



# Teen employment, poverty, and the minimum wage: Evidence from Canada<sup>☆</sup>

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## ABSTRACT

In May 2007, the U.S. Congress enacted legislation, which increased the Federal minimum hourly wage from \$5.15 to \$7.25, over a two year time period. This increase to the minimum wage was the first in nearly a decade and was approved with the objective of alleviating poverty among low-income households. However, a higher minimum wage may result in more unemployment and poverty. We exploit time-series variation in minimum wages set by Canadian provinces between 1981 and 2004. OLS and IV results suggest that a 10% increase in the minimum wage is significantly correlated with a 3%–5% drop in teen employment. Further, a 10% rise in the minimum wage is also significantly associated with a 4%–6% increase in the percentage of families living under Low Income Cut Offs (LICOs). Difference-in-difference estimates from the 1993, 1995, and 1998 waves of the Survey of Consumer Finances (SCF) support these findings as they suggest that income earned by teens constitutes a non-trivial portion of household income for families beneath Low Income Cut Offs. Therefore, a higher minimum wage may paradoxically result in a significant negative shock to household income among low-income families.

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## 1. Introduction

In 2007 the U.S. Congress passed the Fair Minimum Wage Act, which amended the Fair Labor Standards Act of 1938, raising the federal hourly minimum wage from \$5.15 to \$7.25.<sup>1</sup> The passage of the bill was a key initiative of the Democratic Party, which assumed control of the U.S. House of Representatives in January 2007. Many representatives who voted for the bill were vocal in their belief that a higher minimum wage is an effective tool for reducing poverty and improving the welfare of low-income households.<sup>2</sup> However, this view is not confined to the United States. Some policy groups in Canada are currently urging the Federal Government to increase the minimum wage to \$10 per hour, which they believe would reduce national poverty levels.<sup>3</sup>

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<sup>1</sup> The transition to higher federal minimum wages occurred through an increase to \$5.85 per hour effective 24th July 2007, \$6.55 per hour on 24th July 2007, and finally to \$7.25 per hour, effective 24th July 2009.

<sup>2</sup> See for example 'Statement by the Hon. George Miller (D-CA) on the Fair Minimum Wage Act of 2007,' available at <http://edlabor.house.gov/statements/011007GMinwage.shtml>.

<sup>3</sup> Please refer to <http://www.campaign2000.ca/BRIEFInCmtAug1508.pdf> for further details.

The problem with these opinions is that they do not reflect well-established theory and empirical work conducted by economists, which suggest that a higher minimum wage may in fact result in low-income households being made worst off. Specifically, an increase in the minimum wage results in higher costs for employers, potentially forcing them to reduce their labour force. This could lead to higher unemployment rates and an increased incidence in poverty. Such an effect would significantly impact teens, given that their demographic group constitutes the majority of minimum wage earners in the U.S. and Canada.<sup>4</sup> However, it is also possible that employment effects are minimal, or that even if a higher minimum wage results in significantly lower teen employment, there will be no corresponding shifts in poverty levels as most teens reside with parents or other older family members. In Canada, almost two-thirds of minimum wage earners live with their parents or another family member.<sup>5</sup> Therefore, the negative shocks from teen unemployment may plausibly be cushioned, if other household members retain employment and earn income.

<sup>4</sup> 2004 data from the Labour Force Surveys (LFS) conducted by Statistics Canada reveals that almost half of all minimum wage earners in Canada are between 15 and 19 years of age. Please see 'Fact Sheet on Minimum Wage', Perspectives on Labour and Income, September 2005, available at <http://www.statcan.gc.ca/studies-etudes/75-001/comm/5018829-eng.pdf>. On the other hand, estimates from the 2004 wave of Current Population Survey (CPS) show that half of all hourly-paid workers in the U.S. earning at or less than the federal minimum wage were under age 25, and about one-fourth were from 16 to 19 years of age. These statistics are available at <http://www.bls.gov/cps/minwage2004.htm>.

<sup>5</sup> 'Fact Sheet on Minimum Wage', Perspectives on Labour and Income, September 2005.

This paper attempts to resolve these ambiguities by pooling provincial Canadian data from 1981 to 2004 to estimate the impacts of the minimum wage on teen unemployment. Using Canadian data is attractive given that minimum wage legislation is set by the province, resulting in rather rich identifying variation across jurisdictions and over time.<sup>6</sup> While relying on Canadian data is certainly not a novel strategy, a contribution of this research is our attempt to assess the magnitude of potential simultaneity bias in coefficient estimates of the minimum wage through Instrumental Variables (IV) estimation.

Perhaps more importantly, we extend the literature by estimating the effects of the minimum wage on provincial poverty levels defined through Low Income Cut Offs (LICO) constructed by Statistics Canada, with the same cross-province and time-series data. The objective of this exercise is to evaluate whether increases to the minimum wage may ultimately lead to a higher incidence of poverty through more unemployment. Finally, we gain a better understanding of the dynamics surrounding teen unemployment and family poverty through the 1994, 1996, and 1998 waves of the Survey of Consumer Finances (SCF).

Our empirical exercise yields the following results. First, OLS estimates of the impact of the minimum wage with respect to teen (15 to 19 years) employment are statistically significant (at the 1% level) denoting elasticities roughly between  $-0.3$  and  $-0.5$ . These estimates are comparable across different specifications (levels, semi-log, and log-log) as well as to the inclusion of province linear trends and leaded and lagged values of the minimum wage. Second, IV estimates of the effects of the minimum wage are comparable to corresponding OLS results. Third, OLS estimates of the minimum wage with respect to LICOs of economic families are statistically significant (at the 1% level) revealing elasticities approximately between  $0.4$  and  $0.6$ . In other words, an increase in the minimum wage is significantly correlated with a higher percentage of families beneath the Low Income Cut Off. We are able to reconcile these findings as evidence from the Survey of Consumer Finances (SCF) suggests that teens earn a substantial portion of income for low-income households. Therefore, it is quite possible that a higher minimum wage may actually lead to higher poverty rates through increased teen unemployment, resulting in a significant negative shock to the household income of low-income families.

The remainder of the paper is organized as follows. The next section discusses the relevant literature. Section 3 presents some simple data trends across provinces. The empirical specifications are detailed in Section 4. Section 5 contains a summary of our main results. Finally, Section 6 concludes the paper.

## 2. Literature review

### 2.1. Minimum wage and employment

The minimum wage literature is vast and offers no clear consensus.<sup>7</sup> During the early 1980s most papers agreed that a 10% increase in the minimum wage was significantly associated with a 1%–3% drop in employment (Brown, 1999). However, subsequent research based on a ‘case study’ approach casts doubts on these findings. Specifically, Card et al. (1999), Card and Krueger (1994), Card (1992) and Katz and Krueger (1992) find a positive (and sometimes insignificant) correlation between the minimum wage and teen employment. Dube et al. (2007) do not find any significant

effects resulting from the 2004 minimum wage increase in San Francisco upon employment or hours. However, these studies have been criticised on the adequacy of control groups, small sample size, and short time frames.<sup>8</sup>

Another set of studies explore variation in the minimum wage across more states and over longer time horizons. U.S. based research includes Neumark and Wascher (1992, 1994), and Burkhauser et al. (2000). Research on Canadian provincial legislation includes Baker et al. (1999), Goldberg and Green (1999), Campolieti et al. (2005), and Campolieti et al. (2006). Canadian data are particularly rich because minimum wage legislation is enacted by the provinces rather than the federal government. Baker et al. (1999) note that both in terms of the timing and the level of minimum wage changes, Canadian data provides substantially more variation than U.S. data.<sup>9</sup> Their results suggest minimum wage elasticities (with respect to teens) of around  $-0.25$ .<sup>10</sup> In contrast, Goldberg and Green (1999) do not obtain a persistent and statistically significant relation between the minimum wage and employment. However, Campolieti et al. (2005) report an interval of  $-0.3$  to  $-0.5$  while Campolieti et al. (2006) suggest a range of  $-0.14$  to  $-0.44$ .<sup>11</sup> Using longitudinal data (from Canada) Yuen (2003) finds that teens with wages at or below a new minimum wage are more likely to experience a lower probability of employment (relative to others). Specifically, his results suggest that a 30% increase in the minimum wage is significantly correlated with a lower probability of employment (from  $-3%$  to  $-4%$ ). Employing U.S. data, Burkhauser et al. (2000) find elasticities from  $-0.2$  to  $-0.6$ .<sup>12</sup> Finally, Dube et al. (forthcoming) demonstrate that coefficient estimates of the minimum wage are sensitive to the inclusion of state linear trends and leaded values of minimum wage legislation, which are, however, important to employ in order to account for jurisdiction specific heterogeneity in employment growth.

