The Employment Impact of Minimum Wage Policy Changes on Low Wage Workers: A Difference-in-Differences Analysis of Canadian Labour Markets 2001-2019

Introduction

In labour economics, the minimum wage is still a fundamental policy meant to provide workers with a reasonable standard of life. However, the public, policymakers, and economists continue to vigorously argue its implications for employment levels. By investigating the impact of minimum wage policy changes on employment among low-paid workers in Canada, this research aims to contribute to the ongoing discussion.

By employing a Difference-in-Differences (DiD) analytical framework, we can leverage variations in minimum wage legislation across Canadian provinces, both over time and across different regions. The analysis is based on data from the 2009 Labour Force Survey, which allows for a thorough examination of employment trends before and after policy adjustments. Our analysis will examine two specific groups of low-wage workers: adolescents aged 15-19 and young adults aged 20-24. We will focus on four different provinces: Quebec in 2011, Ontario in 2009, Alberta in 2015, and British Columbia in 2012. The provinces were selected based on their implementation of significant minimum wage adjustments, making them suitable for our DiD research.

Initial data suggest that the reaction to minimum wage hikes is complex and differs depending on age group and province. Clustering standard errors at the provincial level, which is a methodological improvement to address correlation within provinces, changes the significance levels of our findings. This highlights the relevance of taking such correlations into account in empirical labour market research. For example, when the standard errors are not clustered, teenagers in Quebec exhibit a strong and positive reaction to the increase in minimum wage in 2011. However, when clustering is considered, this impact loses its statistical significance. This indicates that interpretation should be approached with caution.

This paper begins by placing our results within the larger body of empirical research, providing a thorough explanation of the methodological approach used, and examining the policy implications that might be drawn from our findings. By doing this, the goal is to provide a detailed understanding of how minimum wage rules impact employment for young individuals with low wages, thereby enhancing the policy discussion with insights based on data.

Past Research

Campolieti's research (CAMPOLIETI et al., 2006), influenced by Neumark's (2001) predetermined research methodology, offers a thorough examination of the Canadian labour market between 1981 and 1997. The research suggests that the rise in minimum wage in Canada has resulted in insignificant negative impacts on employment. The study computes the

elasticities for young workers, which are determined to be substantial and generally vary between -0.14 and -0.44, with -0.30 being a credible estimate.

The choice to prioritize low-paid workers is based on the substantial discoveries in Campolieti's research(CAMPOLIETI et al., 2006), which emphasize the susceptibility of young workers to changes in minimum wage regulations. By following this careful and systematic approach, our study aims to analyze the labour market in more detail. We will focus on certain age groups to determine the varied effects with more accuracy. An in-depth analysis of the literature on low-wage employment uncovers recurring patterns and factors that have significant significance for the overall economic structure. According to Statistics Canada, individuals classified as 'low-wage' workers are those who make less than two-thirds of the median hourly salary within their specific demographic category (*Employees With Low Pay, 1998 to 2021*, 2022). We apply the 2009 Labour Force Survey data, adjusted to the 2006 census population, to examine the demographic distribution of low-wage workers in Canada.

Table 1 displays the demographic distribution of low-wage workers, revealing a notably larger percentage of workers aged 15 to 19 in the low-wage group, with a ratio of .8565583. The prevalence of low-wage employment diminishes gradually as individuals age, indicating that younger people are overrepresented in such jobs. The gender distribution indicates that females are more likely to be engaged in low-wage occupations compared to males, with proportions of .2568361 and .1507111, respectively. Education also has a crucial impact, as persons with lower levels of education - specifically those with 'some secondary' education or less - make up a significant portion of the low-wage sector. Unionization provides a measure of safeguard against low-paying jobs, as union members have a lower likelihood of falling into this category, with a ratio of .0710725, in contrast to non-union workers. This highlights the potential influence of collective bargaining in protecting against inadequate compensation.

Empirical Framework

The empirical underpinnings of this study are rooted in a Difference-in-Differences (DiD) approach, which affords the examination of causal effects by exploiting natural experiments—in this case, the variation in minimum wage policies across Canadian provinces. We utilize the April Labour Force Survey data, which aligns with the period when minimum wage rates are typically adjusted, thereby reflecting the most immediate labor market responses to policy changes.

