PARETO

Undergraduate Journal of New Economists

University of Toronto Mississauga

Title:	Jobs During the Pandemic: Re-Evaluating the Importance of Being 'Essential'
Author:	Nina Zi Wei Low
Source:	*PARETO: Undergraduate Journal of New Economists*, Vol. 2, Winter 2024
Published By:	Department of Economics, University of Toronto Mississauga
Stable URL:	https://doi.org/10.33137/pugj.v2i1.44734

Economics
UNIVERSITY OF TORONTO
MISSISSAUGA

Jobs During the Pandemic: Re-Evaluating the Importance of Teleworkability, Contact-Intensity, and Being 'Essential'

By Nina Zi Wei Low

This paper investigates the shock to labour demand from the government's large-scale emergency policy response to COVID-19. A primary goal being to identify which occupational characteristics elicit significant responses to COVID-19 policy. A secondary goal was to evaluate the allocation efficiency of federal business assistance programs during COVID-19. This paper utilizes high-frequency Canadian online job postings data provided by the Labour Market Information Council (LMIC) in a Random Effects regression framework. This paper finds that occupations classified as teleworkable or essential experienced a decrease in labour demand during the pandemic. This non-intuitive result could be attributable to the assumption that COVID-19 and its policies only influence labour demand changes from a business feasibility perspective.

***Keywords**: Recessions, Labor market, Job loss, Furlough, Short-time work, Coronavirus, Covid-19, Working from home, Teleworkable, Contact-Intensive, Occupational Characteristics, Business feasibility*

***DOI**: https://doi.org/10.33137/pugj.v2i1.44734*

I. Introduction & Conceptual Framework

At the start of this decade COVID-19 swept across the globe bringing profound and uneven changes to the composition of the labor market in its wake. In response to the COVID-19 pandemic the Canadian unemployment rate rose to its peak of 13.4% on May 2020, and was above the typical 6.0% for 21 consecutive months.[1] The strong contractions in the labor force and high unemployment rate could be attributed to the government's attempt to 'flatten the curve' and reduce virus transmission. The strictly enforced social and physical distancing policies accompanied by the shut-down of non-essential businesses seriously inhibited business activity. As a result, some occupations, and the populations involved in those occupations, were relatively more sheltered by job and earning loss compared to others.

On March 10th 2020, the Canadian government followed the World Health Organization's recommendations for businesses to transition to a work-from-home model. The encouragement of remote work, and a more socially distanced lifestyle, created a division between occupations that were able to easily transition to an online environment and those that could not. Each province announced a list of essential workers or essential workplaces limiting the operation of business. As a result, for disease preventive measures, any contact-intensive occupations

[1]This statement is based on data from the Statistics Canada Labour Force Survey

considered non-essential, such as food and beverage servers, found themselves vulnerable for layoffs and earning loss.

To interpret the economic intuition behind changes in labour demand as a result of COVID-19's interaction with occupational characteristics, the labour market can be visualized as a venn diagram shown in appendix figure A1. This paper predicts a positive increase in labour demand for teleworkable occupations during the pandemic. Occupations that were teleworkable could continue to provide goods and services online with minimal disruptions relative to occupations that were non-teleworkable. Furthermore, due to changes in consumer taste and restrictions with in-person contact, goods and services that could make the transition to an online environment faced an increase in demand for goods and services relative to their non-teleworkable business counterparts. For businesses with contact-intensive occupations, due to preventative measures and restrictions, they faced temporary or permanent shut-downs if they were unable to transition easily to an online environment. Employability or labour demand for contact-intensive occupations will have experienced negative growth in these conditions. For essential occupations, which broadly include occupations that support public health and safety, essential products, and other infrastructure support, they are likely to have experienced an increase in labour demand compared to the occupations not included in the list of essential occupations. These essential occupations continued to provide goods and services during the pandemic and may have even experienced a stronger demand for their goods and services as people began to hoard essential products.

Six separate subsidy programs, costing a total of 112.2 billion CAD, were launched at the federal level at different periods of the pandemic for different target populations. The subsidy reallocation and distribution among different industries and occupational groups may have accelerated the recovery of businesses and industries, but considering that some occupations are likely more sheltered by the COVID-19 Emergency Response, it is vital to investigate if occupations most vulnerable and negatively impacted were also most subsidized. Additional research may help to answer whether the government could have improved the policy response to achieve similar results at a lower cost.

In summary, this paper seeks to analyze the shock to labour demand from the government's large-scale emergency policy response to COVID-19, identify what occupational characteristics are most related to COVID-19 policies, and to evaluate the allocation efficiency of federal business assistance programs during COVID-19. When considering how pandemic policies impact business feasibility, this paper predicts that teleworkability and being classified as essential improves labour demand during a pandemic whilst being contact-intensive decreases an occupation's demand.

