequalities perpetuated by the pandemic.

### 2.1. Human capital investment

Research in human capital investment can help shed light on the impacts of COVID-19 on employment and wage gaps. [Bowlus and Robinson \(2020\)](#) examine human capital investments across generations of females by considering three cohort effects: education, wage, and skill-based approaches. They find that past studies have failed to correctly analyse the evolution of women's human capital investment by limiting consideration of education and recommend a wage-based method of [Ben-Porath \(1967\)](#) with further refinements. In this framework, the post-schooling period becomes part of the analysis in determining the optimum life cycle of human capital accumulation. This approach includes other types of human capital and lessens the parametric assumption on the human capital production function ([Heckman et al., 1998](#); [Kuruscu, 2006](#)). [Bowlus and Robinson \(2012\)](#) allow for cohort effects mitigated by the ability of women to choose the school they attend. They find that the skill-based approach is opposite to the wage-based approach because it allows for a multidimensional skills portfolio of the same workers' skillset across all education groups. [Blundell et al. \(2020\)](#) argue that the pandemic's effect on education and childcare has negatively impacted the in-demand human capital skills investment for low-income female workers to upgrade their skill sets, particularly technology. This resulted in a significant hindrance in the elevation of women as the economy demanded more remote work and intensive use of digitized platforms requiring greater technical skills. Thus, investment in such human capital upgrades becomes ever more critical in addressing the gender wage and employment gaps.

### 2.2. Social factors

An extensive body of work investigates the social factors limiting female employment. [Reichelt et al. \(2021\)](#) address the social attitudes during the COVID-19 pandemic and find that the roles of 'mother' and 'caretaker' heavily influence decisions surrounding work and type of work. Women are more likely to prefer flexibility or part-time employment, positions typically found in the service industries. Besides, the authors note that with a scarcity of jobs, women leaving the workforce or seeking part-time work further intensifies gender disparities in the labour force. These trends are likely to be more prominent in larger urban areas like Toronto, with high childcare costs ([Moyser, 2017](#)). [Fortin \(2005\)](#) notes that since the mid-1990s, there have been considerable efforts to close the gender wage gap in OECD nations. However, a recent slowdown in narrowing the gap, likely caused by changing attitudes towards gender roles, supports studies such as [Clarke \(2001\)](#) and [O'Neil \(2003\)](#). [Fortin \(2005\)](#) also highlights discrimination in the labour market and women's attitudes towards work as implicit factors behind gender inequalities. For example, during scarcities of work, women are more likely to feel the need for men to keep their job status. Also, fewer women enter the workforce or hold full-time employment because of their preference for being a homemaker. In alignment with a desire to be a homemaker, 'mother's guilt' is also one factor in narrowing the gender wage gap. Fortin attributes education as a positive factor in improving women's attitudes towards work. With an increase in women enrolling in business schools, there have been some attitudinal shifts towards the desire to work.

### 2.3. COVID-19

The COVID-19 pandemic has accentuated adverse labour outcomes for women due to the requirement to work from home, reduced hours, and layoffs. [Reichelt et al. \(2021\)](#) argue that the employment losses led to women losing an egalitarian footing and pushed gender roles towards more traditional thinking, further perpetuating unemployment and wage gaps.

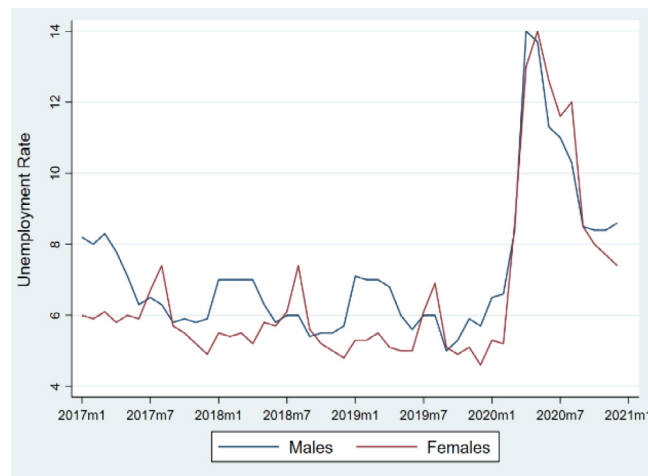
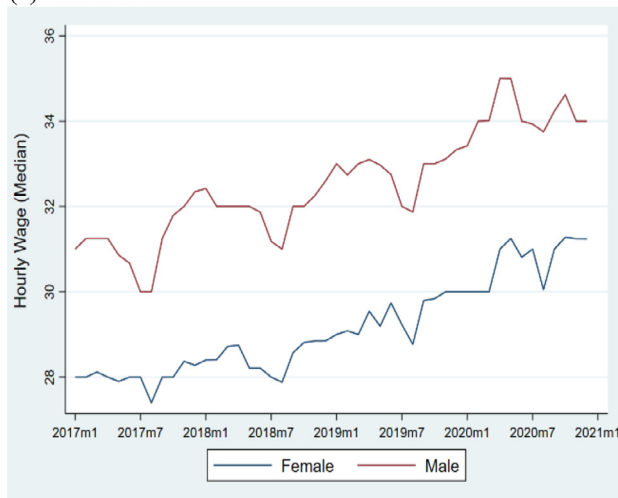


Fig. 1. Unemployment Rate in Canada by Gender. Source: LFS, Statistics Canada.