April's minimum wage rates are taken as a proxy for the annual wage levels due to their concurrence with the release of the Labour Force Survey in Table 2 below, ensuring that our employment outcome measures are contemporaneous with wage policy updates. This choice is strategic, enabling us to capture the labor market just before and after the implementation of new minimum wage rates, which typically come into effect around this time.

Our analysis focuses on the period between 2007 and 2017, encapsulating a range of economic conditions and labor dynamics. The selection of Quebec, Ontario, British Columbia, and Alberta

TABLE 1
Proportion of Low-Wage Workers by Demographic Characteristics

Proportion of Low-Wage Workers (Age Group)		Proportion of Low-Wage Workers (Gender Group)		Proportion of Low-Wage Workers (Education Level)		Proportion of Low-Wage Workers (Union Status)	
Age group	ratio_age	Sex	ratio_sex	Education Level	ratio_edu	Union Membership Status	ratio_union
15 to 19	.8565583	Male	.1507111	0 to 8 years	.3128925	Union member	.0710725
20 to 24	.471627	Female	.2568361	Some secondary	.4472138	Not a member, covered	.136137
25 to 29	.1878355			Grade 11 to 13, graduate	.2629074	Not a member or covered	.3152073
30 to 34	.1294689			Some post-secondary	.3533916		
35 to 39	.1150467			Post-secondary certificate	.1291558		
40 to 44	.1120344			Bachelor's degree	.0902672		
45 to 49	.1075748			Graduate degree	.0582737		
50 to 54	.1064442						
55 to 59	.1214517						

Notes: This table delineates the proportions of workers earning low wages across specified demographic categories, utilizing the 2009 Labour Force Survey data, which has been rebased to the 2006 census population. For the purposes of this study, 'low-wage' employees are classified as those whose hourly earnings are below two-thirds of the median hourly wage in their demographic segment. These proportions are derived by dividing the count of low-wage workers in each subgroup by the total employed population within that same subgroup. This approach allows for a nuanced analysis of low-wage employment across varying ages, genders, educational backgrounds, and union affiliations, providing a foundational understanding of the demographic distribution of low-wage work in Canada.

TABLE 2
Minimum Wage by Province in Canada, April 2001-2019(in CAD per hour)

year	Newfoundland	Prince Edward Island	Nova Scotia	New Brunswick	Quebec	Ontario	Manitoba	Saskatchewan	Alberta	British Columbia
2001	5.50	5.80	5.70	5.75	7.00	6.85	6.25	6.00	5.90	7.60
2002	5.50	6.00	5.80	5.90	7.00	6.85	6.50	6.00	5.90	8.00
2003	6.00	6.25	6.00	6.00	7.30	6.85	6.75	6.65	5.90	8.00
2004	6.00	6.50	6.50	6.20	7.30	7.15	7.00	6.65	5.90	8.00
2005	6.00	6.80	6.50	6.30	7.45	7.45	7.25	6.65	5.90	8.00
2006	6.50	7.15	7.15	6.50	7.60	7.75	7.60	7.55	7.00	8.00
2007	7.00	7.50	7.15	7.00	**7.75**	**8.00**	8.00	7.95	**7.00**	**8.00**
2008	8.00	7.50	7.60	7.75	**8.00**	**8.75**	8.50	8.25	**8.40**	**8.00**
2009	8.50	8.00	8.60	8.00	**8.50**	**9.50**	8.50	8.60	**8.80**	**8.00**
2010	9.50	8.40	9.20	8.50	**8.50**	**10.25**	9.00	9.25	**8.80**	**8.00**
2011	10.00	9.00	9.65	9.50	**9.50**	**10.25**	9.50	9.25	**8.80**	**8.00**
2012	10.00	10.00	10.15	10.00	**9.65**	**10.25**	10.00	9.50	**9.40**	**9.50**
2013	10.00	10.00	10.30	10.00	**9.90**	**10.25**	10.25	10.00	**9.75**	**10.25**
2014	10.00	10.00	10.40	10.00	**10.15**	**10.25**	10.45	10.00	**9.95**	**10.25**
2015	10.25	10.35	10.60	10.30	**10.35**	**11.00**	10.70	10.20	**10.20**	**10.25**
2016	10.50	10.50	10.70	10.65	**10.55**	**11.25**	11.00	10.50	**11.20**	**10.45**
2017	10.75	11.25	10.85	11.00	**10.75**	**11.40**	11.00	10.72	**12.20**	**10.85**
2018	11.15	11.55	11.00	11.25	11.25	14.00	11.15	10.96	13.60	11.35
2019	11.15	12.25	11.55	11.50	12.00	14.00	11.35	11.06	15.00	12.65