There are benefits to using cross-state (province) and time-series data. The most obvious being that they offer variation with which to distinguish factors that change over time and across states, from the ‘pure’ minimum wage effect. However, state panel studies (and earlier time-series studies for that matter) are still subject to the issue of an endogenous minimum wage variable. For example, if policy makers are more likely to raise the minimum wage at times when the economy is stable and strong, the estimated minimum wage effect might be biased upward. Acknowledging the endogeneity problem, Neumark and Wascher

<sup>8</sup> Please refer to Neumark and Wascher (2006) for further details.

<sup>9</sup> Hammermesh (2002) also points to the rich cross-jurisdictional and time-series variation available from Canadian data.

<sup>10</sup> It is important to note that they also find that a decomposition of elasticities into short and long run components yields long run elasticities of  $-0.413$  and  $-0.092$  for teens and young adults, respectively. On the other hand short run elasticities are positive and insignificant. These results are seminal as they offer a reconciliation of the generally insignificant estimates found by the case study approach and the significant relationships obtained through data across jurisdictions and over a longer time period. In other words, an amendment to the minimum wage may not result in immediate employment effects, and may take some time before having visible labor market impacts.

<sup>11</sup> Shannon and Beach (1995) rely on micro data to study the 1991 proposal of the Ontario provincial government to raise the minimum wage to 60% of the average wage. Their simulation results suggest that the policy would reduce the number of jobs by 1.2–1.5%.

<sup>12</sup> There are, of course, studies that have investigated the effects of minimum wage legislation in other countries. Dickens et al. (1999) and Stewart (2004) find that minimum wage laws in the U.K. have had little impact on employment. On the other hand Alatas and Cameron (2008) and Gindling and Terrell (2007) report that a higher minimum wage is correlated with some adverse employment effects in Indonesia and Costa Rica, respectively. These conflicting results are mirrored in recent U.S. studies (please see Wolfson and Belman (2004), Singell and Terbork (2007), Dube et al. (2007) and Orrenius and Zavodny (2008)).

<sup>6</sup> In the U.S. some states have minimum wage higher than federal levels. Examples include Washington, California, Massachusetts and Oregon.

<sup>7</sup> For an excellent and comprehensive recent survey please refer to Neumark and Wascher (2006).

(2006) point out that few studies have attempted to correct for such simultaneity bias.<sup>13</sup> In recent research, Lemos (2005) follows a similar strategy to the one proposed by Besley and Case (2000), and constructs instruments by relying on different sets of political variables. She does not find any difference between OLS and IV estimates.

## 2.2. Poverty and the minimum wage

A growing body of literature attempts to link minimum wage policy to poverty outcomes. Burkhauser and Finegan (1988) and Burkhauser and Sabia (2007) simulate the effect of proposed minimum wage hikes in the United States, assuming no job loss. Both studies report that the hikes should decrease poverty rates. In contrast, Card and Krueger (1995) regress the change in a state's poverty rate on the fraction of workers (in 1989) that should have been affected by the 1991 U.S. federal minimum wage hike. Their results suggest that poverty rates fall as the fraction of workers increases. However, their estimates for the overall poverty rate are small and statistically insignificant. Using state level data over time, Addison and Blackburn (1999) and Burkhauser and Sabia (2007) estimate the direct effect of minimum wage on poverty rates and report a small negative relationship.<sup>14</sup> On the other hand, Millar et al. (2005) conclude that poverty, as measured by welfare caseloads, increases with minimum wage. Similarly, results from Neumark and Wascher (2002) suggest that an increase in the minimum wage is correlated with higher net poverty rates. In summary, as was the case with the employment effects of the minimum wage, there seems to be a similar lack of consensus with respect to the relationship between the minimum wage and poverty. Finally, the possibility that the minimum wage may be endogenous to poverty has been noted (but not addressed) in some of these studies.<sup>15,16</sup>

Our study expands on the above literature in the following ways. First, given the ambiguity regarding findings from previous studies, results from a different but comparable jurisdiction (Canada) should be of interest to policymakers. Second, we reassess previous findings on minimum wage elasticities by using more recent data over a longer time-series.<sup>17</sup> Third, we are unaware of any study that has attempted to simultaneously evaluate the impacts of an increase to the minimum

wage on employment as well as poverty. Fourth, we investigate the possibility that coefficient estimates of the minimum wage may be confounded because of simultaneity bias. Fifth, from the perspective of Canadian policy, this study is the first to estimate the effects of the minimum wage on (a proxy for) provincial poverty rates.

## 3. Data trends

Table A1 in Appendix A presents all amendments to the nominal minimum wage for each province for 1981 and 2004 (the beginning and end sample points). There is clear variation across provinces at the end of 1981 with Quebec and Saskatchewan possessing the highest minimum wages and Newfoundland and Nova Scotia the lowest. Most provinces implemented several amendments from 1993 to 2004. Specifically, 10 amendments to the minimum wage were enacted by Quebec, 9 by Nova Scotia, 7 by Manitoba, 6 by British Columbia and New Brunswick, 5 by Newfoundland, 4 by Saskatchewan, and finally, 3 by Alberta and Ontario. This is the main motivation for our use of data up to 2004 – a desire to exploit these time-series changes within provinces.

Figs. 1 and 2 are, respectively, scatter-plots of the teen (15 to 19 years) employment rate versus the natural logarithm of the real minimum wage and versus the percentage of all economic families falling under Low Income Cut Offs (LICO) after taxes— one of our measures of poverty.<sup>18</sup> Fig. 1 suggests a slightly negative relationship between teen employment rates and the ln (minimum wage) while a modest positive trend is visible in Fig. 2 between provincial LICOs and the ln (minimum wage). It is, of course, difficult to attribute any causal relationships on the basis of these plots. The only observation, which we make is that the data offers some interesting cross-province and time-series variation in order to identify the effects of the minimum wage. The next section suggests a more formal framework to disentangle the causal pathways between teen employment, poverty, and the minimum wage.

## 4. Empirical specification

We employ the following base specification in order to estimate the impact of minimum wages on teen employment-to-population ratios and poverty.

$$EMPTEEN_{it} \text{ or } LICO_{it} = \alpha + \beta_1 LOGRMW_{it} + \beta_2 EARN_{it} + \beta_3 UI_{it} + \beta_4 GDP_{it} + \beta_5 GTRANS_{it} + \beta_6 TEENPOP_{it} + \sum_i p_i + \sum_t Y_t + u_{it} \quad (1)$$

Here, *i* refers to the province and *t* to the year, and  $u_{it}$  is the (independently and identically distributed) error term. The data are between 1981 and 2004 for 9 Canadian provinces (excluding Prince Edward Island), yielding 216 observations.<sup>19,20</sup> All data were obtained from Statistics Canada. Summary statistics are available from Table 1.<sup>21</sup>

<sup>13</sup> Dickens et al. (1999), Machin and Manning (1994), and Katz and Krueger (1992) use minimum wage lags, changes and gaps, respectively, as instruments while Neumark and Wascher (1992) employ the average minimum wage from neighboring states. The problem with both these approaches is that, implicit in their use, they must be excluded from the employment equation. Simultaneity bias may be a reason why early studies generally find the minimum wage to be insignificantly correlated with employment trends of low wage earners. However, the significant association found in more recent studies may also be because the minimum wage has had a greater impact on the real wage distribution in recent years. We are grateful to an anonymous referee for pointing this out.

<sup>14</sup> The results are insignificant across most specifications reported by Burkhauser and Sabia (2007). Moreover when the data is limited to the 1980s, Addison and Blackburn (1999) report that minimum wage increased, rather than decreased poverty.