(a) Public sector



(b) Private sector

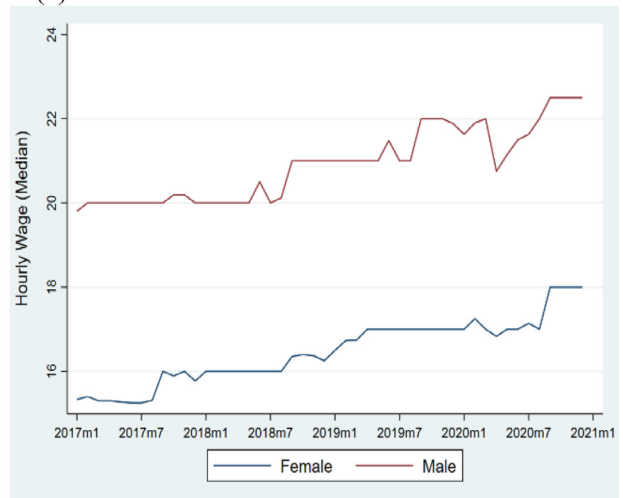


Fig. 2. Median hourly Wages in Canada. Source: LFS, Statistics Canada.

Gezici and Ozay (2020) support the findings and state that childcare and attitudes towards domestic duties were primary drivers for females leaving the workforce. Likewise, Colliver et al. (2021) surmise that mothers with young children were 4 to 5 times more likely to reduce their working hours in the US during the pandemic than males, leading to a wage gap increase of 20–50%. In a UK study, Oreffice and Quintana-Domeque (2020) find that females rate concerns about getting sick and virus spread along with childcare requirements higher than their male counterparts. Another discriminating factor is increased mental health issues amongst women during the pandemic (Pan et al., 2021). A study by Dang and Viet Nguyen (2021) identifies that the effects of COVID-19 on income, expenditures, savings, and job loss were more significant for women than men. Furthermore, with the loss of income and increased expenses, women were likely to be left with fewer savings and not as likely to sustain their lifestyles as men.

Several studies show that the private sector labour market faced much greater turbulence than the public sector (ILO, 2021; OECD, 2021). Past evidence shows that the public sector offers better job protection across gender, race, and educational characteristics during the recession (Groeneveld, 2011; Richwine and Biggs, 2011; Kopelman and Rosen, 2015; Korac et al., 2019). Another factor that helps to shield the economic fallouts in the public sector, unlike the private sector, is the availability of strong union and collective bargaining protection. A comparative study between Canada and the US labour market by Card et al. (2020) identifies that women benefit from a unionized work environment with better jobs and wage security. Mueller (1998) finds a significant wage premium for females in the Canadian public sector.

Similarly, Fuller (2005) finds that women enjoy much better protection in the provincial public sector in British Columbia – thus, a decline in employment in this sector harms the progress in reducing the gender wage gap. Other studies show the direct linkage between unionization and the reduction of the gender gap in labour outcomes (Doiron and Riddell, 1994;

Blau and Kahn, 2003; Misra and Murray-Close, 2014). Collective bargaining typically increases wages, employee retention, job security, time off, and access to childcare and healthcare (Jung et al., 2020).

While the literature points to a growing negative impact of the pandemic on women, there is a scarcity of a methodological approach to identify if they have suffered more than other groups and whether their vulnerability increased in specific industries. Our study differs from other studies in that we focus on the effects of COVID-19 and the gender wage and employment gaps while also identifying the outcomes in various industries.

### 3. Methodology

#### 3.1. Data collection

We use monthly data from the Canadian Labour Force Survey (CLFS)<sup>3</sup> for individuals aged 15 to 65 from January 2017 to December 2020. The aim of selecting this period is to capture the effects of the pre-pandemic and pandemic periods.

#### 3.2. COVID-19 and unemployment

We employ a logit model of Béland et al. (2020b) to examine the simultaneous effects of the pandemic on employment outcomes along with gender and all other regressors, termed Model 1:

$$Y_{it} = \alpha_i + \theta_{month} + \tau_{year} + \delta_{prov} + \beta_1 COV_{it} + \sum_{j=1}^4 \rho_j X_{ijt} + \sum_{j=1}^3 \lambda_j (COV_{it} \times X_{ijt}) + \varepsilon_{it} \dots \dots \dots (1)$$

Where

$Y$  is a binary variable = 1 if unemployed or 0 otherwise

$COV$  is a binary variable that denotes the COVID-19 pandemic = 1 if observation occurs during or after April 2020<sup>4</sup> or 0 otherwise

$X$  is a set of categorical variables:

$X_1$  = 1 if an individual has some post-secondary certificate or diploma, 2 if they have a bachelor's degree or above or 0 otherwise

$X_2$  = 0 if landed (immigrated) in Canada within the last 10 years, 1 if landed over 10 years ago or 2 if born in Canada

$X_3$  = 1 if women or 0 otherwise

$X_4$  = 1 if married/common law or 0 otherwise

$\theta_{month}$  and  $\tau_{year}$  refer to the time fixed effects for different months and years, respectively

$\delta_{prov}$  denotes the fixed effects for the provinces

$(COV_{it} \times X_{ijt})$  estimates the interaction effects to assess the simultaneous effects of COVID-19 and other independent variables (except for marital status).

#### 3.3. COVID-19 and hourly wages

The pandemic has had other negative consequences on the labour market, such as a lower hourly wage. To examine the direction and the size of this effect on hourly wages by gender, we use a similar model as Eq. (1) with some modifications, which we term Model 2. The unemployment variable is replaced with the employee's hourly wage in the equation. In this new model, the hourly wage is a continuous dependant variable, and for econometric purposes, we use log values. To estimate the models with or without interaction effects of COVID-19, we use an OLS method with the fixed month and year effects.