Note: This table outlines the nominal minimum hourly wages by Canadian province for April 2001-2019. Values are in CAD and unadjusted for inflation. Highlighted entries indicate the selected provinces and years where significant minimum wage changes were enacted, serving as treatment events in our Difference-in-Differences analysis. These highlighted changes allow for a multi-treatment DiD estimation, leveraging the temporal variation in policy implementation. Consequently, each province at various times serves both as a control and as a treatment group, providing a robust framework for assessing the impact of minimum wage adjustments on employment metrics.

as our case studies is deliberate, predicated on the substantive minimum wage changes observed within these regions. These provinces provide a natural variation in the timing and magnitude of wage adjustments, making them ideal candidates for a multi-treatment DiD model. This model excels in instances where treatment is not uniform across groups or time, as it allows for the estimation of the treatment effect while controlling for other unobserved variables that could influence the outcome.

The DiD model is specified as follows:

$$E_{it} = \alpha + \beta_1 \text{Treat}_{it} + \beta_2 \text{Post}_t + \beta_3 (\text{Treat}_{it} \times \text{Post}_t) + \gamma X_{it} + \beta_4 PROV_i + \beta_5 YEAR_t + \epsilon_{it}$$

where E_{it} is the employment–population ratio for a given age group in region i, Treat_{it} is the treatment indicator, Post_t indicates the post-treatment period, the interaction term ($\text{Treat}_{it} \times \text{Post}_t$) in a DiD model captures the incremental effect of a policy or treatment at a specific time. *Xit* includes other covariates, $PROV_i$ and $YEAR_t$ are province and year fixed effects, and ϵ_{it} is the error term.

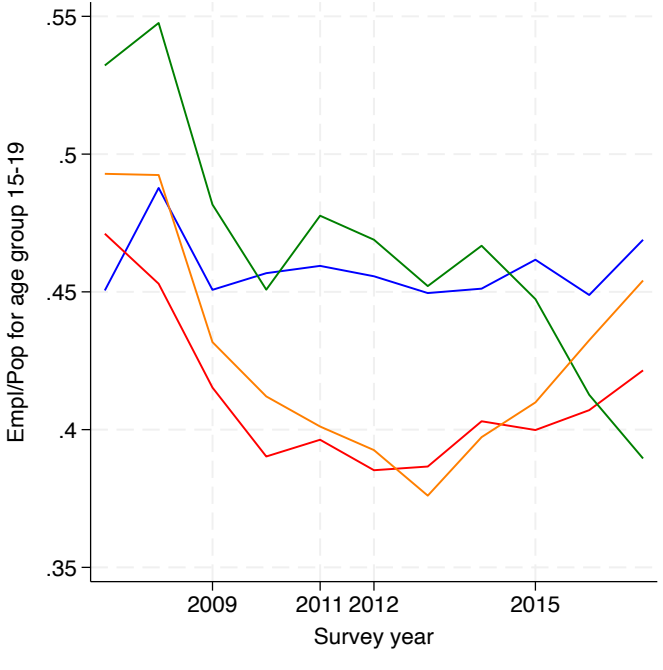
Controlling for province and year fixed effects allows us to mitigate the impact of unobserved heterogeneity across regions and time. We further account for potential autocorrelation within provinces by clustering standard errors at the provincial level, providing robustness to our estimates. This methodology is designed to yield insights into the impact of minimum wage increases on employment rates among low-wage workers, with a particular focus on the heterogeneous effects across different age groups. Through this lens, we aim to contribute to the ongoing discourse on the optimal structuring of wage policy to support labor market health and worker welfare.