II. Contextualizing the Literature

Our paper mainly contributes to two strands of literature. First, it contributes to the literature examining the immediate labor market impacts of social-distancing policies during the pandemic. Since early 2020, there has been an influx of research to quantify the economic costs of the pandemic and corresponding policies. One aspect of these costs is centred on the rigidity of work arrangements and the ability of the labour market to transition to remote work. Dingel and Neiman used the Occupational Employment Statistics (OES) to identify job characteristics

that clearly rule out the possibility of working entirely from home to deduce teleworkable feasibility [Dingel and Neiman (2020)]. Their findings indicate 57% of occupations in the U.S. can be performed entirely from home. Messacar, Morissette, and Deng conducted a similar study in the Canadian context and found similar results for teleworkable feasibility [Messacar et al. (2020)]. Leibovici, Santacreu, and Famiglietti, along the same lines, conducted analysis considering an occupation's physical-proximity rather than work-from-home feasibility in the US. Their results reinforced the existing literature but also underscored the non-negligible aspects of high contact-intensity occupations in the US in terms of employment and total labor income [Famiglietti et al. (2020)]. Basso and colleagues built their own proximity-index with predetermined thresholds using European data based on pre-determined thresholds with O*NET, and matched it with European occupations [Basso et al. (2020)]. Their findings again supported the existing literature on remote work. A consistent trend among these papers is the use of standardized occupational indices, such as O*NET or NOC, and employment statistics, such as OES or the Labor Force Survey. By contrast, this paper focuses on which occupational groups (considering teleworkability, contact-intensity, and essential versus non-essential categorizations) are most sheltered during a pandemic in terms of employment. All of these studies find significant region and industry variation. It is also common to report a greater flexibility for remote work in higher paying jobs and for wealthier economies.

Other papers in this literature, such as [Mongey et al. (2021)], [Brugiavini et al. (2021)], and [Adams-Prassl et al. (2020)], focus on specific population groups that may have been disproportionately impacted looking at the dimensions of teleworkability and contact-intensity. Using data containing worker characteristics reveals that vulnerable populations, such as women, less educated workers, and individuals who were originally working on temporary contracts, were more likely to lose their jobs and experience disruption with their employment across the US and UK during the pandemic. They reached this conclusion by identifying the occupational groups that were most affected by the pandemic according to teleworkability and contact-intensity. Yet, there were occupations that suffered disproportionately solely based on essential worker classification. Our paper will attempt to understand whether being classified as essential is a significant indicator in influencing the employability of certain occupations.

The required physical proximity of some occupations adds another dimension when looking at labour market changes. Mongey, Pilossoph, and Weinberg, in particular, looked into the relationship between physical proximity and employment losses and concluded that the relationship flattened as social distancing mandates expired [Mongey et al. (2021)]. However, only data between February and August 2020 were available and utilized in this study. Considering other mechanisms and factors, such as COVID-19 fatigue and additional subsidies funneled into individual industries, it would be important to re-evaluate the conclusions reached by Mongey, Pilossoph, and Weinberg. With longer time frames and higher frequency data, our paper will observe whether a similar conclusion holds across countries and over extended time periods.

Secondly, our paper builds on the growing literature that uses online job posting data to analyze labor market outcomes. [Turrell et al. (2019)] leverage online vacancies from Reed, a UK job site, to study the labor mismatch related to productivity estimates in the UK. They concluded that regional mismatch was a greater contributing factor than occupational mismatch in impacting productivity. Similarly, [Hensvik et al. (2021)] analyzes real-time data on the

largest online job board in Sweden to understand how job search behaviour is impacted by the pandemic. Additionally, [Marinescu and Wolthoff (2020)] uses data from CareerBuilder.com, a worldwide employment website to explain the relationship between job titles and wage variance. Numerous studies have utilized data from Indeed.com, including [Adrjan and Lydon (2019)], [Bellatin and Galassi (2022)], and [Sinclair and Gimbel (2020)]. Topics of these studies include: tightness in the labor market, US employer and job seeker mismatch, and evolution of technology-related occupational postings. Our paper adds to the pool of growing literature on potential measurement error using online job posting data. A limitation of using job posting data is in its ability to properly reflect employer decisions and reflect changes in quantity of labour demanded. Using the novel Canadian job posting data powered by LMIC, our paper will attempt to uncover whether online job posting data is a good proxy for labour demand after controlling for occupational characteristics and other covariates directly affected by the pandemic.

Overall the existing literature offers only limited suggestions on how to relate government policy to labour market shocks during a pandemic. Leveraging a generalized Pareto distribution, Marani and colleagues estimate that the yearly probability of extreme pandemics may triple in the coming decades [Marani et al. (2021)]. Factors such as population growth, changes in food systems, environmental degradation, increasing emergence of viral disease from animals, and increase contact between humans and disease-harboring animals, lead researchers, epidemiologists, and other environmental engineering researchers alike to speculate outbreaks will happen more frequently [Madhav et al. (2017)]. Hence, to better prepare and harbour the negative shocks extreme pandemics bring, circumstances warrant a more quantitative investigation.

III. Data

This paper leverages a variety of publicly available data to assemble a complete and novel dataset. In order to proxy quantity of labor demand for each occupation reliably, similar to Bellatin and Galassi (2021), this paper utilizes high-frequency Canadian online job postings data provided by the Labour Market Information Council (LMIC) and the Future Skills Centre (FSC). The data repository consists of online job postings collected from thousands of Canadian websites and job boards per month, per province, and at the 4-digit unit National Occupation Classification (NOC) level. Running from January 2018 to September 2022, the dataset consists of 55 months and 385 unique occupations.The data repository cleaned and organized all job posting data using AI and big data technology powered by Vicinity. In particular, the firm used cascading style sheet selectors to retrieve job market information followed by feature extraction to process raw data into a form conducive to further statistical analysis. Then natural langauge processing was leveraged to remove fake and duplicate job postings (95% duplicates per month). Finally, machine learning and text classifiers were used to organize cleansed data into a specific set of NOC classification. It is important to note that 10-15% of job postings lacked enough detial to be matched.