#### 3.4. COVID-19 and industries

While the pandemic negatively influenced overall female employment, the impacts have been more profound in some industries. To examine the most and least affected sectors by COVID-19 in Canada, we use a logit model, like Eq. (1), with some modifications. We add a new variable  $Ind_{ij}$ , which refers to the industry of the main job for the employed females. Model 3 is depicted as:

$$Y_{it} = \alpha_i + \theta_{month} + \tau_{year} + \delta_{prov} + \beta_1 COV_{it} + \beta_2 Ind_{it} + \lambda_{ci} (COV_{it} \times Ind_{ij}) + \sum_{j=1}^3 \rho_j X_{ijt} + \sum_{j=1}^2 \lambda_j (COV_{it} \times X_{ijt}) + \varepsilon_{it} \quad (2)$$

<sup>3</sup> Canadian Labor Force Survey: m1 2017-m12 2020. (n.d.). Statistics Canada. Retrieved April 13, 2021, from <https://www.statcan.gc.ca/eng/survey/household/3701>.

<sup>4</sup> We use April 2020 onward as the pandemic period based on the WHO declaring COVID-19 a pandemic on March 11, 2020, see <https://www.who.int/emergencies/diseases/novel-coronavirus-2019/events-as-they-happen>. Retrieved September 2, 2021.

**Table 1a**

The Impact of COVID-19 on Unemployment in Canada by Job Status.

Independent Variables	Full Time			Part-Time		
	Basic		Interactive Effects	Basic		Interactive Effects
	(1) Coefficients	(2) Coefficients		(4) Coefficients	(5) Coefficients	(6) Odds Ratio
Post-COVID	0.5809*** (0.0095)	0.4356*** (0.0085)	1.545*** (0.0232)	0.7697*** (0.0163)	0.6208*** (0.0260)	1.8804*** (0.0484)
Women	−0.2860*** (0.0070)	−0.3349*** (0.0085)	0.7153*** (0.0061)	−0.3475*** (0.0121)	−0.3999*** (0.0146)	0.6707*** (0.0098)
Education: Postsecondary	−0.3153*** (0.0075)	−0.3335*** (0.0090)	0.7163*** (0.0064)	−0.1560*** (0.0131)	−0.1908*** (0.0158)	0.8262*** (0.0131)
Bachelor & above	−0.8399*** (0.0102)	−0.8344*** (0.0124)	0.4340*** (0.0053)	−0.2452*** (0.0177)	−0.2503*** (0.0216)	0.7785*** (0.0168)
Immigrant Status: Landed less than 10 years ago	0.1811*** (0.0149)	0.0757*** (0.0185)	1.0787*** (0.0199)	0.1547*** (0.0234)	0.1552*** (0.0285)	1.1679*** (0.0333)
Landed over 10 years ago	−0.0404*** (0.0122)	−0.178*** (0.0154)	0.8369*** (0.0129)	0.0103 (0.0215)	−0.0208 (0.0270)	0.9793 (0.0265)
Married	−0.6075*** (0.0069)	−0.6075*** (0.0069)	0.5446*** (0.0037)	−0.5000*** (0.0130)	−0.5001*** (0.0146)	0.6064*** (0.0079)
Women × Post COVID		0.1567*** (0.0152)	1.1696*** (0.0178)		0.1599*** (0.0255)	0.6707*** (0.0098)
Post-Secondary × Post COVID		0.0610*** (0.0165)	1.0629*** (0.0175)		0.1079*** (0.0275)	1.1139*** (0.0306)
Bachelor & above × Post COVID		−0.0161 (0.0218)	0.9839 (0.0214)		0.0221 (0.0363)	1.0224 (0.0371)
Landed less than 10 years ago × Post COVID		0.3226*** (0.0310)	1.3808*** (0.0428)		0.0022 (0.0492)	1.0022 (0.0493)
Landed over 10 years ago × Post COVID		0.3977*** (0.0249)	1.4885*** (0.0371)		0.0871** (0.0441)	1.0910** (0.0481)
Observations	2127,953	2127,953	2127,953	481,825	481,825	481,825

Notes:

(1) Authors' calculations.

(2) Unemployment is a binary variable that equals 1 if an individual aged 16–65 years reported being unemployed or 0 otherwise.

(3) Post-COVID is a binary variable that equals 1 if the observation occurs during or after April 2020 or 0 otherwise.

(4) Education is a categorical variable that equals 1 if an individual has some post-secondary certificate or diploma, 2 if they have a bachelor's degree and above or 0 otherwise.

(5) Immigrant status is a categorical variable that equals 0 for individuals born in Canada, 1 for immigrants who landed over 10 years ago, and 2 for those who landed over ten years ago.

(6) Married is a binary variable that equals 1 if an individual is married or in a common-law relationship or 0 otherwise.

(7) All models contain fixed effects for months, years, and provinces.

(8) \*\*\* and \*\* refer to significance levels of 1% and 5%, respectively.

(9) Standard errors are depicted in brackets.

(10) Columns (1) and (4) display results without the interactive effects, whereas columns (2), (3), (5) and (6) include the interactive effects.

Where,

 $Y$  is a binary variable = 1 if women are unemployed or 0 otherwise $COV$  is a binary variable that denotes the COVID-19 pandemic = 1 if observation occurs during or after April 2020 or 0 otherwise $X$  is a set of categorical variables: $X_1 = 1$  if an individual has some post-secondary certificate or diploma, 2 if they have a bachelor's degree or above or 0 otherwise $X_2 = 0$  if landed (immigrated) in Canada within the last 10 years, 1 if landed over 10 years ago or 2 if born in Canada $X_3 = 1$  if married/common law or 0 otherwise $Ind_{ij}$  refers to the industries of the main job for the employed women.<sup>5</sup> $(COV_{it} \times Ind_{ij})$  refers to the interactive effects of the COVID-19 pandemic with the level of education and immigrant status $\theta_{month}$  and  $\tau_{year}$  refer to the time fixed effects for different months and years, respectively.