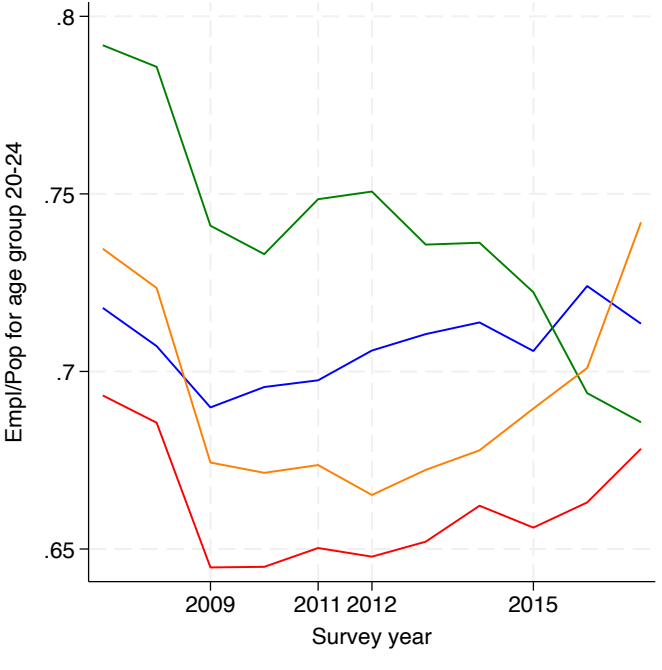
Results

The empirical analysis of the minimum wage policy changes and their impact on employment among low-wage workers in Canada reveals a complex narrative, affirmed by both statistical and visual evidence. Our Difference-in-Differences (DiD) approach rests on the foundational assumption of parallel trends. See Graph 1 below, the DiD plots serve as a preliminary check for this assumption, indicating that before the implementation of minimum wage increases, employment trends for young workers in the treated provinces—Quebec, Ontario, Alberta, and British Columbia—moved in near alignment with those in provinces not subject to the policy changes during the same periods.

This roughly parallelism in pre-treatment trends suggests that the provinces were on a comparable trajectory regarding the employment of young workers, thus satisfying the critical condition for the DiD methodology to yield valid causal inferences. The subsequent divergence in trends post-treatment, as illustrated in the DiD plots, visually captures the essence of the policy's impact. For instance, the noticeable increase in employment rates among teens in Quebec post-2011 aligns with the positive interaction term from Table 3 (0.0838^{**}) suggesting an employment-enhancing effect of the minimum wage increase for this demographic. This positive

DiD Plot for Selected Provinces in Canada 2007-2017





Graph 1

Quebec Ontario Alberta British Columbia

trend stands in contrast to the decline observed in Alberta post-2015, where the employment rates for teens dropped, mirroring the negative coefficient reported in the table (-0.0936^{**}).

The magnitude and direction of these divergences are not uniform across provinces or age groups, indicating the presence of distinct regional labor market dynamics and demographic sensitivities to wage policy alterations. In particular, the contrasting responses between teens and young adults highlight the variability in employment elasticity within these age cohorts.

Delving deeper into the regression results from Table 3, the significant coefficients for the interaction term in Quebec and Ontario suggest that minimum wage increases in these provinces were associated with an upward shift in employment for the specified age groups. However, when standard errors are clustered at the province level to account for within-province correlation, some of these effects become statistically insignificant, which underscores the importance of considering potential intraprovincial economic interdependencies.

In Alberta and British Columbia, the trends and corresponding coefficients indicate a more traditional economic narrative, wherein increased minimum wages are followed by a reduction in employment among teens. These findings contribute to a growing body of literature that documents the heterogeneous impacts of minimum wage policies, challenging the notion of a one-size-fits-all effect on employment.

The results from our study suggest that the effect of minimum wage changes on employment can be both positive and negative, with variations contingent upon regional economic conditions and demographic characteristics. This nuanced understanding of the policy's impact is critical for policymakers who must balance the goal of raising worker earnings against the potential for reduced employment opportunities.