<sup>15</sup> Millar et al. (2005) note that if wage increases occur in response to increases in welfare caseloads the “policy variable will be endogenous and our estimates may be biased upward” (Millar et al., 2005: 291). Addison and Blackburn (1999) also allude to the endogeneity problem, stating that for early years “economic conditions were initially better in those states that did increase the wage minima and that this difference was particularly large in the poverty rate” (Addison and Blackburn (1999): p. 17).

<sup>16</sup> We are unaware of any Canadian specific research that has specifically isolated the effects of the minimum wage on poverty using an econometric approach. In terms of distributional effects Benjamin (2001) finds some evidence that low wage earners gained relatively more in provinces that experienced a larger increase in the minimum wage. However, consistent with Shannon and Beach (1995) who focus on Ontario, his results also suggest that low wages are only loosely connected with low family income and poverty. Mascella et al. (2009) find similar results using a simulation based approach.

<sup>17</sup> Baker, Benjamin, and Stanger (1999) use data from 1975 to 1992, while Campolieti et al. (2006) employ cross-province data between 1981 and 1997.

<sup>18</sup> The LICO will be discussed later in detail.

<sup>19</sup> Prince Edward Island was omitted due to missing observations for some covariates.

<sup>20</sup> The specification is constructed in order to replicate as much as possible, the methodology used by Baker et al. (1999) and Goldberg and Green (1999).

<sup>21</sup> We obtain extremely similar results whether we use a levels, log–log or semi-log specification. Different studies have relied on either of these models. However, we restrict our focus to estimates from the semi-log model denoted by Eq. (1) based on Likelihood Ratio tests comparing the logarithmic maximum likelihood across specifications. Specifically, Likelihood Ratio tests based on Box–Cox regressions do not reject the use of a semi-logarithmic specification.

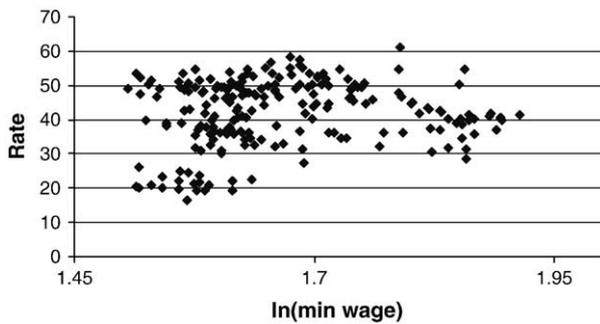


Fig. 1. Teen (ages 15–19) employment rates at observed  $\ln(\text{real minimum wages})$ .

#### 4.1. Dependent variables

Teen employment-to-population ratios ( $EMPTEN_{it}$ ) denote the proportion of teens employed as a fraction of the total number of teens in a given province, which serves as our proxy for low-wage workers. We use this measure as our dependent variable to assess the impact of provincial minimum wage policies. This is a common measure in the literature, as it captures teen employment fluctuations independently from trends in teen population.

Trends in the poverty rate are captured through different measures of the percentage of economic families with (before and after taxes) income below the Low Income Cut ( $LICO_{it}$ ). The use of Low Income Cut Offs (LICOs) as a proxy for poverty comes with the following caveats. First, it is important to emphasize that LICOs do not officially represent Canada's poverty line.<sup>22</sup> Instead, they are intended to convey the income level at which a family may be in 'strained circumstances' because it has to spend a greater proportion of its income on necessities than the average family of similar size. Statistics Canada defines the threshold as the income below which a family is likely to spend 20 percentage points more of its income on food, shelter and clothing than the average family.<sup>23</sup> Therefore, the LICO is a measure of relative rather than absolute well-being.<sup>24</sup>

However, in the absence of an official measure of poverty, the LICO has been widely used in empirical work. Phipps (1993) used LICOs as well as other indices to measure poverty, while Osberg (2003) employed the LICO to evaluate policy impacts on poverty in Canada. We take comfort from the fact that Osberg (2003) obtained quite similar results from employing the LICO and the proportion of families below one half of the median income – a much more robust proxy for poverty.<sup>25</sup> Finally, the LICO is not that different from poverty cut off rates employed in recent U.S. research such as Burkhauser and Sabia (2007).<sup>26</sup>

We use the following LICO measures to capture trends in poverty: all families; economic families with two or more members; the

<sup>22</sup> Statistics Canada is particularly careful to point out that the LICO is not intended as a measure of poverty. In 1997, when referring to the use of LICO lines as poverty lines, Statistics Canada's Chief Statistician, Ivan Fellegi warned, "We regularly and consistently emphasize that these are quite different from measures of poverty. They reflect a well-defined methodology which identifies those who are substantially worse off than the average. Of course, being significantly worse off than the average does not necessarily mean that one is poor... Statistics Canada does not and cannot measure the level of poverty in Canada." (Sarilo, 2000: 21).

<sup>23</sup> The LICO is constructed for varying family sizes and different places of residence. The greater the level of urbanization, the higher the income amount required to reach the Low Income Cut Off.

<sup>24</sup> Further, being a 'cut-off', the LICO cannot measure poverty intensity through the poverty gap, which is essentially the difference between the poverty line and how far families, on average, are away from it.

<sup>25</sup> Osberg (2003) contains an excellent discussion of the implications of using LICOs as poverty indices.

<sup>26</sup> As in Card and Krueger (1995), Burkhauser and Sabia (2007) calculate state poverty rates based on the following classification. An individual aged 16–64 is defined as living in poverty if the ratio of family income to the family size-adjusted federal poverty line is less than 1.

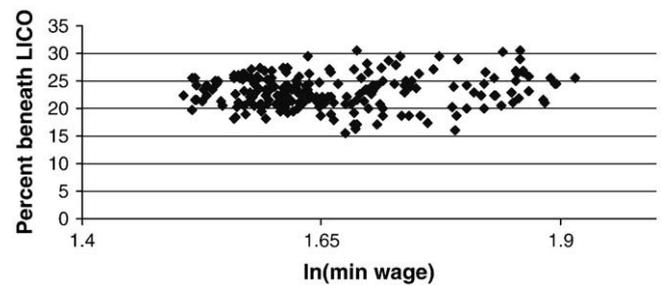


Fig. 2. Percent of economic families that fall below the Low Income Cut Off (LICO) at observed  $\ln(\text{real minimum wages})$ .

elderly; and two parent households with children. Each of these measures consists of the percentage of families falling below the specific Low Income Cut Off for each category. Our study employs before as well as after tax figures.

#### 4.2. Covariates

The natural logarithm of the nominal legislated minimum wage deflated by the consumer price index ( $LOGRMW_{it}$ ) is the key policy variable in our model.<sup>27</sup> We also include average annual earnings of workers paid on an hourly basis in real dollars ( $EARN_{it}$ ) to capture the effects of changes in the minimum wage relative to growth patterns observed in average wages. Prime aged unemployment rates for males ( $UI_{it}$ ) and the real provincial Gross Domestic Product ( $GDP_{it}$ ) are used to control for provincial economic cycles. These variables are used to quantify the effects of economic conditions on teen employment and poverty. Teen population as a proportion of the working age population ( $TEENPOP_{it}$ ) is used to account for the effects on teen employment that are due to an increasing or decreasing proportion of teens eligible for labour force participation.<sup>28</sup> Finally, federal and provincial transfers to the poorest quintile of population in real dollars ( $GTRANS_{it}$ ) are employed to account for shifts in welfare transfers.

We employ additional covariates when a LICO is the dependent variable. This is because there are potential determinants of poverty that do not necessarily affect trends in teen employment.<sup>29</sup> First, we construct variables capturing the proportion of population aged 50 to 59 as well as those who are aged 60–64. The 50–59 covariate represents the effects of demographic changes from aging baby boomers while the 60–64 covariate focuses on more elderly individuals. The intent is to control for the elderly population, who are at obvious risk for poverty. Second, we include unemployment rates for specific industries: forestry, fishing, mining, oil and gas; construction; and manufacturing. We also construct a variable that denotes the number of new immigrants per capita of population.