To categorize job postings based on teleworkability, contact-intensity, and essential or non-essential characteristics, this paper uses existing classifications or indices. All indices are coded as a binary variable. The 'Teleworkability' dimension follows Dingel and Neiman's classification [Dingel and Neiman (2020)]. The authors utilized O*NET's Work Context Questionnaire and Generalized Work Activities Questionnaire to provide an upper-bound estimate of occupations

that are teleworkable. The classification clearly rules out the possibility of working-at-home and may have ignored occupational characteristics that would make working-at-home difficult. Of 141 unit-level NOC occupations (excluding healthcare workers), 63 occupations have been identified as teleworkbale according to the index. The 'Contact-Intensity' dimension follows Leibovici, Santacreu, and Famiglietti's classification [Famiglietti et al. (2020)]. Leibovici and colleages combined individual-level data from the 2017 American Community survey with O*NET's index of Occupational Contact-Intensity to compute the degree that job tasks are performed in close physical proximity to others. Three levels of intensity were identified in the final classification. To observe clear differences in COVID-19's impact on contact-intensive jobs, our paper only takes into account occupations that are either high contact-intensive or low contact-intensive according to the classification. Medium contact-intensive occupations are excluded. Of the 977 6-digit unit Standard Occupation Code, the US equivalent of NOC 4-digit, 159 occupations are identified as contact-intensive while 272 are identified as low-contact intensive. Lastly, the 'essential' dimension follows Rosenbaum's Pan-Canadian List of Essential Services and Related Occupations, which documented provincial announcements of essential services to match occupational titles at the NOC 4-digit unit level [Rosenbaum (2020)]. Of the 59 essential services announced during the pandemic, the Pan-Canadian List of Essential Services found 273 unique NOC 4-digit unit level occupations. Using the same list, this paper excludes occupations associated with the healthcare sector due to their unique development associated with an ongoing pandemic.

Outside of the job posting data, this paper includes 'COVID-19 stringency' to control for policy stringency during the pandemic period, and how this may have affected job postings independent of the job characteristics. 'COVID-19 stringency' is a continuous variable extracted from the Bank of Canada's COVID-19 stringency index, which references the Oxford COVID-19 Government Response Tracker's (OxGRT) methodology. This dataset covers Jan 1, 2020 to July 25, 2022 across each province and computes a value for daily stringency. Due to the granuarlity of the job posting data at the monthly level, average stringency is used as a covariate.

Finally, the main data source to investigate Canadian business subsidies during the pandemic comes from the government of Canada website. This paper uses three of the four largest business subsidies: Canadian Emergency Wage Subsidy (CEWS), Canadian Emergency Rent Subsidy (CERS), and Canadian Recovery Hiring Program (CRHP). All three data sets use NAICS to organize the total amount approved in each industry and an average per employee.

Appendix Table A1 summarizes the key statistics on postings for each occupational subgroup considering the three binary dimensions. Prominent examples of job categories from the subgroup are listed for intuitive interpretation. To maintain quality, the job postings are truncated at a minimum of twenty five, which contributed to the panel being unbalanced. This dataset provides an improvement over data currently utilized in the existing literature and a contribution in its own right.

A. Methodology

Let S denote the state of the world, where $S = 1$ is when the state of the world has COVID-19 at time t and $S = 0$ is the state of the world when there is no COVID-19 at time t. The parameter of interest in this paper is $E[JobPostings_{i,t}^{S=1} - JobPostings_{i,t}^{S=0} | covid = 1]$, which

can be interpreted as the average difference in number of job postings if the pandemic happened compared to not (or the average treatment effect (ATE)). However, it is impossible to observe the counterfactual $E[JobPostings_{i,t}^{S=0}|covid = 1]$ because COVID-19 has impacted all occupations regardless of magnitude. Therefore, this paper uses an identification assumption that average job postings before pandemic levels should continue after the pandemic, or $E[JobPostings_{i,t}^{S=0}|covid = 1] = E[JobPostings_{i,t}^{S=0}|covid = 0]$. In other words, to estimate the ATE of COVID-19, the parameter of interest $E[JobPostings_{i,t}^{S=1} - JobPostings_{i,t}^{S=0}|covid = 1]$ can be rewritten as $E[JobPostings_{i,t}^{S=1}|covid = 1] - E[JobPostings_{i,t}^{S=0}|covid = 0]$.

Since the dimensions (teleworkability, essential or non-essential, and contact-intensity) vary among occupations but not over time, a random effects regression clustered at the NOC 4-digit unit level is used to estimate the potential outcomes ATE. Specifically, the following Random Effects regression model is employed:

$$\begin{aligned} JP_{i,t} = \beta_0 + \beta_1 TEL_i + \beta_2 ESS_i + \beta_3 CI_i + \beta_4 COVID_t + \beta_5 COVIDxTel + \beta_6 COVIDxESS \\ + \beta_7 COVxCI + \beta_8 ESSxTEL + \beta_9 ESSxCI + \beta_{10} CIxTEL + \beta_{11} COVIDxESSxTEL \\ + \beta_{12} COVxESSxCI + \beta_{13} COVxTELxCI + \beta_{14} CIxESSxTEL + stringency + \epsilon \end{aligned}$$

where TEL_i is a binary variable that takes value 1 if occupation i is teleworkable, ESS_i is a binary variable that takes value 1 if occupation i is essential, CI_i is a binary variable that takes value 1 if occupation i is contact-intensive, and $COVID_t$ is a binary variable that takes value 1 if t is equal or after March 2020. Other variables are interaction terms based on combinations of the variables above.