Conclusions

Our study's results contribute to a complex tapestry of existing literature on the minimum wage's employment effects, displaying both conformity and divergence in findings. In line with studies by authors like Card and Krueger (Card & Krueger, 2000), our analysis for Quebec and Ontario indicates that increases in the minimum wage can coincide with employment growth among young workers, challenging the traditionally espoused negative correlation. Notably, the size of the estimated positive effects, particularly in Quebec, is significant, aligning with the upper bounds of effects reported in more optimistic research.

Conversely, the negative impacts observed in Alberta and British Columbia resonate with the classical viewpoint and the findings of Neumark (Neumark, 2019), reaffirming the potential for minimum wage increases to contract employment, especially among teens. However, the magnitude of these effects varies, with Alberta showing more pronounced employment reductions than British Columbia, underscoring the role of regional economic variances.

TABLE 3

Impact of Minimum Wage Policy Changes on Employment Among Low-Wage Young Workers in Selected Canadian Provinces

	Quebec 2011 treated		Ontario 2009 treated		Alterta 2015 treated		British Columbia 2012 treated	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
DiD Measure	Teens 15-19	Young Adult 20-24	Teens 15-19	Young Adult 20-24	Teens 15-19	Young Adult 20-24	Teens 15-19	Young Adult 20-24
Baseline, estimates the coefficients without clustering standard errors at the province level								
Post_treated_year	-0.000733**	0.0185**	-0.0278**	0.000878**	0.0277**	0.0193**	0.0126**	0.0187**
	(0.000111)	(7.82e-05)	(0.000132)	(8.16e-05)	(0.000124)	(7.51e-05)	(0.000135)	(8.29e-05)
Treat	-0.0177**	-0.000736**	0.0210**	-0.00630**	0.0720**	0.0640**	-0.0520**	-0.0578**
	(7.37e-05)	(5.31e-05)	(8.22e-05)	(5.24e-05)	(8.78e-05)	(5.51e-05)	(0.000104)	(6.50e-05)
TreatXPost	0.0838**	0.0340**	-0.0394**	-0.0266**	-0.0936**	-0.0544**	0.0108**	0.0196**
	(8.64e-05)	(6.08e-05)	(8.51e-05)	(5.38e-05)	(0.000141)	(8.63e-05)	(0.000131)	(8.06e-05)
Constant	0.419**	0.679**	0.462**	0.705**	0.408**	0.686**	0.462**	0.730**
	(8.91e-05)	(6.45e-05)	(0.000105)	(6.67e-05)	(9.97e-05)	(6.15e-05)	(0.000111)	(6.95e-05)
Clustering at the Province Level								
Post_treated_year	-0.000733	0.0185*	-0.0278	0.000878	0.0277	0.0193	0.0126	0.0187
	(0.0143)	(0.00718)	(0.0361)	(0.0165)	(0.0180)	(0.0105)	(0.0215)	(0.0106)
Treat	-0.0177**	-0.000736	0.0210	-0.00630	0.0720**	0.0640**	-0.0520**	-0.0578**
	(0.00360)	(0.00329)	(0.0154)	(0.00621)	(0.00387)	(0.00239)	(0.00843)	(0.00435)
TreatXPost_Clust	0.0838**	0.0340**	-0.0394	-0.0266*	-0.0936**	-0.0544**	0.0108	0.0196
	(0.00750)	(0.00622)	(0.0269)	(0.0103)	(0.0156)	(0.00875)	(0.0198)	(0.00991)
Constant	0.419**	0.679**	0.462**	0.705**	0.408**	0.686**	0.462**	0.730**
	(0.0179)	(0.00640)	(0.0164)	(0.00986)	(0.00549)	(0.00364)	(0.00851)	(0.00413)
Observations	1,857,954	1,718,038	1,857,954	1,718,038	1,857,954	1,718,038	1,857,954	1,718,038
R-squared	0.690	0.805	0.581	0.799	0.623	0.813	0.535	0.778
FE	YES	YES	YES	YES	YES	YES	YES	YES

Note: This table presents DiD estimates of the impact of minimum wage changes on employment rates among low-wage young workers in selected Canadian provinces. The analysis is segmented into two age groups: Teens (15-19) and Young Adults (20-24), across four provinces with different years of minimum wage policy changes—Quebec (2011), Ontario (2009), Alberta (2015), and British Columbia (2012). Columns (1)-(4) provide baseline estimates without clustering, while columns (5)-(8) show results with clustered standard errors at the province level. Coefficients marked with ** are significant at the 1% level, and * at the 5% level. Standard errors are in parentheses. The table incorporates province and year fixed effects, as indicated by 'FE: YES'.

