The Effect of Minimum Wage Changes on Employment: An Empirical Analysis Using Canadian Labor Force Survey Data

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Introduction

The minimum wage argument is a significant topic in labour economics, with substantial implications for both workers and firms. Arguments for and against minimum wage laws in Canada have been divisive, with sides ranging from possible job losses to higher living conditions for low-paid workers. The purpose of this research is to test the hypothesis of whether increasing the minimum wage affects employment in Canada, with a particular emphasis on the interactions that exist across various provinces and demographic groupings.

Empirical Framework

This research employs a two-part empirical framework to assess the effects of minimum wage changes on employment in Canada, using data from the Labour Force Survey.

Descriptive Analysis

The first part involves a descriptive analysis to identify groups most likely affected by low-wage employment. This is done by first filtering the data to include only April observations each year, ensuring consistency. Next, a binary variable *low_wage* is generated to identify workers earning at or below the minimum wage. The variables *age_group* and *province_group* are then created for categorization and tabulated against *low_wage* to reveal demographic patterns in low-wage employment.

Econometric Analysis

The second part employs econometric models to estimate the causal impact of minimum wage changes.

The econometric analysis is executed through multiple models to ensure the comprehensiveness and robustness of the results. The Ordinary Least Squares (OLS) Regression model serves as the foundation, providing baseline relationships between the treatment and employment metrics. To address potential concerns of endogeneity, an Instrumental Variables (IV) Regression is employed, utilizing minimum wage changes as an instrument. This method is particularly crucial in drawing causal inferences from the observed relationships.

The study introduces a lagged minimum wage variable (*lag_minwage*), which captures the time-related dynamics of wage policy changes. Additionally, a binary indicator (*minwage_change*) is constructed to denote instances of minimum wage alterations. This indicator plays a pivotal role in identifying periods of policy shifts, thereby facilitating a clear demarcation between pre- and post-policy change scenarios.

The post-treatment period is defined as the years succeeding 2010, marking a significant policy change timeline. Within this framework, specific age groups are identified as treated groups, particularly focusing on ages represented by $age\_12 == 1$ or $age\_12 == 2$. This delineation is based on the premise that these age groups are most likely to be impacted by minimum wage policies. An interaction term, *treat_x_post*, is then created, which becomes fundamental in quantifying the treatment effect during the post-treatment period.

The Difference-in-Differences (DiD) method is pivotal in comparing employment outcomes before and after the 2010 period. This approach effectively isolates the effects of minimum wage changes by contrasting the experiences of treated and untreated groups. The Instrumental Variables (IV) method,

on the other hand, is instrumental in addressing the potential endogeneity between minimum wage changes and employment, thereby enhancing the causal interpretation of the results.

Regression Model

The core of the empirical framework is the regression model specified as follows:

$$\begin{aligned} E_{it} =& \beta_0 + \beta_1 \text{MinimumWage}_{it} + \beta_2 \text{Treat}_{it} + \beta_3 \text{Treat}_{it} \times \text{Post}_t \\ &+ X_{it}\beta_4 + \mu_i + \lambda_t + \epsilon_{it} \end{aligned}$$

For the IV approach, where $\text{MinimumWageChange}_{it}$ serves as an instrument, the model is

$$E_{it} = \beta_0 + \beta_1 \text{TreatXPost}_{it} + X_{it}\beta_2 + \mu_i + \lambda_t + \epsilon_{it}$$

In these models:

$$\begin{aligned} E_{it} &= \text{employment rate in province } i \text{ at time } t \\ \text{MinimumWage}_{it} &= \text{minimum wage} \\ \text{Treat}_{it} &= \text{treatment indicator for the target age groups} \\ \text{Post}_t &= \text{marks the post-treatment period} \\ X_{it} &= \text{vector of control variables} \\ i \text{ and } t &= \text{province and year-fixed effects, respectively} \\ \epsilon_{it} &= \text{error term} \end{aligned}$$