IV. Results

A. Labour Demand by Occupation Sub-group

This section outlines the regression results and interpretation for each occupational sub-group to identify which occupational sub-group was impacted by the pandemic and its policy. Running the specified econometrics random effects model clustered at the NOC 4-digit unit level yields coefficient values and robust standard errors shown in Table 1.

Table 1—Regression Estimates for Total Job Postings

Input Variable	Estimate	Robust SE
Constant	287.11**	107.37
Teleworkability	237.86	160.36
Essential	-169.32	115.50
Contact-Intensity	-7.18	62.89
Covid	345.93***	89.51
Covid x Teleworkability	-199.66*	79.48
Covid x Essential	-115.89	69.48
Covid x Contact-Intensity	-44.27	31.73
Essential x Teleworkability	1163.18*	1148.57
Essential x Contact-Intensity	1139.90***	279.01
Contact-Intensity x Teleworkability	-190.86	86.68
Covid x Essential x Teleworkability	-127.49	171.92
Covid x Essential x Contact-Intensity	276.50*	122.94
Covid x Teleworkability x Contact-Intensity	98.88*	41.77
Time Dummies		Yes
σ_u		838.56
σ_e		288.55
ρ		0.89

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

A before and after solution yields estimates for the average job postings (AJP) before COVID-19, during COVID-19, and the ATE or average job posting difference as a result of COVID-19 as shown in table 2. Significance is shown based on Wald testing the beta values for individual occupational sub-groups prior to COVID-19 and during COVID-19. It can be noted that the ATE for some occupational groups is double the amount of pre-pandemic average job-posings, which suggests that some occupations suffered a significant change as a result of the pandemic.

Table 2—Average Job Postings Estimates Per Occupational Sub-Group

Category	CI	Tel	Ess	Pre-Covid AJP	Covid AJP	Treatment AJP
Material Handlers Light Duty Cleaners Store Shelf Stockers, Clerks & Order Fillers	0	0	0	287.1***	633.0***	345.9***
Food & Beverage Services Bartenders Other Assisting Occupations	1	0	0	279.9***	581.6***	301.7***
Public Works Equipment Operators Railway & Motor Transport Labour Industrial & Manufacturing Engineers	0	0	1	117.8***	347.8***	230.0***
Registered Nurses & Psychiatric Nurses Delivery & Courier Drivers Transport Truck Drivers	1	0	1	1250.5***	878.4***	-372.1***
Administrative Assistants Administrative Officers Financial Sales Representatives	0	1	0	525.0***	671.2***	146.3***
Occupations in Therapy & Assessment Secondary School Teachers Other Instructors	1	1	0	326.9***	527.8***	200.9***
Retail & Wholesale Trade Managers Technical Sales Specialists Postal & Courier Services Managers	0	1	1	1518.8***	1421.7***	-97.1***

The treatment Average Job Postings lends insights on employers hiring decisions during the pandemic compared with pre-pandemic hiring. Intuitively, employers who are unable to sustain their businesses would not demand more workers or would even lay-off existing workers. From the figures, occupations that are essential, contact-intensive, and non-teleworkable, such as transport truck drivers, were most negatively impacted by the pandemic relative to all other sub-groups. This was followed by occupations that are essential, or non-contact-intensive but essential, such as postal and courier service managers. Interestingly, no dimension strongly dominates the change in labour demand negatively or positively as a result of pandemic policies.

To investigate this further, a comparison between sub-groups conditional on other character-

istics can be used and is discussed in the remainder of this section. By focusing on relevant job categories, table 2 can be used to determine the importance of contact intensity, teleworkability, and essential status while holding constant each classification and other occupational characteristics. Based on these results we focus first on contact-intensity while holding all else constant. The sign and significance of contact-intensity is unclear and insignificant. This suggests, contrary to prior belief, that occupations classified as contact-intensive likely face a decrease in labour demand (although the relationship is not strong). Contact-intensity's influence on labour demand is also dependent on other characteristics.

Table 2 also highlights the importance of being essential holding constant other occupational characteristics, teleworkability and contact-intensity. Unlike contact-intensity, the sign of estimated coefficients is consistent but unexpected. At the 10% significance level, being essential decreases an occupation's quantity of labour demand. This goes against economic intuition previously established. Even though essential occupations were guaranteed to be able to provide goods and services relative to their non-essential counterparts, they demanded less labour during the pandemic. This suggests that there are other mechanisms that may influence essential or non-essential employers' decisions that are not accounted for. For example, the large subsidies provided by the central government may have influenced the reactions and decisions on how employers hired or layed-off workers.

Finally, table 2 highlights the importance of teleworkability holding constant other occupational characteristics, essential classification and contact-intensity. Similar to results investigating the essential classification, coefficients are consistently negative. However, being teleworkable significantly influences an occupation's labour demand negatively, which suggests a teleworkable occupation was less desired by employers during the pandemic compared to a non-teleworkable job holding other occupational characteristics constant. These results go against economic intuition. Given that teleworkable businesses are able to continue to sell their goods and services, teleworkable occupations should be in greater demand. A likely explanation for the negative sign could be changes in turnover rates from the employee's end as a result of health considerations during the pandemic. Compared to teleworkable occupations, non-teleworkable occupations had an increased likelihood of health risk during the pandemic. Employees might resign in hopes of finding an occupation that does not jeopardize their health and future income stream, which causes businesses that are non-teleworkable to constantly be seeking people to replace those employees that have resigned. Complementing this mechanism, existing employees who hold teleworkable occupations are relatively less likely to resign considering the non-teleworkable alternatives. Thus, results may show slower growth in labour demand for teleworkable jobs while non-teleworkable jobs faced higher labour demand.