<sup>5</sup> Industries are 1: Construction; 2: Manufacturing – durable goods; 3: Manufacturing – nondurable goods; 4: Wholesale trade; 5: Retail trade; 6: Transportation and warehousing; 7: Finance and insurance; 8: Real estate and rental and leasing; 9: Professional, scientific and technical services; 10: Business, building and other support services; 11: Educational services; 12: Health care and social assistance; 13: Information, culture and recreation; 14: Accommodation and food services; 15: Other services (except public administration); 16: Public administration.

**Table 1b**

The Impact of COVID-19 on Unemployment in Canada by Public and Private Sectors.

Independent Variables	Public Sector			Private Sector		
	Basic	Interactive Effects		Basic	Interactive Effects	
	(1) Coefficients	(2) Coefficients	(3) Odds Ratio	(4) Coefficients	(5) Coefficients	(6) Odds Ratio
Post-COVID	0.4774*** (0.0219)	0.4335*** (0.0445)	1.5427*** (0.0686)	0.6561*** (0.0089)	0.4769*** (0.0136)	1.6111*** (0.0220)
Women	−0.0694*** (0.0166)	−0.1057*** (0.0199)	0.8996*** (0.0179)	−0.2534*** (0.0065)	−0.3214*** (0.0079)	0.7251*** (0.0057)
Education:						
Postsecondary	−0.5553*** (0.0208)	−0.5470*** (0.0249)	0.5786*** (0.0144)	−0.2138*** (0.0069)	−0.2397*** (0.0082)	0.7868*** (0.0065)
Bachelor & above	−0.8129*** (0.0217)	−0.7817*** (0.0260)	0.4575*** (0.0118)	−0.5557*** (0.0102)	−0.5599*** (0.0125)	0.5712*** (0.0071)
Immigrant Status:						
Landed less than 10 years ago	0.3292*** (0.0386)	0.3282*** (0.0648)	1.3886*** (0.0650)	0.0749*** (0.0134)	−0.0087 (0.0166)	0.9913 (0.0165)
Landed over 10 years ago	−0.0191 (0.021)	−0.0847** (0.021)	0.9187** (0.0336)	−0.0419*** (0.0115)	−0.1593*** (0.0146)	0.8526*** (0.0124)
Married	−0.6376*** (0.0161)	−0.6375*** (0.0161)	0.5285*** (0.0085)	−0.5271*** (0.0064)	−0.5271*** (0.0064)	0.5902*** (0.0038)
Women × Post COVID		0.1188*** (0.0362)	1.1262*** (0.0408)		0.2146*** (0.0139)	0.7251*** (0.0057)
Post-Secondary × Post COVID		−0.0303 (0.0452)	0.9701 (0.0438)		0.0857*** (0.0149)	1.0895*** (0.0163)
Bachelor & above × Post COVID		−0.1023** (0.0469)	0.9026*** (0.0423)		0.0152 (0.0214)	1.0153 (0.0217)
Landed less than 10 years ago × Post COVID		0.0007 (0.0822)	1.3808 (1.0007)		0.2557*** (0.0279)	1.2914*** (0.0361)
Landed over 10 years ago × Post COVID		0.1984*** (0.0615)	1.2195*** (0.0750)		0.3322*** (0.0235)	1.3941*** (0.0328)
Observations	612,513	612,513	612,513	1827,981	1827,981	1827,981

Notes:

(1) Authors' calculations.

(2) Unemployment is a binary variable that equals 1 if an individual aged 16–65 years reported being unemployed or 0 otherwise.

(3) Post-COVID is a binary variable that equals 1 if the observation occurs during or after April 2020, or 0 otherwise.

(4) Education is a categorical variable that equals 1 if an individual has some post-secondary certificate or diploma, 2 if they have a bachelor's degree and above or 0 otherwise.

(5) Immigrant status is a categorical variable that equals 0 for individuals born in Canada, 1 for immigrants who landed less than 10 years ago, and 2 for those who landed over ten years ago.

(6) Married is a binary variable that equals 1 if an individual is married or in a common-law relationship or 0 otherwise.

(7) All models contain fixed effects for months, years, and provinces.

(8) \*\*\* and \*\* refer to significance levels of 1% and 5%, respectively.

(9) Standard errors are depicted in brackets.

(10) Columns (1) and (4) display results without the interactive effects, whereas columns (2), (3), (5) and (6) include the interactive effects by multiplying COVID-19 with other independent variables (two-way interaction).

 $\delta_{prov}$  denotes the fixed effects for the provinces

## 4. Results

We first present a descriptive analysis showing gender disparity in the Canadian labour market. Using the first model, we apply a logit regression to compare the impacts of COVID-19 on various groups. The aim is to compare the intensity of the adverse effects on female versus male employment. Then, we examine the adversity on the difference in earnings between women and men in the labour market by estimating an ordinary least square regression model in the second model. Lastly, in the third model, we examine the effects on various industries that employ females. We also filter our data based on public and private sectors and full-time versus part-time.

### 4.1. Descriptive analysis

Canada suffered a 15% decrease in employment and a 32% decline in the aggregate number of weekly hours worked by employees ages 20–64, with the lowest-earning quartile suffering the most (Lemieux et al., 2020). An analysis of the labour market in Canada shows females fared better than males in the pre-pandemic period; the situation changed during the pandemic (Fig. 1). While the unemployment rate increased rapidly at the onset of the pandemic, it mostly remained



**Table 2**

The Impacts of COVID-19 on Wages in Canada by Job Status.