The comparative significance of our results lies not just in their direction but also in their magnitude, suggesting that the relationship between minimum wage policies and employment is not uniform but context-dependent. This underscores the necessity for nuanced policy-making that considers the diversity of local labor market conditions and demographic sensitivities.

(Count: 1826)

Reference

Card, D., & Krueger, A. B. (2000, December 1). Minimum Wages and Employment: A Case Study of the Fast-Food Industry in New Jersey and Pennsylvania: Reply. *American Economic Review*, *90*(5), 1397–1420. https://doi.org/10.1257/aer.90.5.1397

Neumark, D. (2019, August 1). The Econometrics and Economics of the Employment Effects of Minimum Wages: Getting from Known Unknowns to Known Knowns. *German Economic Review*, *20*(3), 293–329. https://doi.org/10.1111/geer.12184

CAMPOLIETI, M., GUNDERSON, M., & RIDDELL, C. (2006, March 10). Minimum Wage Impacts from a Prespecified Research Design: Canada 1981–1997. *Industrial Relations: A Journal of Economy and Society*, *45*(2), 195–216. https://doi.org/10.1111/j.1468-232x.2006.00424.x

Employees with low pay, 1998 to 2021. (2022, May 30). https://www150.statcan.gc.ca/n1/pub/14-28-0001/2020001/article/00007-eng.htm