Data

Table 1: Mean Minimum Wages by Year and Province

Year	Newfoundland	Prince Edward Island	Nova Scotia	New Brunswick	Quebec	Ontario	Manitoba	Saskatchewan	Alberta	British Columbia
2001	5.5	5.8	5.7	5.75	7	6.85	6.25	6	5.9	7.6
2002	5.5	6	5.8	5.9	7	6.85	6.5	6	5.9	8
2003	6	6.25	6	6	7.3	6.85	6.75	6.65	5.9	8
2004	6	6.5	6.5	6.2	7.3	7.15	7	6.65	5.9	8
2005	6	6.8	6.5	6.3	7.45	7.45	7.25	6.65	5.9	8
2006	6.5	7.15	7.15	6.5	7.6	7.75	7.6	7.55	7	8
2007	7	7.5	7.15	7	7.75	8	8	7.95	7	8
2008	8	7.5	7.6	7.75	8	8.75	8.5	8.25	8.4	8
2009	8.5	8	8.6	8	8.5	9.5	8.5	8.6	8.8	8
2010	9.5	8.4	9.2	8.5	8.5	10.25	9	9.25	8.8	8
2011	10	9	9.65	9.5	9.5	10.25	9.5	9.25	8.8	8
2012	10	10	10.15	10	9.65	10.25	10	9.5	9.4	9.5
2013	10	10	10.3	10	9.9	10.25	10.25	10	9.75	10.25
2014	10	10	10.4	10	10.15	10.25	10.45	10	9.95	10.25
2015	10.25	10.35	10.6	10.3	10.35	11	10.7	10.2	10.2	10.25
2016	10.5	10.5	10.7	10.65	10.55	11.25	11	10.5	11.2	10.45
2017	10.75	11.25	10.85	11	10.75	11.4	11	10.72	12.2	10.85
2018	11.15	11.55	11	11.25	11.25	14	11.15	10.96	13.6	11.35
2019	11.15	12.25	11.55	11.5	12	14	11.35	11.06	15	12.65

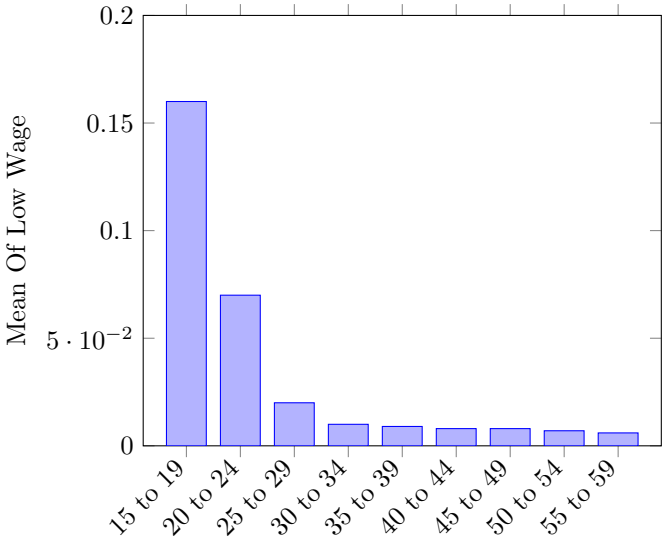
This study specifically draws its data from the Labour Force Survey to show the development of low-wage work across Canadian provinces over time. Table 1 shows the average minimum earnings per province from 2001 to 2019. This table, which captures the constantly changing shifts and trends in minimum wage policy, is an essential part of our empirical study as well as a historical record. It also reveals a clear upward trajectory in minimum wages over time, a trend consistent across all provinces.

Analysis Of Results

Who Are Low-Wage Workers?

The most striking feature of the labour landscape is the concentration of low-wage work among the youth. Teenagers, falling within the 15-19 age bracket, are significantly represented in this sector, with 24,651 of the 155,643 individuals—a substantial 15.8%—earning wages that do not exceed the minimum threshold. Following closely are young adults aged 20-24, where 10,316 out of 143,735, approximately 7.2%, occupy low-wage positions. Figure 1 gives us a graphical representation of the proportion of low-wage workers in each age group. It shows a decline in the proportion of low-wage workers with the most drastic change being between the 15 to 19 age group and the 25 to 29 age group.

Figure 1: Proportion of Low Wage Workers by Age Group



Other Trends in Low-Wage Employment

In the broader context of law-wag employment, disparities emerge across different provinces and demographic segments. For example, Newfoundland has a relatively small fraction of low-wage earners at 3.5% of its workforce earning at or below the minimum wage. In contrast, Ontario has a higher prevalence of low-wage labour, with 5.5% of its workforce in this category.