B. Government Business Subsidy Allocation

This section explores the allocation efficiency of government business subsidies using changes in labour demand as a metric. Over the span of 27 months, 112 billion CAD was spent by the Canadian federal government to subsidize businesses. This subsidy came in various forms, such as rent subsidies, wage subsidies, or recovery hiring. Occupational sub-groups with differing occupational characteristics experienced negative impacts of the pandemic with varied magnitude. To analyze government subsidy data, which aggregates to the North American Industry

Classification System (NAICS), this paper matched each occupation to its appropriate NAICS to observe how each industry's quantity of labour demand has been impacted by COVID-19. Full results are available in Appendix Table A2. Figures 1 and 2 below showcase government business subsidy allocation per industry per subsidy. It is clear that while some industries seem to demand more employees, others experienced negative changes in labour demand.

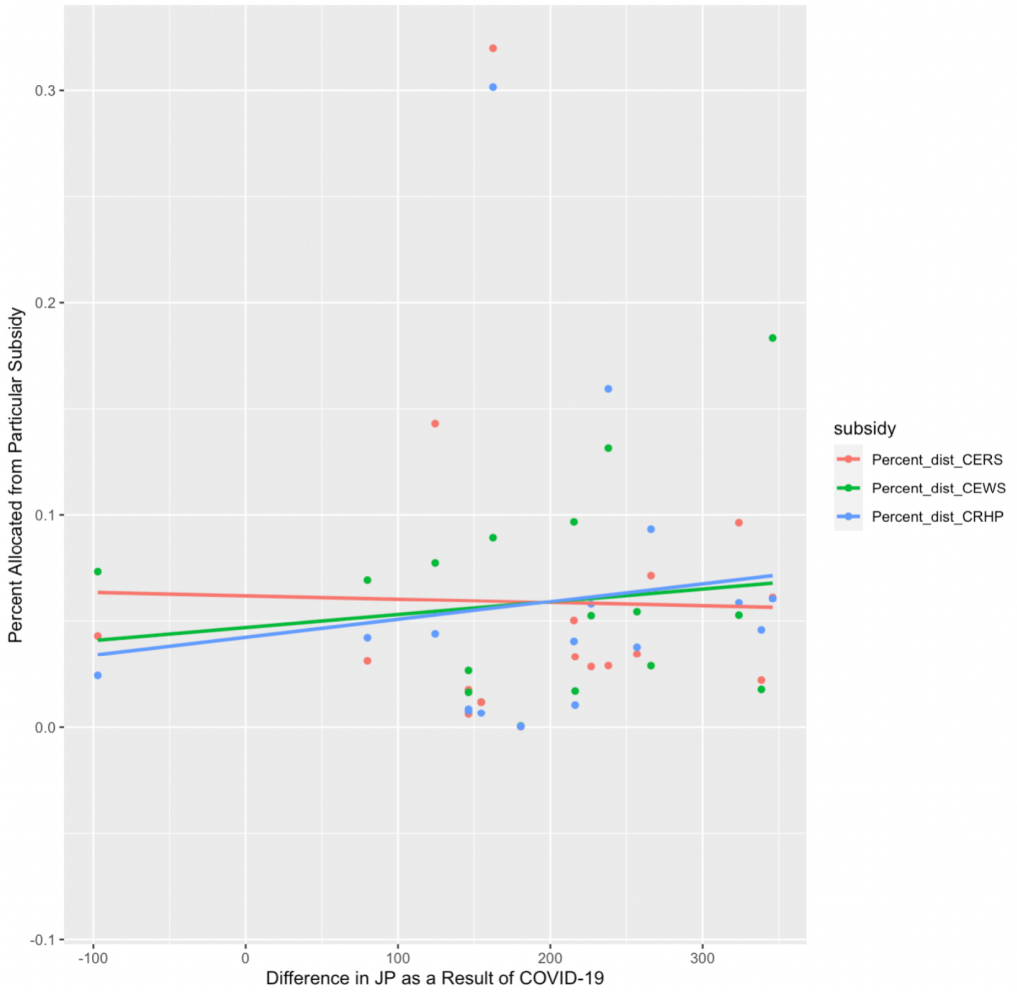

Figure 1. Relative Subsidy Allocated to Each Industry for Each Subsidy

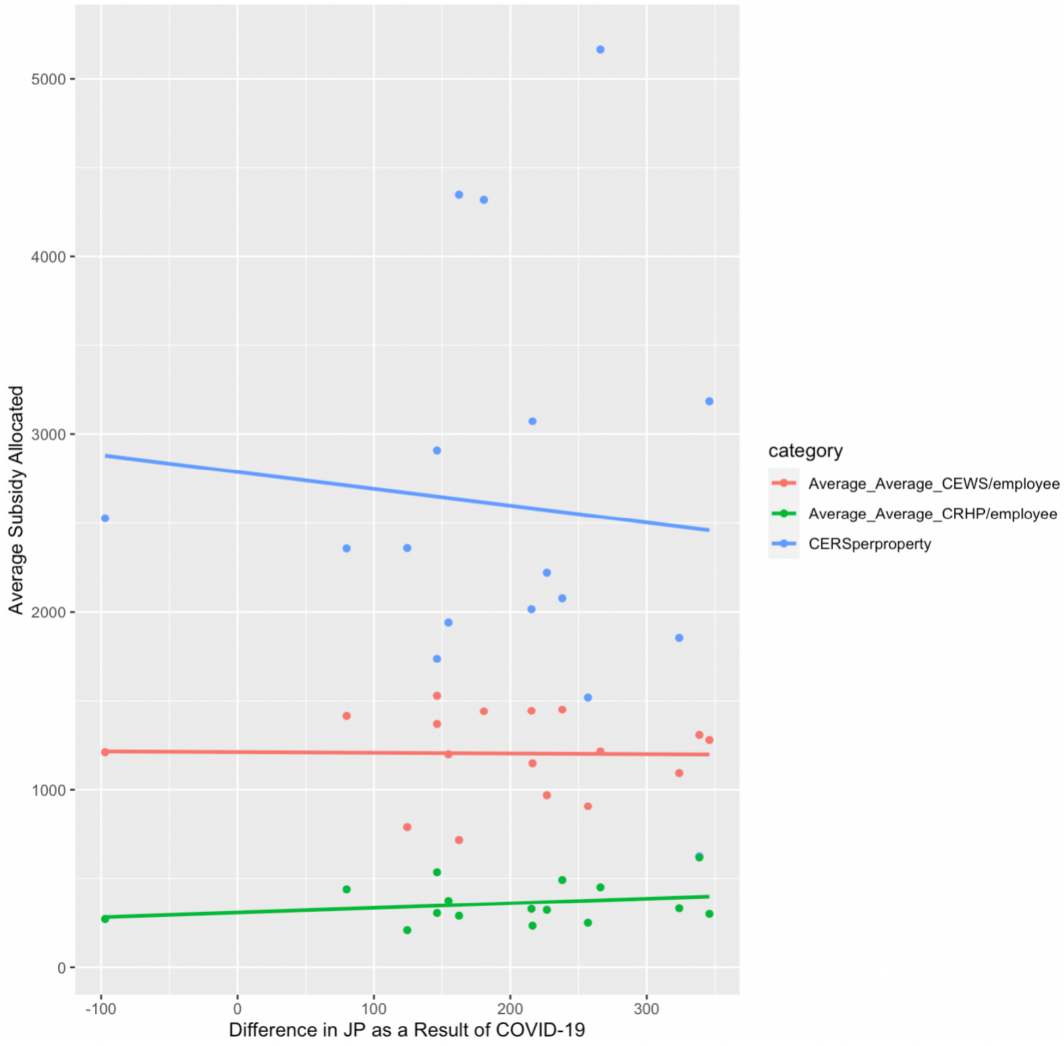

FIGURE 2. AVERAGE SUBSIDY PER EMPLOYEE TO EACH INDUSTRY FOR EACH SUBSIDY

Figure 1 suggests the percentage subsidy allocated to particular businesses are generally non-targeted and are exacerbating the inequality in financial impacts COVID-19 caused to different industries. The wage and recovery hiring programs, in particular, seem to have increased their subsidies as those industries experienced greater labour demand. For industries or occupations that experienced higher labour demand during the pandemic, this could have been entirely motivated by increases in turnover. Therefore, governments were simply funding those occupations or industries that experienced high turnover rates.

Figure 2 showcases subsidies but looks specifically at the average subsidy received by employees in each industry. The relatively steeper line of best fit for the rent subsidy implies industries that happen to hire fewer labourers due to the pandemic receiving greater subsidies. However, similar to that of the previous figure, there is no obvious targeting of the wage subsidy or the hiring program.