Appendix: STATA Code

```
* Set directory
cd "/Users/cherylz/Desktop/ECO339/339THA"
* Open a log, save as .txt
log using "339log" , text replace
* Load data
use "lfs0119rr.dta", clear

****************************** PART1
**************************************
* Calculate the median hourly earnings
egen medianwage = median(hrlyearn), by(prov survmnth survyear)
* Define the low pay threshold as two-thirds of the median
hourly earnings
gen lowage_threshold = 2/3 * medianwage
* Identify workers earning below this threshold
gen lowage_worker = hrlyearn < lowage_threshold
* Analyze characteristics of low wage workers
tabulate age_12 if lowage_worker, summarize(hrlyearn)
tabulate sex if lowage_worker, summarize(hrlyearn)
tabulate educ90 if lowage_worker, summarize(hrlyearn)
tabulate union if lowage_worker, summarize(hrlyearn)

gen employed = inlist(lfsstat, 1, 2)
* Have an original copy of the data
preserve

* Create the ratio of low-wage workers to total empolyed worker
for each characteristic
foreach var in age_12 sex educ90 union {
    * Count the total number of employed workers in each category
    egen total_`var' = total(employed), by(`var')

    * Count the number of low-wage workers in each group
    egen lowage_`var' = total(lowage_worker), by(`var')

    * Create a temporary file to hold ratios
    tempfile tempdata
    save `tempdata'

    collapse (sum) total_`var' lowage_`var', by(`var')

    * Generate the ratio
    gen ratio_`var' = lowage_`var' / total_`var'

    * Display the table with ratios in STATA
    list `var' ratio_`var' in 1/L, clean

    use `tempdata', clear
}


****************************** PART2
```

```
    ****************************************
50  * Collapse to see which prov to choose to be treated or
    controlled and create a minimum wage summary table
51  restore
52  collapse (mean) minwage, by(survyear prov survmnth)
53  keep if survmnth == 4
54  drop survmnth
55  format minwage %9.2f
56  reshape wide minwage, i(survyear) j(prov)
57
58  export excel using "minwage_pivot_table.xlsx", firstrow(variables
    ) replace
59
60  restore
61
62  * The outcome: employment-population ratio for a given age group
63  egen employed_rate = mean(employed), by(prov survyear age_12)
64  egen employed_rate1519 = mean(employed) if age_12 == 1, by(prov
    survyear)
65  egen employed_rate2024 = mean(employed) if age_12 == 2, by(prov
    survyear)
66
67  * Emperical Framework: Over the years of our data, some
    provinces acts as both treatment groups and control groups at
    some point in time. So we can use a DiD model with multiple
    treatments.
68  gen post2011 = (survyear >= 2011)
69  gen post2009 = (survyear >= 2009)
70  gen post2015 = (survyear >= 2015)
71  gen post2012 = (survyear >= 2012)
72
73  * Dummy Variables for Year and Region
74  foreach p in 10 11 12 13 24 35 46 47 48 59 {
75      gen prov_`p' = (prov == "`p'")
76  }
77  forvalues y = 2001/2019 {
78      gen year_`y' = (survyear == `y')
79  }
80
81  * Quebec as the treatment group
82  gen treat = (prov == 24)
83  gen treated24_2011 = treat * post2011
84
85  reg employed_rate1519 post2011 treat treated24_2011 i.prov_* i.
    year_* [aweight=fweight]
86  outreg2 using "339t1.xls", ctitle("`x'") se 2aster replace keep(
    post2011 treat treated24_2011) addtext(FE, YES)
87  reg employed_rate2024 post2011 treat treated24_2011 i.prov_* i.
    year_* [aweight=fweight]
88  outreg2 using "339t1.xls", ctitle("`x'") se 2aster append keep(
    post2011 treat treated24_2011) addtext(FE, YES)
89
```

```
90  * Ontario as the treatment group
91  drop treat
92  gen treat = (prov == 35)
93  gen treated35_2009 = treat * post2009
94
95  reg employed_rate1519 post2009 treat treated35_2009 i.prov_* i.
    year_* [aweight=fweight]
96  outreg2 using "339t2.xls", ctitle("`x'") se 2aster replace keep(
    post2009 treat treated35_2009) addtext(FE, YES)
97  reg employed_rate2024 post2009 treat treated35_2009 i.prov_* i.
    year_* [aweight=fweight]
98  outreg2 using "339t2.xls", ctitle("`x'") se 2aster append keep(
    post2009 treat treated35_2009) addtext(FE, YES)
99
100 * Alterta as the treatment group
101 drop treat
102 gen treat = (prov == 48)
103 gen treated48_2015 = treat * post2015
104
105 reg employed_rate1519 post2015 treat treated48_2015 i.prov_* i.
    year_* [aweight=fweight]
106 outreg2 using "339t3.xls", ctitle("`x'") se 2aster replace keep(
    post2015 treat treated48_2015) addtext(FE, YES)
107 reg employed_rate2024 post2015 treat treated48_2015 i.prov_* i.
    year_* [aweight=fweight]
108 outreg2 using "339t3.xls", ctitle("`x'") se 2aster append keep(