	Full Time		Part-Time	
	(1) Basic	(2) Interactive Effects	(3) Basic	(4) Interactive Effects
	Coefficients	Coefficients	Coefficients	Coefficients
Post-COVID	−0.1136*** (0.0057)	−0.1854*** (0.0108)	−0.4612*** (0.0129)	−0.4397*** (0.0240)
Women	0.4213*** (0.0039)	0.4346*** (0.0045)	0.5782*** (0.0096)	0.5774*** (0.0109)
Education:				
Postsecondary	0.3036*** (0.0048)	0.2872*** (0.0054)	−0.0972*** (0.0100)	−0.0973*** (0.0113)
Bachelor & above	0.5957*** (0.0054)	0.5373*** (0.0061)	−0.1752*** (0.0127)	−0.1702*** (0.01435)
Immigrant Status:				
Landed less than 10 years ago	−0.1835*** (0.0083)	−0.1592*** (0.0094)	0.2603*** (0.0182)	0.2719*** (0.0205)
Landed over 10 years ago	−0.4484*** (0.0063)	−0.4319*** (0.0072)	−0.3212*** (0.0155)	−0.2869*** (0.0177)
Married	−0.0688*** (0.0042)	−0.0688*** (0.0042)	−0.6921*** (0.0093)	−0.6920*** (0.0093)
Women × Post COVID		−0.0619*** (0.0152)		0.0022 (0.0231)
Post-Secondary × Post COVID		0.0814*** (0.0118)		0.0003 (0.0243)
Bachelor & above × Post COVID		0.2640*** (0.0130)		−0.0227 (0.0298)
Landed less than 10 years ago × Post COVID		−0.1103*** (0.0200)		−0.0545 (0.0437)
Landed over 10 years ago × Post COVID		−0.0741*** (0.0150)		−0.1469* (0.0364)
Observations	2127,953	2127,953	481,825	481,825

Notes:

(1) Authors' calculations.

(2) All regressions are estimated using OLS and contain fixed effects for months, years, and provinces.

(3) Hourly wage is a continuous variable that includes an employee's hourly wage in the public or private sector.

(4) Post-COVID is a binary variable that equals 1 if the observation occurs during or after April 2020 or 0 otherwise.

(5) Education is a categorical variable that equals 1 if an individual has some post-secondary certificate or diploma, 2 if they have a bachelor's degree and above or 0 otherwise.

(6) Immigrant status is a categorical variable that equals 0 for individuals born in Canada, 1 for immigrants who landed less than 10 years ago, and 2 for those who landed over ten years ago.

(7) Married is a binary variable that equals 1 if an individual is married or in a common-law relationship or 0 otherwise.

(8) \*\*\* and \* refer to 1% and 10% significance levels, respectively.

(9) Standard errors are depicted in brackets.

higher for females than males. However, the situation changed since the pandemic's beginning (March 2020), with women faring worse than men. The gender wage disparity shows a similar story, with females consistently earning less than males, with the gap being more profound in private compared to the public sector (Fig. 2). The gap persisted and rose during the pandemic, with the wages remaining flat for both sectors.

#### 4.2. COVID-19 and unemployment

Model 1, as displayed by Eq. (1), estimates the determinant of unemployment. Table 1a shows the results by classifying the job status as full-time versus part-time, while Table 1b segregates the data according to the public and private sectors. We also estimate the results with (columns 2, 3, 5 and 6) and without the interactive effects (columns 1 and 4). Estimating the basic model enables us to assess the robustness – to see if the results from the model with interactive effects contradict the results of the basic model.

The results without interaction terms show that COVID-19 has a positive and significant effect on unemployment for those employed in part-time and full-time jobs; however, the impact was greater for the former than for the latter (Table 1a). With positive coefficients, the prevalence of COVID-19 increases the odds<sup>6</sup> of being unemployed for those working full-time by 1.78 and those part-time by 2.16 times compared to the pre-pandemic period. To better understand the effect

<sup>6</sup> The odds ratio is calculated as:  $e^{0.5809}=1.7876$  (full-time) and  $e^{0.7697}=2.1591$  (part-time).



**Table 3**

The Impacts of COVID-19 on Wages in Canada by Sector.

	Public Sector		Private Sector	
	(1)	(2)	(3)	(4)
	Basic	Interactive Effects	Basic	Interactive Effects
	Coefficients	Coefficients	Coefficients	Coefficients
Post-COVID	−0.0671*** (0.0048)	−0.1507*** (0.0129)	−0.2870*** (0.0054)	−0.2725*** (0.0101)
Women	−0.0815*** (0.0036)	−0.0761*** (0.0041)	−0.2370*** (0.0040)	−0.2176*** (0.0045)
Education:				
Postsecondary	0.3198*** (0.0054)	0.0300*** (0.0061)	0.1393*** (0.0045)	0.1335*** (0.0051)
Bachelor & above	0.6110*** (0.0054)	0.5797*** (0.0061)	0.2549*** (0.0057)	0.2204*** (0.0065)
Immigrant Status:				
Landed less than 10 years ago	−0.2971*** (0.0088)	−0.2919*** (0.0101)	0.0160** (0.0079)	0.0404*** (0.0090)
Landed over 10 years ago	−0.0494*** (0.0059)	−0.0404*** (0.0067)	−0.1451*** (0.0066)	−0.1231*** (0.0074)
Married	0.2735*** (0.0037)	0.2733*** (0.0037)	0.1494*** (0.0041)	0.1495*** (0.0041)
Women × Post COVID		−0.0243*** (0.0085)		−0.0903*** (0.0097)
Post-Secondary × Post COVID		0.0910*** (0.0131)		0.0287** (0.0111)
Bachelor & above × Post COVID		0.1432*** (0.0130)		0.1536*** (0.0137)
Landed less than 10 years ago × Post COVID		−0.0210 (0.0206)		−0.1123*** (0.0192)
Landed over 10 years ago × Post COVID		−0.0388*** (0.0138)		−0.0975*** (0.0115)
Observations	612,513	612,513	1827,981	1827,981

Notes:

(1) Authors' calculations.

(2) All regressions are estimated using OLS and contain fixed effects for months, years, and provinces.

(3) Hourly wage is a continuous variable that includes an employee's hourly wage in the public or private sector.