V. Conclusion

This paper analyzed how labour demand of occupational sub-groups, divided by telework-ability, contact-intensity, and the 'essential' classification, were altered during the COVID-19 pandemic. Results show no particular sub-group experienced COVID-19 similar to one another due to the differences in occupational characteristics. Interestingly, when uncovering the importance of specific occupational characteristics in influencing labour demand during COVID-19, none of the results fit prior economic intuition discussed in the existing conceptual framework. Occupations classified as teleworkable or essential experienced a decrease in labour demand during the pandemic. This non-intuitive result could be attributable to the assumption that COVID-19 and its policies only influenced labour demand from the business feasibility perspective. However, this fails to consider how reactionary employers may be with subsidies or how employees may be motivated to resign their current occupation for an occupation that exposes them to lower health-risks during the pandemic. The failure to control for certain mechanisms that could have explained the non-intuitive changes in labour demand would bias the beta coefficients yielded when running the random effects regression. Therefore, the figures observed when investigating the government subsidy allocation efficiency also need to be re-evaluated.

Since the current model does not control for certain determinants and provides non-intuitive coefficient estimates, this warrants further investigation that looks at which labour demand determinants need to be controlled for. The beta estimates yielded could be heavily biased by omitted variables such as turn-over rates or number of employees at time t. Both variables would lend insight to the total labour demanded by the particular occupation at time t. Additionally, future work could include data on the amount of subsidy provided at time t for occupation i to account for hiring differences with additional financial support.