As for gender, the data indicated that women are more susceptible to low-wage employment than their male counterparts. Of the 736,554 female workers, 4.6%—are compensated with low wages. This compares to about 3% among male workers.

Educational attainment also plays a significant role. The trend shows that as educational attainment increases, the likelihood of being a low-wage worker is less. Those who have some secondary education had the worst outcomes where 8.5% fall into the low-wage bracket.

Interestingly, non-union members face higher vulnerability than unionized workers, with 8.4% of non-unionized workers earning low wages. In contrast, unionized workers had a mere 1.5% representation in low-wage employment which is almost on par with the proportion of low-wage workers for those with a graduate degree.

Given these insights, the analysis justifiably narrows its focus to the first two age groups (15 to 19 and 20 to 24), where the propensity for low-wage employment is highest. This strategic choice aligns intending to the assessment of the immediate effects of minimum wage policy changes on these vulnerable demographics.

The Effect(s) Of Increasing Minimum Wage

Firstly, it must be noted that the *treat_x_post* variable signifies the interaction between the treatment effect (affected by minimum wage changes) and the post-treatment period (2010). This is used to impact the minimum wage increase specifically after the policy change.

The OLS regression results, given in Table 2 and incorporating factors like age, province, gender, and education level, show a positive association between the *treat_x_post* variable and employment. The observed coefficient of 0.7142649 (standard error of 0.0292342) shows that increases in the minimum wage are generally associated with higher employment rates. However, this trend reverses for age groups beyond 20 to 24, where a negative coefficient is observed. This implies that among older groups, a rise in the minimum wage tends to be related to a decrease in employment.

VARIABLES	OLS Regression Results
treat_x_post	0.714***
	(0.0292)
2.*age_12*	-0.719***
	(0.000425)
3.*age_12*	-1.129***
	(0.000434)
4.*age_12*	-1.198***
	(0.000435)
5.*age_12*	-1.264***
	(0.000433)
6.*age_12*	-1.322***
	(0.000425)

7.*age_12*	-1.317***
	(0.000423)
8.*age_12*	-1.204***
	(0.000422)
9.*age_12*	-0.711***
	(0.000429)
11.*prov*	-0.409***
	(0.00159)
12.*prov*	-0.346***
	(0.000911)
13.*prov*	-0.325***
	(0.000952)
24.*prov*	-0.437***
	(0.000751)
35.*prov*	-0.424***
	(0.000742)
46.*prov*	-0.656***
	(0.000876)
47.*prov*	-0.623***
	(0.000900)
48.*prov*	-0.594***
	(0.000775)
59.*prov*	-0.394***
	(0.000769)
2.*sex*	0.339***
	(0.000181)
1.*educ*90	-0.725***
	(0.000561)
2.*educ*90	-1.372***
	(0.000541)
3.*educ*90	-1.116***
	(0.000586)
4.*educ*90	-1.642***
	(0.000528)
5.*educ*90	-1.692***
	(0.000555)
6.*educ*90	-1.768***
	(0.000613)
Constant	4.828***
	(0.000917)
Observations	397,457,992
R-squared	0.134

Standard errors in parentheses
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table 2: OLS Regression Results

The OLS method, while useful may lead to bias due to endogeneity. To resolve this, and to get a causal interpretation of the relationship between minimum wage changes and employment, an Instrumental Variable approach was employed.

The Two-Stage Least Squares (2SLS) regression analysis, presented in Table 3, examines the impact of minimum wage changes (instrumented by changes in the minimum wage) on labour force status, taking into account various demographic factors and controlling for age, province, gender, and education level.
In this model, the *treat_x_post* coefficient is 1.100919 (standard error of 0.0729698), showing an increase in employment as minimum wage increases. For older age groups, negative coefficients are observed. This is consistent with the OLS regression results.