(4) Post-COVID is a binary variable that equals 1 if the observation occurs during or after April 2020 or 0 otherwise.

(5) Education is a categorical variable that equals 1 if an individual has some post-secondary certificate or diploma, 2 if they have a bachelor's degree and above or 0 otherwise.

(6) Immigrant status is a categorical variable that equals 0 for individuals born in Canada, 1 for immigrants who landed less than 10 years ago, and 2 for those who landed over ten years ago.

(7) Married is a binary variable that equals 1 if an individual is married or in a common-law relationship or 0 otherwise.

(8) \*\*\* and \*\* refer to significance levels of 1% and 5%, respectively.

(9) Standard errors are depicted in brackets.

of the pandemic on full-time jobs, we estimate the interactive effects of COVID-19 and the independent variables. Like the basic model, COVID-19 has a positive and significant impact on the probability of being unemployed with interactive effects (Table 1a). In addition, column 2 indicates that the likelihood of being unemployed during the pandemic was 1.69 and 1.17 times higher for females than males for those employed full-time and part-time, respectively.<sup>7</sup>

The public and private sectors depict some significant differences in the impact of the pandemic on the labour market (Table 1b). Columns 1 and 4 show that the probability of being unemployed during COVID-19 was higher in the private (odds 1.61 times) than in the public sector (odds 1.93 times). The private sector also offered worse outcomes for female workers compared to the public sector – the interactive effects (columns 3 and 6) show that they faced higher odds of being unemployed in private compared to the public sector.

#### 4.3. COVID-19 and wages

Given that we are interested in studying the combined effects of the pandemic with other variables, a model with interaction effects is used. We estimate the magnitude and the difference of the impact of the pandemic on hourly wages by gender by classifying them into full-time and part-time job status (Table 2) and by public and private sector employment (Table 3). The results in Table 2 depict that the pandemic had a much more negative impact on wages for those working part-time (−0.4612) than those in a full-time capacity (−0.1136). The full-time hourly wages declined by 12% compared to

<sup>7</sup> Given the focus is on women workers, we do not discuss the other variables.

**Table 4**  
COVID-19 and Female Unemployment by Industry and Job Status.

	Full Time			Part-Time		
	Basic	Interactive Effects		Basic	Interactive Effects	
	(1) Coefficients	(2) Coefficients	(3) Odds Ratio	(4) Coefficients	(5) Coefficients	(6) Odds Ratio
Post-COVID	0.6859*** (0.0152)	0.4057*** (0.0588)	1.5004*** (0.0882)	0.8513*** (0.0213)	0.4069*** (0.1394)	1.5022*** (0.2094)
Education:						
Postsecondary	−0.1828*** (0.0131)	−0.1831*** (0.0131)	0.8326*** (0.0109)	−0.1118*** (0.0175)	−0.1140*** (0.0175)	0.8922*** (0.0156)
Bachelor & above	−0.6386*** (0.0166)	−0.6387*** (0.0166)	0.5279*** (0.0088)	−0.3362*** (0.0236)	−0.3395*** (0.0236)	0.7120*** (0.0168)
Immigrant Status:						
Landed less than 10 years ago	0.1903*** (0.0230)	0.1954*** (0.0230)	1.2158*** (0.0280)	0.2301*** (0.0304)	0.2319*** (0.0305)	1.2610*** (0.0384)
Landed over 10 years ago	−0.0006 (0.0188)	−0.0021 (0.0188)	0.9978 (0.0187)	0.0121 (0.0276)	0.0070 (0.0276)	1.0070 (0.0278)
Manufacturing - durable goods	−0.5370*** (0.0412)	−0.6745*** (0.0502)	0.5094*** (0.0256)	0.1749 (0.1331)	−0.1748 (0.1738)	0.8395 (0.1459)
Manufacturing - nondurable good	−0.2014*** (0.0337)	−0.1886*** (0.0393)	0.8280*** (0.0326)	0.6038*** (0.0893)	0.5070*** (0.1070)	1.660*** (0.1776)
Wholesale trade	−0.6535*** (0.0444)	−0.7512*** (0.0538)	0.4717*** (0.0254)	−0.1272 (0.1171)	−0.3503** (0.1456)	0.7044** (0.1026)
Retail trade	−0.6410*** (0.0300)	−0.7348*** (0.0355)	0.4795*** (0.0170)	0.2474*** (0.0666)	0.1341* (0.0800)	1.1435* (0.0915)
Transportation and warehousing	−0.5720*** (0.0404)	−0.7077*** (0.0493)	0.4927*** (0.0243)	0.4272*** (0.0785)	0.2956*** (0.0948)	1.3440*** (0.1274)
Finance and insurance	−1.4787*** (0.0423)	−1.4392*** (0.0496)	0.2371*** (0.0117)	−0.5728*** (0.1036)	−0.5672*** (0.1204)	0.5670*** (0.0682)
Real estate and rental and leasing	−0.7337*** (0.0525)	−0.7889*** (0.0627)	0.4543*** (0.0284)	−0.2132** (0.1058)	−0.5361*** (0.1362)	0.5849*** (0.0796)
Professional, scientific, and technical services	−0.6635*** (0.0344)	−0.6828*** (0.0407)	0.5051*** (0.0205)	−0.1543** (0.0785)	−0.3530*** (0.0967)	0.7025*** (0.0679)
Business, building and other support services	−0.2092*** (0.0352)	−0.2781*** (0.0414)	0.7571*** (0.0313)	0.2088*** (0.0742)	0.1846** (0.0888)	1.2028** (0.1068)
Educational services	−0.5601*** (0.0311)	−0.5671*** (0.0365)	0.0567*** (0.0207)	0.6475*** (0.0679)	0.5132*** (0.0816)	1.6707*** (0.1363)
Health care and social assistance	−1.4612*** (0.03028)	−1.5631*** (0.0359)	0.2094*** (0.0075)	−0.3171*** (0.0681)	−0.4530*** (0.0820)	0.6356*** (0.0521)
Information, culture and recreation	0.0094 (0.0343)	−0.1261*** (0.0409)	0.8814*** (0.0361)	0.6820*** (0.0703)	0.3548*** (0.0854)	1.4260*** (0.1218)
Accommodation and food services	−0.01915 (0.0302)	−0.2152*** (0.0356)	0.8063*** (0.0287)	0.5859*** (0.0668)	0.3697*** (0.0803)	1.4474*** (0.1162)
Other services (except public administration)	−0.6796*** (0.0362)	−0.8607*** (0.0442)	0.4228*** (0.0186)	0.0179 (0.0731)	−0.1884** (0.0888)	0.8282** (0.0735)
Public administration	−1.2870*** (0.0367)	−1.2958*** (0.0434)	0.2736*** (0.0118)	0.5597*** (0.0830)	0.5604*** (0.0985)	1.7515*** (0.1725)
Manufacturing - durable goods × COVID		0.4416*** (0.0882)	1.5552*** (0.1373)		0.9465*** (0.2746)	2.5767*** (0.7076)
Manufacturing - nondurable goods × COVID		−0.0327 (0.0750)	0.9677 (0.0726)		0.2512 (0.1928)	1.2856 (0.2478)
Wholesale trade × COVID		0.3276*** (0.0956)	1.3876*** (0.0327)		0.6306*** (0.2457)	1.8788*** (0.4617)
Retail trade × COVID		0.3171*** (0.0665)	1.3732*** (0.0913)		0.3076** (0.1430)	1.3602** (0.1946)
Transportation and warehousing × COVID		0.4360*** (0.0870)	1.5465*** (0.1346)		0.3658** (0.1682)	1.4417** (0.2426)
Finance and insurance × COVID		−0.1022 (0.0945)	0.9028 (0.0853)		−0.1377 (0.2376)	0.8713 (0.2070)
Real estate and rental and leasing × COVID		0.1974* (0.1144)	1.2182* (0.1394)		0.8687*** (0.2192)	2.3839*** (0.5227)
Professional, scientific, and technical services × COVID		0.0947 (0.0754)	1.0993 (0.0829)		0.5500*** (0.1657)	1.7333*** (0.2873)
Business, building and other support services × COVID		0.2365*** (0.0783)	1.2668*** (0.0992)		0.0294 (0.1606)	1.0298 (0.1654)
Educational services × COVID		0.0589 (0.0678)	1.0607 (0.0719)		0.3770*** (0.1450)	1.4580*** (0.2115)