Finally, province and year fixed effects are used to control for any unobserved policy shocks that may be correlated with movements in the minimum wage and are either specific to a province over time or for a year across provinces. We also assess the sensitivity of our findings through the use of province specific linear trends as opposed to province fixed effects. Therefore, the effects of changes to the minimum wage are identified by pooling time-series variation within provinces and either holding constant unobserved province and year specific differences or controlling for unobserved province specific differences that trend over time.

<sup>27</sup> The legislated minimum wage by province is available from: <http://srv116.services.gc.ca/wid-dimt/mwa/index.aspx?report=report2&dec=2>.

<sup>28</sup> Essentially, this variable accounts for supply variations (McDonald and Myatt, 2004: 6).

<sup>29</sup> We thank an anonymous referee for recommending these additional controls.

**Table 1**  
Summary statistics (1981–2004).

Variable	Acronym	Mean	Standard Dev.	Min	Max
Teen employment-to-population ratio	$EPTEEN_{it}$	0.421	0.095	0.164	0.610
% of economic families with income below LICO (before tax)	$LICOB_{it}$	14.41	2.78	8.2	25.2
% of economic families with income below LICO (after tax)	$LICOAT_{it}$	10.03	2.12	5.7	18.2
% of elderly families with income below LICO (before tax)	$ELICOB_{it}$	10.34	5.3	0.7	28.7
% of elderly families with income below LICO (after tax)	$ELICOAT_{it}$	3.78	2.4549621	0.3	13.9
% of two parent families with income below LICO (before tax)	$TLICOB_{it}$	12.3	3.13	6.2	26.6
% of two parent families with income below LICO (after tax)	$TLICOAT_{it}$	8.64	2.51	2.8	20.7
In real minimum wage (\$)	$LOGRMW_{it}$	1.664	0.100	1.506	1.915
Prime aged male unemployment rate (%)	$U_{it}$	8.9	3.6	2.5	19.1
Unemployment rate for forestry employees (%)	$FUNEMP_{it}$	11.66	8.9588221	2.2	24.6
Unemployment rate for construction employees (%)	$CUNEMP_{it}$	17.45	7.59	5.6	39.3
Unemployment rate for manufacturing employees (%)	$MUNEMP_{it}$	9.66	4.38	3.3	27.9
Real provincial GDP (\$)	$GDP_{it}$	89,889	105,720	7911	473,530
Average annual earnings for hourly-paid employees (excluding overtime) (\$)	$EARN_{it}$	5894.444	1343.188	2600	12,400
Average government transfers to poorest quintile (\$)	$GTRANS_{it}$	7606.481	1002.441	5300	10,300
Teen pop. over total population	$TEENPOP_{it}$	0.113	0.017	0.087	0.175
Progressive conservative dummy	$PC_{it}$	0.463	0.500	0	1
Liberal dummy	$LIB_{it}$	0.241	0.429	0	1
New democratic party dummy	$NDP_{it}$	0.185	0.390	0	1
Other political parties dummy	$OTHER_{it}$	0.111	0.315	0	1
20–24 employment-to-population ratio	$EP2024_{it}$	0.509	0.006	0.464	0.567
20–24 pop./total population	$POP2024_{it}$	0.117	0.019	0.094	0.176
25–44 employment-to-population ratio	$EP254_{it}$	0.755	0.067	0.584	0.850
25–44 pop./total population	$POP2544_{it}$	0.465	0.027	0.401	0.527
50–59 pop./total population	$POP5059_{it}$	0.10	0.0166	0.076	0.152
60–64 pop./total population	$POP6064_{it}$	0.041	0.004	.031	0.051
New immigrants per population	$IMMIGP_{it}$	0.0043	0.0034	0.0005	0.014
Regional average real minimum wage (\$)	$REGAV_{it}$	5.305	0.444	4.630	6.620
Proportion of workforce who are unionized	$UNION_{it}$	36.713	7.453	22.90	57.60
Proportion of employment in the trade and retail sector	$TRADE_{it}$	0.164	0.011	0.140	0.200

## 5. Results

### 5.1. Benchmark estimates

Table 2 contains OLS (panel A) and IV (panels B and C) estimates using the teenage employment-to-population ratio as the dependent variable and employing province level data from 1981 to 2004. Unless stated otherwise, standard errors of OLS estimates are clustered by province and year. Empirical estimates in panel A are presented as follows. Column 1 is the base specification, which consists of an estimate of the relationship between teen employment-to-population ratios and the natural logarithm of the minimum wage ( $LOGRMW_{it}$ ) in isolation from all other explanatory variables but for province and year fixed effects. Column 2 incorporates the other covariates of Eq. (1) as explanatory exogenous variables ( $U_{it}$ ,  $GDP_{it}$ ,  $TEENPOP_{it}$ ,  $EARN_{it}$ ,  $GTRANS_{it}$ ). Column 3 evaluates the sensitivity of these results by replacing province specific fixed effects with province linear trends. Finally, column 4 reports corresponding estimates from a specification where the dependent variable and all covariates are in natural logarithms. For the sake of brevity, we do not report the coefficient estimates of additional controls and focus on coefficient estimates of the minimum wage.

The first important result is the negative correlation between teen employment-to-population ratios ( $EMPTEEN_{it}$ ) and the minimum wage ( $LOGRMW_{it}$ ) in column 1, which is statistically significant (at the 1% level) with an implied elasticity of  $-0.33$ . The statistical significance of the minimum wage ( $LOGRMW_{it}$ ) persists (at the 1% level) in column 2 with the inclusion of other covariates. The implied elasticity suggests that, on average, a 10% increase in the minimum wage is significantly associated with a 4.6% reduction in the teen employment-to-population ratio ( $EMPTEEN_{it}$ ). Empirical estimates in column 3 reveal that coefficient estimates of all covariates remain virtually unchanged in magnitude and precision if we use province specific linear trends instead of province fixed effects. Coefficient

estimates from the log–log model (in column 4) are also very comparable to corresponding estimates in columns 2 and 3.

As a sensitivity analysis, we ran regressions with province and year fixed effects and province linear trends using the above semi-logarithmic model as well as log–log and levels specifications.<sup>30</sup> Intriguingly, coefficient estimates of the real minimum wage remained statistically significant (at either the 1% or 5% levels) across all specifications with smaller but comparable implied elasticities.<sup>31</sup> Despite these results, we view the use of province linear trends along with province and year fixed effects as over-parametrization, given the province-year nature of our data. Therefore, for the remainder of the paper, we focus on estimates from semi-logarithmic models with either province and year fixed effects, or through employing province linear trends with year fixed effects.

In summary, our results offer strong evidence of a statistically significant association between a higher minimum wage and lower teen employment. Further, our interval of minimum wage elasticities between  $-0.3$  and  $-0.5$  is slightly above the estimate obtained by Baker et al. (1999), but comparable to the  $-0.30$  ‘point estimate’ and  $-0.3$  to  $-0.5$  interval reported by Campolieti et al. (2006) and Campolieti et al. (2005), respectively. This is informative given our use of more recent data over a longer time dimension.

<sup>30</sup> Employing U.S. quarterly data on employment and earnings of employees of restaurants (NAICS codes 7221 and 7222) between 1990 and 2006 and aggregated to the county level, Dube et al. (forthcoming) initially obtain minimum wage elasticities that are statistically significant and consistent with traditional estimates. However, they are not robust to the use of state level trends, suggesting the presence of spatial heterogeneity that could be the result of unobserved local labour market policies and corresponding employment trends.

<sup>31</sup> Estimates from semi-log, log–log, and levels models yielded implied elasticities of  $-0.13$ ,  $-0.3$ , and  $-0.25$ , respectively. Detailed results are available upon request.