VARIABLES	Regression Results
treat_x_post	1.101***
	(0.0730)
2.*age_12*	-0.719***
	(0.000425)
3.*age_12*	-1.129***
	(0.000434)
4.*age_12*	-1.198***
	(0.000435)
5.*age_12*	-1.264***
	(0.000433)
6.*age_12*	-1.322***
	(0.000425)
7.*age_12*	-1.317***
	(0.000423)
8.*age_12*	-1.204***
	(0.000422)
9.*age_12*	-0.711***
	(0.000429)
11.*prov*	-0.409***
	(0.00159)
12.*prov*	-0.346***
	(0.000911)
13.*prov*	-0.325***
	(0.000952)
24.*prov*	-0.437***
	(0.000751)
35.*prov*	-0.424***
	(0.000742)
46.*prov*	-0.656***
	(0.000876)
47.*prov*	-0.623***
	(0.000900)
48.*prov*	-0.594***
	(0.000775)
59.*prov*	-0.394***
	(0.000769)
2.*sex*	0.339***
	(0.000181)
1.*educ*90	-0.725***
	(0.000561)
2.*educ*90	-1.372***
	(0.000541)

3.*educ*90	-1.116***
	(0.000586)
4.*educ*90	-1.642***
	(0.000528)
5.*educ*90	-1.692***
	(0.000555)
6.*educ*90	-1.768***
	(0.000613)
Constant	4.828***
	(0.000917)
Observations	397,457,992
R-squared	0.134

Standard errors in parentheses
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$
Table 3: 2SLS Regression Results

To validate the 2SLS regression results, two robustness checks were conducted. The first involved enhancing the model with additional variables like union membership and firm size. This resulted in a coefficient of +0.8047 for the *treat_x_post* variable, slightly lower than the original +1.1009 but still indicating a significant positive impact. The second robustness check used interaction terms between age groups and provinces. Here, the impact of minimum wage increases on employment remained positive (+1.1740), suggesting that increasing minimum wages generally results in increased employment. These robustness checks, support a positive relationship between minimum wage changes and labour force status. The consistency of these findings across different model specifications reinforces the reliability and robustness of the 2SLS results. The treatment effect's magnitude may vary slightly across models, but its direction and significance are consistent, underscoring the confidence in the original model's conclusions.

Comparison Of Existing Literature

The 2SLS regression output in this research finds a positive effect (+1.1009) of minimum wage increases on labour force status. However, this finding is not consistent with all literature. For example, Jardim et al., (2017), utilize administrative data from Washington State, focusing on sectors paying below specific real hourly wages. This study, focusing on sectors with wages below certain hourly rates, used Synthetic Control and Interactive Fixed Effects methods to analyze data from nine quarters starting in the second quarter of 2014. Their findings indicated negative impacts by the end of the third quarter of 2016: hours worked decreased (coefficients of -0.092 and -0.064 for Synthetic Control and Interactive Fixed Effects methods, respectively), as did the number of jobs (coefficients of -0.072 and -0.088).

In contrast, other studies have observed positive impacts of minimum wage increases on employment. Card and Krueger (1994), examined the employment effect of minimum wage increases on the fast food services industry in New Jersey (1992) compared to Pennsylvania. It was found that the state of New Jersey had an increase in employment following the rise in the minimum wage. Particularly, establishments with larger wage increases saw more significant employment growth, with an estimated elasticity of employment at 0.73.

Similarly, Katz and Krueger (1992) conducted a study where they examined the employment impact on fast food outlets in Texas following the federal minimum wage changes in 1990 and 1991.

According to their model, the effect of the minimum wage on employment is determined by the difference in employment changes between restaurants that initially pay comparatively higher salaries and those that pay substantially lower wages. Their findings indicated a significant positive effect, with estimated elasticities of minimum wage on employment ranging from 1.70 to 2.65.

These conflicting results highlight the nature of the relationship between minimum wage policies and employment. They suggest that the impact of minimum wage increases may vary significantly depending on the specific context. Therefore, while some studies report a negative impact on employment, others find positive effects or no effect, indicating that the overall picture is multifaceted and context-dependent.

Conclusion

In conclusion, this study on the impact of minimum wage increases in Canada, utilizing data from the Labour Force Survey (2001-2019), reveals a complex issue. Predominantly, low-wage work, including minimum-wage employment, is concentrated among younger workers aged 15-24. The analysis, employing descriptive methods, OLS and IV, suggests a positive correlation between minimum wage increases and employment, specifically in younger demographics. However, this finding contrasts with other studies, such as Jardim et al., (2017), which observed negative employment effects. These variances highlight the context-dependent nature of minimum wage impacts, underscoring the importance of considering local economic conditions, demographics, and job sectors.