Aside from omitted variable bias, the current paper also suffers from measurement error in the dependent variable, online job postings. There is likely an underestimation to the actual job vacancy rate in the labour market based on three rationales. Firstly, online job postings are more likely to capture urban jobs relative to rural jobs. Compared to urban occupations, rural occupations are likely to get filled through word of mouth or physical job boards. Similarly, jobs that require less technology or are not as technical, are likely not publicized in an online environment. Secondly, one job posting could represent multiple job vacancies. Even though

big data technology and AI can extract all job posting information, employers may use one job posting to fill multiple positions. Lastly, when a job posting gets taken down, there is no information to whether this is as a result of the job position being filled or that they are no longer able to hire. Ideally future work will access wage and payroll data to account for changes in turnover rates or get more granular job posting data to minimize measurement error. In this case, the model could better predict and understand which occupations were most impacted by COVID-19.

Overall this paper has taken a first step in analyzing the efficiency of government funding during pandemics. It has not provided support for the success or equity of the federal governments funding strategy.

REFERENCES

[Adams-Prassl et al. 2020] Adams-Prassl, Abi ; Boneva, Teodora ; Golin, Marta ; Rauh, Christopher: Inequality in the impact of the coronavirus shock: Evidence from real time surveys. In: *Journal of Public Economics* 189 (2020), S. 104245. – URL https://www.sciencedirect.com/science/article/pii/S0047272720301092. – ISSN 0047-2727

[Adrjan and Lydon 2019] Adrjan, Pawel ; Lydon, Reamonn: Clicks and jobs: measuring labour market tightness using online data. (2019), Juni, Nr. 6/EL/19. – URL https://ideas.repec.org/p/cbi/ecolet/6-el-19.html

[Basso et al. 2020] Basso, Gaetano ; Boeri, Tito ; Caiumi, Alessandro ; Paccagnella, Marco: The New Hazardous Jobs and Worker Reallocation. (2020). – URL http://www.jstor.org/stable/resrep60784. – Zugriffsdatum: 2025-01-14

[Bellatin and Galassi 2022] Bellatin, Alejandra ; Galassi, Gabriela: What COVID-19 May Leave Behind: Technology-Related Job Postings in Canada. (2022), April, Nr. 22-17. – URL https://ideas.repec.org/p/bca/bocawp/22-17.html

[Brugiavini et al. 2021] Brugiavini, Agar ; Buia, Raluca E. ; Simonetti, Irene: Occupation and working outcomes during the Coronavirus Pandemic. (2021), Nr. 2021:09. – URL https://EconPapers.repec.org/RePEc:ven:wpaper:2021:09

[Dingel and Neiman 2020] Dingel, Jonathan I. ; Neiman, Brent: How many jobs can be done at home? In: *Journal of Public Economics* 189 (2020), S. 104235. – URL https://www.sciencedirect.com/science/article/pii/S0047272720300992. – ISSN 0047-2727

[Famiglietti et al. 2020] Famiglietti, Matthew ; Leibovici, Fernando ; Santacreu, Ana M.: How the Impact of Social Distancing Ripples through the Economy. (2020), April, Nr. 87754. – URL https://ideas.repec.org/p/fip/l00001/87754.html

[Hensvik et al. 2021] Hensvik, Lena ; Le Barbanchon, Thomas ; Rathelot, Roland: Job search during the COVID-19 crisis. In: *Journal of Public Economics* 194 (2021), S. 104349. – URL https://www.sciencedirect.com/science/article/pii/S0047272720302139. – ISSN 0047-2727

[Madhav et al. 2017] Madhav, Nita ; Oppenheim, Ben ; Gallivan, Mark ; Mulembakani, Prime ; Rubin, Edward ; Wolfe, Nathan: *Pandemics: Risks, Impacts, and Mitigation*. S. 315–345. In: *Disease Control Priorities, Third Edition (Volume 9): Improving Health and Reducing Poverty*, 11 2017. – ISBN 978-1-4648-0527-1

[Marani et al. 2021] Marani, Marco ; Katul, Gabriel G. ; Pan, William K. ; Parolari, Anthony J.: Intensity and frequency of extreme novel epidemics. In: *Proceedings of the National Academy of Sciences* 118 (2021), Nr. 35, S. e2105482118. – URL https://www.pnas.org/doi/abs/10.1073/pnas.2105482118

[Marinescu and Wolthoff 2020] Marinescu, Ioana ; Wolthoff, Ronald: Opening the Black Box of the Matching Function: The Power of Words. In: *Journal of Labor Economics* 38 (2020), Nr. 2, S. 535 – 568. – URL https://EconPapers.repec.org/RePEc:ucp:jlabec:doi:10.1086/705903

[Messacar et al. 2020] Messacar, Derek ; Morissette, René ; Deng, Zechuan: Inequality in the feasibility of working from home during and after COVID-19. In: *StatCan Covid-19: Data to Insights for a Better Canada* (2020). – URL https://www150.statcan.gc.ca/n1/pub/45-28-0001/2020001/article/00029-eng.htm

[Mongey et al. 2021] Mongey, Simon ; Pilossoph, Laura ; Weinberg, Alexander: Which workers bear the burden of social distancing? In: *The Journal of Economic Inequality* 19 (2021), September, Nr. 3, S. 509–526. – URL https://ideas.repec.org/a/spr/joecin/v19y2021i3d10.1007$_s$10888 − 021 − 09487 − 6.*html*

[Rosenbaum 2020] Rosenbaum, Zoe: Essential Services and Occupations: A Pan-Canadian List. In: *Labour Market Information Council Publications* (2020). – URL https://lmic-cimt.ca/essential-services-and-occupations-a-pan-canadian-list/

[Sinclair and Gimbel 2020] Sinclair, Tara ; Gimbel, Martha: Mismatch in Online Job Search. (2020). – URL https://EconPapers.repec.org/RePEc:gwi:wpaper:2020-1