    post2015 treat treated48_2015) addtext(FE, YES)
109
110 * BC as the treatment group
111 drop treat
112 gen treat = (prov == 59)
113 gen treated59_2012 = treat * post2012
114
115 reg employed_rate1519 post2012 treat treated59_2012 i.prov_* i.
    year_* [aweight=fweight]
116 outreg2 using "339t4.xls", ctitle("`x'") se 2aster replace keep(
    post2012 treat treated59_2012) addtext(FE, YES)
117 reg employed_rate2024 post2012 treat treated59_2012 i.prov_* i.
    year_* [aweight=fweight]
118 outreg2 using "339t4.xls", ctitle("`x'") se 2aster append keep(
    post2012 treat treated59_2012) addtext(FE, YES)
119
120 * Cluster the data at the prov level, account for province-level
    fixed effects and are robust to within-province correlation in
    the error terms.
121 * Quebec as the treatment group
122 drop treat
123 gen treat = (prov == 24)
124 drop treated24_2011
125 gen treated24_2011 = treat * post2011
126
127 reg employed_rate1519 post2011 treat treated24_2011 i.prov_* i.
```

```
    year_* [aweight=fweight], cluster(prov)
128 outreg2 using "339t5.xls", ctitle("`x'") se 2aster replace keep(
    post2011 treat treated24_2011) addtext(FE, YES)
129 reg employed_rate2024 post2011 treat treated24_2011 i.prov_* i.
    year_* [aweight=fweight], cluster(prov)
130 outreg2 using "339t5.xls", ctitle("`x'") se 2aster append keep(
    post2011 treat treated24_2011) addtext(FE, YES)
131
132 * Ontario as the treatment group
133 drop treat
134 gen treat = (prov == 35)
135 drop treated35_2009
136 gen treated35_2009 = treat * post2009
137
138 reg employed_rate1519 post2009 treat treated35_2009 i.prov_* i.
    year_* [aweight=fweight], cluster(prov)
139 outreg2 using "339t6.xls", ctitle("`x'") se 2aster replace keep(
    post2009 treat treated35_2009) addtext(FE, YES)
140 reg employed_rate2024 post2009 treat treated35_2009 i.prov_* i.
    year_* [aweight=fweight], cluster(prov)
141 outreg2 using "339t6.xls", ctitle("`x'") se 2aster append keep(
    post2009 treat treated35_2009) addtext(FE, YES)
142
143 * Alterta as the treatment group
144 drop treat
145 gen treat = (prov == 48)
146 drop treated48_2015
147 gen treated48_2015 = treat * post2015
148
149 reg employed_rate1519 post2015 treat treated48_2015 i.prov_* i.
    year_* [aweight=fweight], cluster(prov)
150 outreg2 using "339t7.xls", ctitle("`x'") se 2aster replace keep(
    post2015 treat treated48_2015) addtext(FE, YES)
151 reg employed_rate2024 post2015 treat treated48_2015 i.prov_* i.
    year_* [aweight=fweight], cluster(prov)
152 outreg2 using "339t7.xls", ctitle("`x'") se 2aster append keep(
    post2015 treat treated48_2015) addtext(FE, YES)
153
154 * BC as the treatment group
155 drop treat
156 gen treat = (prov == 59)
157 drop treated59_2012
158 gen treated59_2012 = treat * post2012
159
160 reg employed_rate1519 post2012 treat treated59_2012 i.prov_* i.
    year_* [aweight=fweight], cluster(prov)
161 outreg2 using "339t8.xls", ctitle("`x'") se 2aster replace keep(
    post2012 treat treated59_2012) addtext(FE, YES)
162 reg employed_rate2024 post2012 treat treated59_2012 i.prov_* i.
    year_* [aweight=fweight], cluster(prov)
163 outreg2 using "339t8.xls", ctitle("`x'") se 2aster append keep(
    post2012 treat treated59_2012) addtext(FE, YES)
```

```
164
165 * DiD Plots for different age groups
166 collapse (mean) employed, by(prov survyear age_12)
167 keep if survyear >=2007 & survyear <= 2017
168 keep if age_12 >= 1 & age_12 <= 2
169
170 twoway (line employed survyear if prov == 24&age_12 == 1, lc(blue
    )) (line employed survyear if prov == 35&age_12 == 1, lc(red)) (
    line employed survyear if prov == 48&age_12 == 1, lc(green)) (
    line employed survyear if prov == 59&age_12 == 1, lc(orange)),
    legend(label(1 "Quebec") label(2 "Ontario") label(3 "Alberta")
    label(4 "British Columbia") col(4)) ytitle("Empl/Pop for age
    group 15-19") xlabel(2009 2012 2011 2015, valuelabel) ylabel(,
    grid) name(g1, replace)
171 twoway (line employed survyear if prov == 24&age_12 == 2, lc(blue
    )) (line employed survyear if prov == 35&age_12 == 2, lc(red)) (
    line employed survyear if prov == 48&age_12 == 2, lc(green)) (
    line employed survyear if prov == 59&age_12 == 2, lc(orange)),
    legend(off) ytitle("Empl/Pop for age group 20-24") xlabel(2009
    2012 2011 2015, valuelabel) ylabel(, grid) name(g2, replace)
172 * Install package grc1leg to create combined graphs with one
    shared legend
173 net install grc1leg,from( http://www.stata.com/users/vwiggins/)
174 grc1leg g1 g2 , legendfrom(g1) title("DiD Plot for Selected
    Provinces in Canada 2007-2017")
175
176
177 * End of log file
178 log close
179
```