**Table 2**  
OLS and IV estimates of the effects of the minimum wage on teen employment.

	(1)	(2)	(3)	(4)
<i>A. OLS</i>				
In real minimum wage ( <i>LOGRMW<sub>it</sub></i> )	−0.139 (0.033)***	−0.194 (0.033)***	−0.194 (0.033)***	−0.530 (0.082)***
[elasticity]	[−0.330]	[−0.461]	[−0.461]	
Prime aged male unemployment rate, real provincial GDP, average earnings, government transfers, teen pop. over total population.	No	Yes	Yes	Yes
Province linear trends	No	No	Yes	Yes
Province FE	Yes	Yes	No	No
Year FE	Yes	Yes	Yes	Yes
R square	0.9201	0.5609	0.9607	0.9594
	Regular IV	Conditional IV	Regular IV	Conditional IV
<i>B. First stage IV</i>				
F-test	14.90	13.85	15.10	9.88
P value	[0.000]	[0.000]	[0.000]	[0.000]
Conservative ( <i>PC<sub>it</sub></i> )	0.083 (0.020)***	Yes	0.074 (0.020)***	Yes
Liberal ( <i>LIB<sub>it</sub></i> )	0.056 (0.018)***	Yes	0.046 (0.018)***	Yes
New democratic party ( <i>NDP<sub>it</sub></i> )	0.124 (0.020)***	Yes	0.109 (0.020)***	Yes
Regional average real minimum wage ( <i>REGAV<sub>it</sub></i> )			−0.023 (0.019)	Yes
Proportion of workforce who are unionized ( <i>UNION<sub>it</sub></i> )			−0.009 (0.003)***	Yes
Proportion of employment in the trade and retail sector ( <i>TRADE<sub>it</sub></i> )			0.287 (0.507)	Yes
<i>C. Second stage IV</i>				
In real minimum wage ( <i>LOGRMW<sub>it</sub></i> )	−0.181 (0.067)***	−0.181 (0.060)***	−0.244 (0.059)***	−0.244 (0.052)***
[elasticity]	[−0.430]	[−0.430]	[−0.580]	[−0.580]
[Confidence interval − 5% LEVEL]	[−0.314, −0.048]	[−0.300, −0.063]	[−0.360, −0.127]	[−0.347, −0.140]
Other exogenous covariates	Yes	Yes	Yes	Yes
Province FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
R square	0.9609	0.9609	0.9601	0.9601
Obs	216	216	216	216

Notes: The above OLS estimates are obtained from pooling data across 9 Canadian provinces (excluding Prince Edward Island) between 1981 and 2004. Coefficient estimates are presented with standard errors (clustered by province and year), which are in parentheses underneath. Elasticity, at the mean, is given in square brackets. For province and year fixed effects, Quebec is the omitted province and 1988 is the omitted year dummy.

\*\*\* denotes significant at 1% level.

5.2. Instrumental variables

Thus far, we have considered the effects of minimum wage increases on teen employment under the assumption that amendments to the minimum wage are exogenous to teen employment. However, it is plausible that increases to the minimum wage might be a policy response to increases in low-wage unemployment. Should this be the case, then our least squares estimations will result in coefficient estimates that are biased and inconsistent. As proposed by Besley and Case (2000), we construct instruments based on the political party in power in each province. The intuition is that certain policies are identified with a specific party, and implemented if that party assumes power.

In the sample period, five parties formed provincial governments. These parties include the Progressive Conservative Party (*PC<sub>it</sub>*), the Liberal Party (*LIB<sub>it</sub>*), the New Democratic Party (*NDP<sub>it</sub>*), the Social Credit Party, and the Parti Quebecois. We define four dummy variables to capture the variation in governing parties. First, *PC<sub>it</sub>* equals 1 if the governing party is the Progressive Conservative Party and 0 otherwise. Second, *LIB<sub>it</sub>* equals 1 if the governing party is the Liberal Party and 0 otherwise. Third, *NDP<sub>it</sub>* equals 1 if the governing party is the New Democratic Party and 0 otherwise. Therefore, the omitted category is if the governing party is either the Parti Quebecois or the Social Credit Party, which are regionally based, as

opposed to the other parties, which are represented in almost all other provinces.<sup>32</sup>

As is the case in some other countries, left wing political parties in Canada possess ideologies that promote social policies more than right wing parties. Hence, if a left leaning party forms a provincial government, then it follows that minimum wage hikes are more likely to occur than in provinces that are governed by parties that are less left leaning.<sup>33</sup> In this respect, the Conservative Party is considered to be more right wing than the other parties. In contrast, the NDP is generally viewed to be the most left leaning, and is therefore most likely to support increased wage floors. The Liberal party also leans to the left but less so than the NDP. On the other hand, the Social Credit Party and Parti Quebecois support a mix of both left and right wing oriented policies.

We do not exclusively rely on the above political party dummies and include other potential determinants of the minimum wage.<sup>34</sup> First, we employ the regional average minimum wage (*REGAV<sub>it</sub>*),

<sup>32</sup> Specifically, the Parti Quebecois is exclusively confined to the province of Quebec, while the Social Credit Party is based in British Columbia.

<sup>33</sup> As noted in Green and Harrison (2009), such an ideology can be explained by a model of altruistic preferences, which is consistent with redistribution and policies aimed at reducing income inequality.

<sup>34</sup> These instruments are motivated by Green and Harrison (2009). We are extremely grateful to David Green for sharing his data.

which is the average of the minimum wage set by all the other provinces in the region, with the exception of the province in question. The three regions are: Atlantic (Newfoundland, PEI, Nova Scotia and New Brunswick), Central (Ontario and Quebec), and West (Manitoba, Saskatchewan, Alberta and British Columbia).<sup>35</sup>

Our other instruments are based on the influence of lobby groups that are typically captured through political economy models.<sup>36</sup> As noted by Becker (1983), policy decisions are impacted by the competing influence of interest groups who are affected in some manner through such decisions. In this respect, unions usually support increases to the minimum wage while small or retail business owners are on the opposite side. In this spirit, we employ the unionization rate ( $UNION_{it}$ ) among the labour force in a province, as well as the proportion that work in the retail and trade sector ( $TRADE_{it}$ ) as instruments.

First and second stage IV regressions are contained in panels B and C, respectively. Columns 1 and 2 contain results from regular and conditional IV regressions, respectively. Similarly, columns 3 and 4 consist of regular and conditional IV estimates. The difference among columns stems from employing political party dummies as instruments in columns 1 and 2, and the use of additional instruments (regional average minimum wage ( $REGAV_{it}$ ), the unionization rate ( $UNION_{it}$ ), and the proportion of workers employed in the retail and trade sector ( $TRADE_{it}$ )) in columns 3 and 4. Conditional IV estimates are based on the procedure recommended by Moreira and Poi (2003), in order to deal with possibly weak instruments. Even if the instruments are strongly correlated with the endogenous variable, the use of their methodology produces confidence intervals that are informative.<sup>37,38</sup>

Empirical estimates from first stage regressions demonstrate that coefficient estimates of all political party dummies are statistically significant at either the 1% or 5% levels of significance.<sup>39</sup> Further, statistics from the *F*-test of joint significance either roughly equal or are greater than 10, which mitigate concerns that second stage estimates might be unreliable.<sup>40</sup> Therefore, we can comfortably reject the null hypothesis that coefficient estimates of the instruments are equal to zero. We also conducted a test of the over-identifying restrictions. The null hypothesis of exogeneity of the instruments could not be rejected.<sup>41</sup> These results suggest that our instruments have the necessary properties to satisfactorily explain trends in the minimum wage, while remaining uncorrelated with the error term.

<sup>35</sup> Green and Harrison (2009) motivate the use of the regional average minimum wage based on evidence from interviews with policymakers from different provinces, which suggest that they track changes to the minimum wage in neighboring provinces. Of course, the use of the regional average minimum wage as an instrument necessitates the assumption that teen employment in a province is unaffected by changes to the minimum wage in neighboring provinces, which may not be true, especially if teens have low mobility costs. However, as noted, Green and Harrison (2009) are not isolated in their use of the regional average minimum wage as an instrument. Neumark and Wascher (1992) also employ a similar strategy.

<sup>36</sup> As noted by Green and Harrison (2009), relevant discussion is available from Dickson and Myatt (2002) for Canada, and Sobel (1999) for the United States.

<sup>37</sup> Moreira and Poi (2003) state on page 57 of their article: "The conditional approach is then used to find critical value functions for Wald and likelihood ratio tests yielding correct rejection probabilities no matter how weak the instruments. Together with the Anderson–Rubin and score tests, the conditional Wald and likelihood ratio tests can be used to construct confidence intervals that have correct coverage probability even when instruments may be weak and that are informative when instruments are good."

<sup>38</sup> We are very grateful to Phil Oreopoulos for recommending this procedure to us.