References

[KK92] L. Katz and A. Krueger. "The Effect of the Minimum Wage on the Fast Food Industry". In: (1992). URL: https://doi.org/10.3386/w3997.

[CK93] D. Card and A. Krueger. "Minimum Wages and Employment: A Case Study of the Fast Food Industry in New Jersey and Pennsylvania". In: (1993). URL: https://doi.org/10.3386/w4509.

[Jar+17] E. Jardim et al. "Minimum Wage Increases, Wages, and Low-Wage Employment: Evidence from Seattle". In: (2017). URL: https://doi.org/10.3386/w23532.

Appendix

```
cd "C:\Users\Maria Mangru\Desktop\STATA\339"
use "C:\Users\Maria Mangru\Desktop\STATA\339\lfs0119rr.dta"

ssc install outreg2, replace


**** Part (a) - what types of workers work for low wages, including the minimum wage?

keep if survmnth == 4 // filtering data to keep April only
gen low_wage = hrlyearn <= minwage  // generate variable to identify low wage workers

egen age_group = group(age_12) // grouping data based on age
egen province_group = group(prov) // grouping data based on province

// generate descriptive statistics for low wage workers
tabulate age_group low_wage
tabulate province_group low_wage
tabulate sex low_wage
tabulate educ90 low_wage
tabulate union low_wage
tabulate firmsize low_wage

// table showing the mean minimum wage by year and province
table survyear prov, statistic(mean minwage) nototals


// graphical display of proportion of low-wage workers by age group
graph bar (mean) low_wage, over(age_group) asyvars ///
title("Proportion of Low Wage Workers by Age Group") ///
bar(1, color(blue%10)) bar(2, color(blue%20)) bar(3, color(blue%30)) ///
bar(4, color(blue%40)) bar(5, color(blue%50)) bar(6, color(blue%60)) ///
bar(7, color(blue%70)) bar(8, color(blue%80)) bar(9, color(blue%90)) ///
legend(label(1 "15 to 19") label(2 "20 to 24") label(3 "25 to 29") ///
label(4 "30 to 34") label(5 "35 to 39") label(6 "40 to 44") ///
label(7 "45 to 49") label(8 "50 to 54") label(9 "55 to 59")) ///
scheme(s2color)


**** Part (b) - what is the effect of an increase of minimum wage on employment
gen unique_id = string(prov) + "_" + string(survyear) + "_" + string(survmnth) //generate a unique identifier for each observation

```

```
sort prov survyear survmnth

by prov: gen lag_minwage = minwage[_n-1] // generate a lagged minimum
    wage variable to capture preios period's  wage

// binary varibale to indicate changes in minimum wage
gen minwage_change = (minwage != lag_minwage)
replace minwage_change = 0 if _n == 1


gen post_treatment = survyear >= 2010 // define post-treatment period
gen treated = (age_12 == 1 | age_12 == 2) & post_treatment // define
   treatment group
gen treat_x_post = treated * minwage_change // create an interaction
   term

// perform the OLS regression and output results
reg lfsstat treat_x_post i.age_12 i.prov i.sex i.educ90 [fw=fweight]
outreg2 using ols_regression_results.tex, replace ctitle("OLS
   Regression Results") tex

// perform 2SLS regression as an IV approach and output resilts
ivregress 2sls lfsstat (treat_x_post = minwage_change) i.age_12 i.
   prov i.sex i.educ90 [fw=fweight]
outreg2 using regression_results.tex, replace ctitle("Regression
   Results") tex


// tobustiness check
ivregress 2sls lfsstat (treat_x_post = minwage_change) i.age_12 i.
   prov i.sex i.educ90 i.union i.firmsize [fw=fweight] // adding
   additional control variables

foreach var in age_12 prov {
    ivregress 2sls lfsstat (treat_x_post = minwage_change) i.age_12##
       i.prov i.sex i.educ90 [fw=fweight]
} // adding interaction terms with other variables
```

Listing 1: STATA Code