(continued on next page)

Table 4 (continued)

	Full Time			Part-Time		
	Basic	Interactive Effects		Basic	Interactive Effects	
	(1) Coefficients	(2) Coefficients	(3) Odds Ratio	(4) Coefficients	(5) Coefficients	(6) Odds Ratio
Health care and social assistance × COVID		0.3369*** (0.0663)	1.4006*** (0.0929)		0.3838*** (0.1458)	1.4679*** (0.2140)
Information, culture, and recreation × COVID		0.4473*** (0.0750)	1.5642*** (0.1174)		0.9399*** (0.1503)	2.5598*** (0.3849)
Accommodation and food services × COVID		0.6598*** (0.0666)	1.9344*** (0.1289)		0.6222*** (0.1431)	1.8631*** (0.2667)
Other services (except public administration) × COVID		0.5623*** (0.0781)	1.7548*** (0.1371)		0.5808*** (0.1560)	1.7874*** (0.2789)
Public administration × COVID		0.0598 (0.0806)	1.0616 (0.0856)		−0.0596 (0.1810)	0.9421 (0.1705)
Observations	979,419	979,419	979,419	327,960	327,960	327,960

Notes:

(1) Authors' calculations.

(2) All regressions are estimated using OLS and contain fixed effects for months, years, and provinces.

(3) Post-COVID is a binary variable that equals 1 if the observation occurs during or after April 2020 or 0 otherwise.

(4) Education is a categorical variable that equals 1 if an individual has some post-secondary certificate or diploma, 2 if they have a bachelor's degree and above or 0 otherwise.

(5) Immigrant status is a categorical variable that equals 0 for individuals born in Canada, 1 for immigrants who landed less than 10 years ago, and 2 for those who landed over ten years ago.

(6) Married is a binary variable that equals 1 if an individual is married or in a common-law relationship or 0 otherwise.

(7) \*\*\*.

\*\* and \* refer to significance levels of 1%, 5% and 10%, respectively.

(8) Standard errors are depicted in brackets.

59% for part-time employees.<sup>8</sup> The interactive effects show that full-time female workers saw a decline in hourly wages, with the gender gap in this job category increasing by 6%. Notably, while there was no impact on part-time wages, research show that the gender pay gap in Canada was much more profound in full-time than part-time jobs in the pre-pandemic period (Antonie et al., 2020). Thus, the negative effect on the full-time female jobs worsened the already prevailing gender wage gap. It is interesting to note that the pandemic has an unequal impact on sectoral wages. For example, sectors such as technology and education services, which usually offer full-time, well-paying jobs, benefited from higher wages due to higher demand during the pandemic.<sup>9</sup> The impact of COVID-19 as an interaction variable substantiates the gender wage disparity, with women receiving 2% lower wages in the public sector compared to 9% in the private sector.<sup>10</sup>

The results for unemployment and wages indicate that while women generally faced gender disparity extenuated by the pandemic, the impact was much more severe in the private sector. A likely reason for the minimal effect on the public sector is the prevalence of stronger union and collective bargaining agreements and more full-time jobs that faced the lesser brunt of the pandemic compared to the part-time jobs.