<sup>39</sup> The stata code from Moreira and Poi (2003) do not yield specific first stage coefficient estimates.

<sup>40</sup> Please see Staiger and Stock (1997) for further details. We are extremely grateful to an anonymous referee for pointing this out.

<sup>41</sup> We employ the procedure recommended by Hansen (1982). The test statistic is given by  $O = s^2(Z'e)'(Z'Z)^{-1}(Z'e)$ , where  $Z$  is the matrix of instruments,  $e$  is the vector of error terms from the second stage IV estimation routine and  $s^2$  is the estimated variance of the error terms from this regression. Under the null hypothesis of exogeneity of the instruments,  $O$  is distributed  $\chi^2$  with degrees of freedom given by the number of overidentifying restrictions ( $J+1$ ), where  $J$  is the number of endogenous variables.

In terms of specific estimates, the presence of either a Liberal or Conservative government (in column 3) is significantly correlated with between a roughly 0.5 and 0.7 increase in the natural logarithm of the real minimum wage. On the other hand, the coefficient estimate for the NDP covariate is slightly higher at roughly 0.11. These results conform with expectations, as a higher minimum wage is a key platform for many provincial NDP parties.<sup>42</sup> However, the other instruments do not offer much explanatory power. Coefficient estimates of the regional average minimum wage ( $REGAV_{it}$ ) and proportion employed in the retail and trade sector ( $TRADE_{it}$ ) are statistically insignificant. The unionization rate ( $UNION_{it}$ ) is statistically significant, but possesses a counter-intuitive negative sign.

Broadly speaking, second stage IV estimates are very similar in magnitude to corresponding OLS results. The effect of the minimum wage ( $LOGRMW_{it}$ ) on teen employment-to-population ratios ( $EMPTEN_{it}$ ), in terms of the elasticity, is negative, with values of  $-0.43$  or  $-0.58$ . Coefficient estimates of other explanatory variables remain more or less unchanged in terms of magnitude and statistical precision relative to corresponding OLS estimates in the previous table, and are therefore, not reported for the sake of brevity. We also do not report results from IV regressions based on province linear trends and year fixed effects, as they are remarkably similar to IV estimates with province and year fixed effects. Finally, it is interesting to observe that confidence intervals of minimum wage elasticities become tighter in columns 3 and 4 with the use of additional instruments. However, these results should be viewed with caution given that not all of the additional instruments – specifically the regional average minimum wage and the proportion of workers employed in the retail and trade sector – are statistically significant.

### 5.3. Further sensitivity analysis

Table 3 contains OLS results from the addition of leaded values and lags of the minimum wage. Column 1 contains two, three and four year lagged values while column 2 studies the effects of including two, three, and four year leaded values. Column 3 investigates the effects of including all the above lagged and leaded values. The inclusion of these lags and leads reduces our sample size to the years 1985–2000 and therefore, 144 observations. The estimable equation thus becomes;

$$\begin{aligned} EMPTEN_{it} = & \alpha + \beta_1 LOGRMW_{it} + \beta_2 LOGRMW_{i,t+2} + \beta_3 LOGRMW_{i,t+3} \\ & + \beta_4 LOGRMW_{i,t+4} + \beta_5 LOGRMW_{i,t-2} + \beta_6 LOGRMW_{i,t-3} \\ & + \beta_7 LOGRMW_{i,t-4} + \beta_8 EARN_{it} + \beta_9 UI_{it} + \beta_{10} GDP_{it} + \beta_{11} GTRANS_{it} \\ & + \beta_{12} TEENPOP_{it} + \sum_i P_i + \sum_t Y_t + u_{it}. \end{aligned} \quad (2)$$

The motivation for including leads is to evaluate whether coefficient estimates of the minimum wage are biased because of unobserved spatial heterogeneity. Specifically, it is possible that jurisdictions which frequently enact amendments to the minimum wage are also more likely to implement other policies, which impact local labour market conditions. In the extreme case, contemporary estimates of the minimum wage might not be robust to the inclusion of leaded values. This would then suggest that the statistically significant correlation between teen employment and the minimum wage we have so far obtained is merely an artifact of unobserved

<sup>42</sup> For example see NDP wants '\$2 boost in B.C. minimum wage', available at <http://www.cbc.ca/canada/british-columbia/story/2007/04/12/bc-wages.html>.

**Table 3**  
OLS estimates of the effects of leads and lags in the minimum wage.

	(1)	(2)	(3)
In real minimum wage ( $LOGRMW_{it}$ )	−0.117 (0.037)***	−0.19 (0.042)***	−0.10 (0.04)**
[elasticity]	[−0.28]	[−0.46]	[−0.24]
Two year lagged In real minimum wage ( $LOGRMW_{it}$ )	−0.094 (0.045)**		−0.083 (0.045)**
[elasticity]	[−0.23]		[−0.2]
Three year lagged In real minimum wage ( $LOGRMW_{it}$ )	−0.076 (0.062)		−0.091 (0.063)
[elasticity]			
Four year lagged In real minimum wage ( $LOGRMW_{it}$ )	−0.018 (0.055)		−0.007 (0.054)
[elasticity]			
Two year leaded In real minimum wage ( $LOGRMW_{it}$ )		−0.115 (0.072)	−0.095 (0.066)
[elasticity]			
Three year leaded In real minimum wage ( $LOGRMW_{it}$ )		0.051 (0.085)	0.07 (0.08)
[elasticity]			
Four year leaded In real minimum wage ( $LOGRMW_{it}$ )		0.02 (0.07)	0.015 (0.064)
[elasticity]			
Prime aged male unemployment rate, real provincial GDP, average earnings, government transfers, teen pop. over total population.	Yes	Yes	Yes
Province FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
R square	0.9799	0.9768	0.9804
Obs	144	144	144

Notes: The above OLS estimates are obtained from pooling data across 9 Canadian provinces (excluding Prince Edward Island) between 1985 and 2000. Coefficient estimates are presented which are in parentheses *beside*. Elasticity, at the mean, is given in square brackets. For province and year fixed effects, Quebec is the omitted province and 1988 is the omitted year dummy.

\*\*\* denotes significant at 1% level, \*\* denotes significant at 5% level.

province specific heterogeneity.<sup>43</sup> On the other hand, employing lagged values is an evaluation of whether the impacts of the minimum wage occur within the year or actually take some time to affect teen employment.

Coefficient estimates of the contemporary minimum wage are statistically significant (either at the 1% or 5% levels) across all columns – even with the use of leaded and lagged values. Implied elasticities of the contemporary minimum wage range from −0.24 to −0.46 and are comparable to previous estimates. Empirical estimates of all leaded values of the minimum wage are statistically insignificant, suggesting that coefficient estimates of the contemporary minimum wage are not confounded by unobserved heterogeneity. In contrast, two year lagged values (in columns 1 and 3) are statistically significant (at the 5% level), implying that the complete impacts of an amendment to the minimum wage take longer than a year.

The results are consistent with Baker et al. (1999) who suggest that the longer run effects of the minimum wage may be significant. Campolieti et al. (2006) also focus on lagged values of the minimum wage. However, we are careful in the emphasis we place on this finding given that not all the lagged minimum wage covariates are statistically significant. Despite their statistical significance, it is also important to note the negative signs of the two year leads and the positive signs of the three year leads in columns 2 and 3, which imply a rather big drop in the outcome variable between these time periods. What we do infer is that coefficient estimates of the minimum wage remain statistically robust even after employing lagged values and with a considerable reduction in the sample size (from 216 to 144 observations).

There are other strategies to assess the presence of unobserved heterogeneity. Dube et al. (2010) establish the importance of evaluating the relationship between employment and the minimum wage while controlling for changes in the minimum wage over a longer time period. Since they have multiple overlapping changes to the minimum wage, they do not use a pure event strategy, and instead employ distributed lag and lead models, which allows one to study

the impacts of cumulative as opposed to point changes in the natural logarithm of the minimum wage.