[Turrell et al. 2019] Turrell, Arthur ; Speigner, Bradley ; Djumalieva, Jyldyz ; Copple, David ; Thurgood, James: Transforming Naturally Occurring Text Data Into Economic Statistics: The Case of Online Job Vacancy Postings. (2019), Nr. 25837. – URL https://EconPapers.repec.org/RePEc:nbr:nberwo:25837

APPENDIX

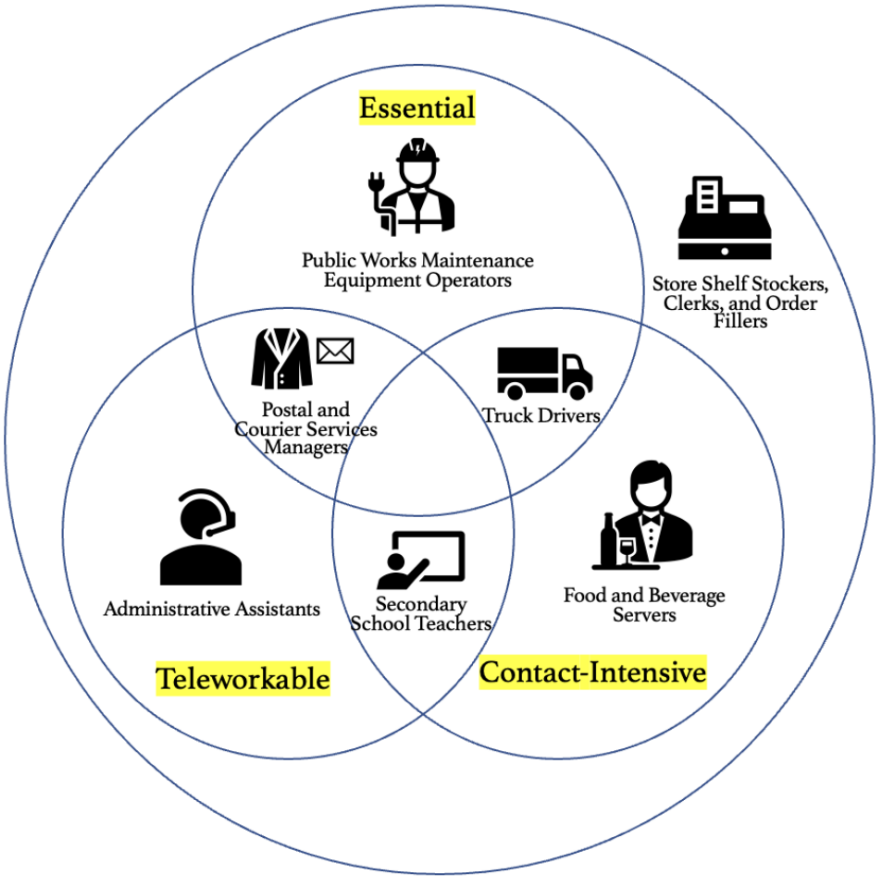

FIGURE A1. RELATIVE SUBSIDY ALLOCATED TO EACH INDUSTRY FOR EACH SUBSIDY

Table A1—Summary Statistics for Prominent Occupational Sub-Groups

Category	CI	Tel	Ess	Obs	Mean	SD	Min	Max
Material Handlers Light Duty Cleaners Store Shelf Stockers, Clerks & Order Fillers	0	0	0	1486	501.0	979.5	25	7754
Food & Beverage Services Bartenders Other Assisting Occupations	1	0	0	1599	320.7	384.9	25	2790
Public Works Equipment Operators Railway & Motor Transport Labour Industrial & Manufacturing Engineers	0	0	1	307	145.4	99.3	25	504
Registered Nurses & Psychiatric Nurses Delivery & Courier Drivers Transport Truck Drivers	1	0	1	220	2641.0	1236.9	642	5710
Administrative Assistants Administrative Officers Financial Sales Representatives	0	1	0	2594	568.3	876.7	25	7127
Occupations in Therapy & Assessment Secondary School Teachers Other Instructors	1	1	0	318	163.7	79.9	26	513
Retail & Wholesale Trade Managers Technical Sales Specialists Postal & Courier Services Managers	0	1	1	115	2004.4	2012.0	25	6777

Table A2—Estimated Average Total Job Postings per NAICS Industry

NAICS Industry	Pre-Covid AJP	Covid AJP	Treatment AJP
(11) Agriculture, Forestry, Fishing & Hunting	285.9	624.5	338.5
(23) Construction	261.9	500.0	238.1
(33) Manufacturing	287.1	633.0	345.9
(41) Wholesale Trade	1518.8	1421.7	-97.1
(44) Retail Trade	903.0	1027.4	124.4
(48) Transportation & Warehousing	658.1	738.0	80.0
(51) Information & Cultural Industries	525.0	671.2	146.3
(52) Finance & Insurance	484.3	638.9	154.6
(54) Professional, Scientific & Technical Services	424.7	640.2	215.5
(56) Administrative Support, Waste Management & Remediation	377.8	604.6	226.8
(61) Education Services	377.3	593.5	216.3
(62) Health Care & Social Assistance	349.8	606.7	256.9
(71) Arts, Entertainment & Recreation	382.3	648.3	266.1
(72) Accommodation & Food Services	527.4	689.8	162.4
(81) Other Services, except Public Administration	283.5	607.3	323.8
(91) Public Administration	454.5	635.1	180.6