#### 4.4. COVID-19 and female unemployment by industries

The pandemic brought severe contractions in most economic sectors and industries; however, some industries faced greater upheaval than others, as shown by Model 3 (Table 4). The finding with interaction effects of COVID-19 and industries for full-time jobs implies that accommodation and food services, other services (except public administration), information, culture and recreation, manufacturing and durable goods, and transportation and warehousing were the hardest-hit industries. In addition, health care and social assistance, wholesale trade, retail trade, business, building and other support services also saw an adverse impact on their labour market outcomes. Although most industries faced difficulties, a few thrived. For instance, finance and insurance and manufacturing - nondurable goods report a positive result (the odds ratio below 1); however, the coefficients are statistically insignificant. Part-time jobs also responded negatively to the pandemic. Real estate and rental and leasing, wholesale trade, accommodation and food services, other services (except public administration), and professional, scientific, and technical services were the topmost affected industries. In addition, adverse job market outcomes for health care and social assistance and educational services were evident. However, finance and insurance and the manufacturing of nondurable goods jobs remained unaffected by the pandemic.

<sup>8</sup> Changes in full-time hourly wage =  $e^{0.1136} - 1 = 0.12$ ; part-time hourly wage =  $e^{0.4612} - 1 = 0.59$ .

<sup>9</sup> Economic impacts and recovery related to the pandemic (2020). Statistics Canada. Retrieved on April 22, 2021 from, <https://www150.statcan.gc.ca/n1/en/pub/11-631-x/2020004/s5-eng.htm>.

<sup>10</sup> Changes in female hourly wage in public sector =  $e^{0.0243} - 1 = 0.02$ ; private sector =  $e^{0.0903} - 1 = 0.09$ .

These results are concerning, as data show that from 2020 to 2021, while approximately 250,000 jobs were added to the highest wage quartile, 740,000 jobs were lost at the bottom of the wage quartile, with a net loss of 22% in employment for those earning minimum wage (Lundy, 2021). Most of the job losses were in the accommodation, food and retail sectors that employ more females, immigrants and those with lower education. Investments in human capital, such as education and skill development, are needed to offset these deficits. It is also worth noting that vulnerable sectors such as accommodation and food have low union participation rates (e.g., 4.6%), the second-lowest amongst all industries in Canada in 2020.<sup>11</sup> With low levels of unionization, workers in these sectors are more vulnerable to joblessness, layoffs, and low wages.

## 5. Conclusion

The COVID-19 pandemic has disproportionately affected our society's most vulnerable population groups. In particular, the labour market for women faced a severe downturn, increasing the gender disparity that was evident even before the pandemic. Our logit model results validate this observation, showing an adverse impact of the pandemic on labour market outcomes, particularly gender disparities in employment and wages. The effects of lockdowns and potential inflation indicate that the gender wage disparity will continue to increase, worsening the economic health of women and making them even more vulnerable to future event risks. The worsening of the gender wage gap is troubling as studies before the pandemic showed some progress to bridge this disadvantage for females in the labour market, especially in full-time jobs (Antonie et al., 2020).

Regarding policy implications, the pandemic has increased challenges in tackling the complex issue of adverse gender labour market outcomes. However, several policy measures can assist. Targeted relief to the most vulnerable sectors and a significant source of employment for women, such as accommodation, hospitality, and retail, can help revive the growth in these sectors. The benefit of labour unions with collective agreements is demonstrated by the public sector escaping the negative impact of the pandemic. Thus, worker union and collective bargaining protection can help mitigate and address why women leave the workforce (for example, childcare and time off) to manage domestic responsibilities. However, the solution to this issue is not just increasing public sector positions but ensuring the protection of workers' rights across sectors. While federal pay equity legislation in Canada aims to provide such wage equity rights, they mainly apply to federally regulated organizations (Schirle and Sogaulo, 2020). Also, these legislations cannot address the inequities within organizations or across industries, mainly within the private sector (Baker and Fortin, 2004; Mikulic and Stefanic, 2018; Fortin, 2019). Improving the conditions at firm levels can address this gap. Policies such as subsidized child and elder care can address inequities such as lower labour force participation and a lower intake of hours of work (Paitnaik, 2019). Several studies point to a general increase in technology adoption across industrial sectors (Shestakofsky, 2017; Lichtenthaler, 2019). The pandemic has also accelerated the creation and adoption of emerging technologies related to big cloud, robotics, artificial intelligence and blockchain (Chernoff and Warman, 2020; Rymarczyk, 2020). Recent evidence also shows that technological advancement can benefit women by reducing the gender wage gap, particularly in jobs requiring technical skills (Cortes et al., 2020). Thus, improving human capital to prepare for the post-pandemic economy and focusing on active collective bargaining can ease the deteriorating gender dynamics in the labour market.

## Availability of data

Publicly available datasets were analysed in this study. The data can be found here: <https://www150.statcan.gc.ca/n1/pub/11-625-x/11-625-x2010000-eng.htm>.

## Declaration of Competing Interest

None.

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## Author Contributions

Conceptualization, V.S.; methodology, H.S. and V.S.; software, H.S.; validation, H.S.; formal analysis, V.S., H.S. and J.T.; investigation, V.S.; resources, V.S.; data curation, V.S. and H.S.; writing—original draft preparation, V.S.; writing—V.S., J.T., H.S. and review and editing, V.S. and J.T.; visualization, H.S.; supervision, V.S.; project administration, V.S.; funding acquisition, V.S. All authors have read and agreed to the published version of the manuscript (Vikram Singh – V.S.; Jessica Turetken – J.T.; Homayoun Shirazi – H.S.).

<sup>11</sup> Union Status by Industry: Table: 14-10-0132-01. (n.d.). Statistics Canada: Retrieved April 13, 2021, from <https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1410013201>.

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