We employ comparable specifications to evaluate the effects of lagged and leaded changes in the minimum wage.<sup>44</sup> Similar to Dube et al. (2010) we rely on a model in which the employment rate, the minimum wage, and leaded and lagged changes to it are in natural logarithms, allowing us to interpret the resulting coefficient estimates as elasticities. Other covariates are kept in levels form.<sup>45</sup> The first specification takes the following form;

$$\begin{aligned} \ln(EMPTEEN_{it}) = & \alpha + \beta_1 LOGRMW_{it} + \beta_2 [LOGRMW_{i,t+3} - LOGRMW_{i,t+2}] \\ & + \beta_3 [LOGRMW_{i,t+4} - LOGRMW_{i,t+3}] \\ & + \beta_4 [LOGRMW_{i,t-2} - LOGRMW_{i,t-3}] \\ & + \beta_5 [LOGRMW_{i,t-3} - LOGRMW_{i,t-4}] \\ & + \beta_6 EARN_{it} + \beta_7 UI_{it} + \beta_8 GDP_{it} + \beta_9 GTRANS_{it} \\ & + \beta_{10} TEENPOP_{it} + \sum_i P_i + \sum_t Y_t + u_{it}. \end{aligned} \tag{3}$$

$\beta_2$  represents the effect of the difference between the natural logarithms of real minimum wages leaded three and two years, while  $\beta_3$  captures the impact of the difference between four and three year leads.  $\beta_4$  and  $\beta_5$  represent the effects of differences between two and three year lagged and three and four lagged values, respectively.

<sup>43</sup> We are extremely grateful to an anonymous referee for suggesting this exercise.

<sup>44</sup> We cannot use an identical model given that Dube et al. (forthcoming) employ quarterly data, which permits them to construct changes in leaded values of the minimum wage between 12 and 4 quarters in the future.

<sup>45</sup> Our results did not change if the other right hand variables were also converted into natural logarithms.

The second model investigates the effects of longer differences and multiple overlapping years. Specifically, instead of relying on differences between consecutive years, we use two year differences;

$$\ln(EMPTEEN_{it}) = \alpha + \beta_1 LOGRMW_{it} + \beta_2 [LOGRMW_{i,t+4} - LOGRMW_{i,t+2}] + \beta_3 [LOGRMW_{i,t+3} - LOGRMW_{i,t+1}] + \beta_4 [LOGRMW_{i,t-2} - LOGRMW_{i,t-4}] + \beta_5 [LOGRMW_{i,t-1} - LOGRMW_{i,t-3}] + \beta_6 EARN_{it} + \beta_7 UI_{it} + \beta_8 GDP_{it} + \beta_9 GTRANS_{it} + \beta_{10} TEENPOP_{it} + \sum_i P_i + \sum_t Y_t + u_{it} \quad (4)$$

$\beta_2$  ( $\beta_3$ ) now captures the effect of the differences between the natural logarithms of four (three) and two (one) year lead values.  $\beta_4$  and  $\beta_5$  measure the impacts of corresponding lags. As was the case with regressions in Table 3, the data are between 1985 and 2000 for 9 Canadian provinces. OLS estimates (clustered by province-year) of the minimum wage and its lags and leads from (3) and (4) are graphed in Figs. 3 and 4, respectively. Confidence intervals (at the 5% level) are also constructed. 'b1' in both graphs is the coefficient estimate of the natural log of the minimum wage, 'b2', 'b3' are the coefficients of the leaded changes, while 'b4' and 'b5' are the effects of the lagged changes.

The coefficient estimate of ( $LOGRMW_{it}$ ) in Fig. 3 (Fig. 4) is  $-0.47$  ( $-0.49$ ) and statistically significant at the 1% level. These estimates are quite comparable to our previous findings. The coefficient estimates of the leaded and lagged changes are of varying signs and are never statistically significant. In summary, we find no evidence that coefficient estimates of the minimum wage are confounded by unobserved heterogeneity.

As a final exercise we ran OLS and IV regressions to estimate the effects of the minimum wage on employment–population ratios of older prime-age workers. We view this as a relevant exercise in order to assess whether coefficient estimates of the minimum wage (with respect to teen employment) are merely a reflection of other unobserved labour market policies or shocks that are economy wide and not specific to teens. While OLS and IV estimates with respect to 20–24 year olds are statistically imprecise, corresponding results with respect to 25–44 olds are significant at the 10% levels. However, minimum wage elasticities are much smaller in magnitude, relative to findings for teen employment. Specifically, OLS and IV estimates suggest that a 10% increase in the minimum wage is significantly correlated with a 1.4% drop in employment among 25–44 year olds. In summary, these findings do yield some support to the notion that coefficient estimates of the minimum wage with respect to teen employment are not contaminated by to unobserved labour market shocks that impact employment trends across all ages.<sup>46</sup>

Our analysis has offered some evidence that increases in the minimum wage have a significant negative effect on teen employment-to-population ratios – our proxy for low-wage employment. We now turn our attention to the potential welfare implications of our results. In this respect, we investigate the links between the employment effects of minimum wage policy and corresponding trends in poverty levels. This is relevant given that the original intent of minimum wage legislation was to protect low-wage workers from exploitation. However, the evolution of public and political sentiment has served to change the focus of minimum wage policy to one of poverty alleviation. In the following sections we address two important questions. First, how does minimum wage legislation affect poverty? Second, conditional on a (statistically significant) relation-

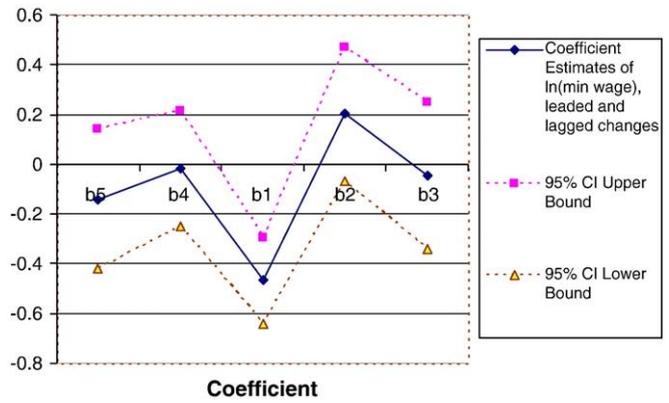


Fig. 3. Coefficient estimates and confidence intervals for the effect of single lagged and leaded changes of ln(real minimum wage) on teen employment. Note: The above OLS estimates are obtained from pooling data across 9 Canadian provinces between 1981 and 2004. Coefficient estimates are derived from the log–log model presented in Eq. (3), where b1 is the coefficient estimate on  $LOGRMW_t$ , b2 and b3 are the coefficient estimates on  $[LOGRMW_{t+3} - LOGRMW_{t+2}]$  and  $[LOGRMW_{t+4} - LOGRMW_{t+3}]$ , and b4 and b5 are the coefficient estimates on  $[LOGRMW_{t-2} - LOGRMW_{t-3}]$  and  $[LOGRMW_{t-3} - LOGRMW_{t-4}]$  respectively.

ship between the minimum wage and poverty, what is the nexus between teen employment and household poverty?

#### 5.4. Poverty

Table 4 contains OLS estimates using different Low Income Cut Offs (LICO) as the dependent variable and employing province level data from 1981 to 2004. Panels A, B, and C contain estimates with respect to all families, the elderly, and two parent families, respectively. Within each panel, columns 1 and 2 consist of results based on LICO calculated before tax while columns 3 and 4 report estimates using after tax data. Further, columns 1 and 3 control for province and year fixed effects and columns 2 and 4 include province linear trends and year fixed effects.

The first important result is the positive correlation between the percentage of all families with income below the LICO and the minimum wage ( $LOGRMW_{it}$ ) across all columns in panel A. Coefficient estimates of the real minimum wage are statistically significant (at the 1% level) with implied elasticities between 0.4 and 0.6. In contrast, the minimum wage does not share a statistically significant association

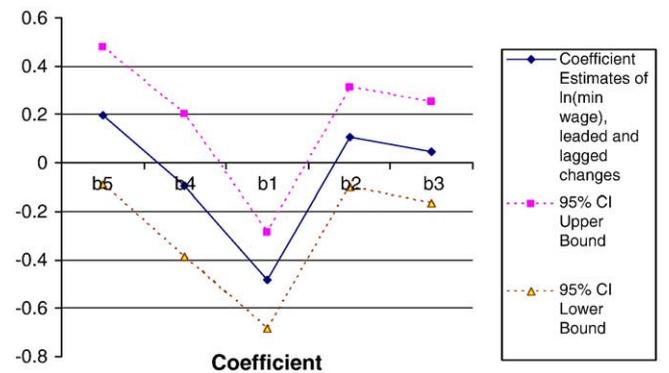


Fig. 4. Coefficient estimates and confidence intervals for the effect of double lagged and leaded changes of ln(real minimum wage) on teen employment. Note: The above OLS estimates are obtained from pooling data across 9 Canadian provinces between 1981 and 2004. Coefficient estimates are derived from the log–log model presented in Eq. (4), where b1 is the coefficient estimate on  $LOGRMW_t$ , b2 and b3 are the coefficient estimates on  $[LOGRMW_{t+4} - LOGRMW_{t+2}]$  and  $[LOGRMW_{t+3} - LOGRMW_{t+1}]$ , and b4 and b5 are the coefficient estimates on  $[LOGRMW_{t-2} - LOGRMW_{t-4}]$  and  $[LOGRMW_{t-1} - LOGRMW_{t-3}]$  respectively.

<sup>46</sup> Detailed econometric estimates are available upon request.

Table 4

OLS estimates of the effects of the minimum wage on the percentage of families with incomes below the LICO.

	(1) Before tax	(2) Before tax	(3) After tax	(4) After tax
<b>A. All economic families</b>				
In real minimum wage ( $LOGRMW_{it}$ )	8.9125 (2.11)***	6.21 (2.24)***	7.24 (1.8)***	5.25 (1.78)***
[elasticity]	[0.63]	[0.43]	[0.72]	[0.52]
Prime aged male unemployment rate, real provincial GDP, average earnings, government transfers, teen pop. over total population, new immigrants per population, unemployment rates for forestry, construction, manufacturing, proportion of population 50–59, proportion of population 60–64.	Yes	Yes	Yes	Yes
Province linear trends	No	Yes	No	Yes
Province FE	Yes	No	Yes	No
Year FE	Yes	Yes	Yes	Yes
R square	0.8119	0.7948	0.7751	0.7591
<b>B. Elderly</b>				
In real minimum wage ( $LOGRMW_{it}$ )	–1.77 (3.55)	–1.01 (3.99)	0.201 (2.26)	1.21 (2.44)
[elasticity]	[0.17]	[0.097]	[0.053]	[0.32]
Prime aged male unemployment rate, real provincial GDP, average earnings, government transfers, teen pop. over total population, new immigrants per population, unemployment rates for forestry, construction, manufacturing.	Yes	Yes	Yes	Yes
Province linear trends	No	Yes	No	Yes
Province FE	Yes	No	Yes	No
Year FE	Yes	Yes	Yes	Yes
R square	0.8332	0.7890	0.7553	0.7314
<b>C. Two parent families</b>				
In real minimum wage ( $LOGRMW_{it}$ )	11.46 (2.59)***	14.49 (2.77)***	7.94 (2.14)***	8.09 (2.06)***
[elasticity]	[0.73]	[0.8]	[0.72]	[0.82]
Prime aged male unemployment rate, real provincial GDP, average earnings, government transfers, teen pop. over total population, new immigrants per population, unemployment rates for forestry, construction, manufacturing.	Yes	Yes	Yes	Yes
Province linear trends	No	Yes	No	Yes
Province FE	Yes	No	Yes	No
Year FE	Yes	Yes	Yes	Yes
R square	0.7261	0.7152	0.6791	0.6360
Obs	216	216	216	216

Notes: The above OLS estimates are obtained from pooling data across 9 Canadian provinces (excluding Prince Edward Island) between 1981 and 2004. Coefficient estimates are presented with standard errors (clustered by province and year) in parentheses underneath. Elasticity, at the mean, is given in square brackets. For province and year fixed effects, Quebec is the omitted province and 1988 is the omitted year dummy. \*\*\* denotes significant at 1% level.

with the percentage of elderly beneath the LICO (panel B). However, results from panel C demonstrate that a 10% increase in the minimum wage is significantly correlated (at the 1% level) with a 0.7–0.8% rise in the percent of two parent families beneath the respective LICO.

These findings offer some evidence that a higher minimum wage is associated with an increase in different measures of poverty. These impacts are especially strong for two parent families. This specific finding is a useful robustness test as it strengthens the possibility that a higher minimum wage may result in more household poverty (through a rise in teen unemployment). On the other hand, as one might expect – an increase in the minimum wage does not share any significant relationship with the percent of elderly under the LICO. This is reassuring as it corresponds with our earlier finding of a statistically insignificant relation between the minimum wage and employment trends among older workers. We obtain similar results whether we use province fixed effects or linear trends. Further, our findings are comparable across before and after tax figures.

### 5.5. Survey of Consumer Finances

In tandem, our empirical results suggest that an increase in the minimum wage results in more teen unemployment as well as more families living below the Low Income Cut Off. These findings can be reconciled if teens contribute a significant amount to the family income of low-income households. In order to investigate this, we

extracted data from the 1993, 1995, and 1998 waves (public use version) of the Survey of Consumer Finances (SCF) conducted by Statistics Canada. We use these surveys as they are specifically conducted to provide data on cross-sectional income for low-income families in Canada. As a result, there is rather detailed information on total income earned by all members within low-income households.<sup>47</sup>

Table 5 contains sample statistics of the total proportion of teens separately for all survey respondents beneath (panel A) and at or above the LICO (panel B). We also construct the sample mean proportion of teens who earn 26% or more of household income.<sup>48</sup> In this respect, sample statistics are remarkably consistent across the different waves. First, teens constitute 9%–10% of all survey respondents for individuals beneath as well as at or above the Low Income Cut Off. However, the proportion of teens who earn 26% or more of household income is much higher for individuals beneath the LICO, ranging from 2.4% to 2.8%. Hence, a little less than 30% of all teens beneath the LICO report earning a significant portion of household income.<sup>49</sup> In contrast, the proportion of teens who are at or above the

<sup>47</sup> The SCF is a supplement annually to the April Labour Force Survey (LFS). Data for the SCF is collected through income questionnaires mailed to 4/6 of LFS households.

<sup>48</sup> Household income consists of total earnings, total investment income, total government transfer payments, retirement pensions, superannuation and annuities, and other money income.

<sup>49</sup> For example the proportion of teen respondents beneath the LICO from the 1993 SCF is 9.5% while the proportion of teens who report earning 26% or more of household income from the same survey is 2.6%. Therefore  $2.6\%/9.5\% = 0.274$ .

**Table 5**  
1993, 1995, and 1998 Survey of Consumer Finances.

	1993	1995	1998
<i>A. Under LICO</i>			
Proportion of teen respondents	0.095 (0.29)	0.101 (0.30)	0.096 (0.29)
Survey respondents who are teens and who earn 26% or more of household income	0.026 (0.16)	0.028 (0.166)	0.024 (0.154)
Total observations (under LICO)	11,712	11,861	10,597
<i>B. At or above LICO</i>			
Proportion of teen respondents	0.09 (0.29)	0.088 (0.28)	0.09 (0.29)
Survey respondents who are teens and who earn 26% or more of household income	0.004 (0.06)	0.004 (0.06)	0.003 (0.06)
Total observations (above LICO)	65,624	64,916	58,036
<i>C. Regression results (dependent variable – 1/0 dummy of whether an individual earns 26% of household income)</i>			
Teen respondent * LICO	0.143 (0.040)***	0.154 (0.022)***	0.126 (0.022)***
Teen respondent (1–15 to 19 years of age; 0 otherwise)	–0.713 (0.006)***	–0.716 (0.004)***	–0.726 (0.005)***
LICO (1 if person is below LICO; 0 otherwise)	0.092 (0.009)***	0.099 (0.006)***	0.093 (0.008)***
Gender (1– male; 0 otherwise)	0.23 (0.008)***	0.22 (0.004)***	0.216 (0.007)***
Province fixed effects	Yes	Yes	Yes
R square	0.2539	0.2492	0.2602
Total observations	77,336	76,777	68,633

Figures in parentheses in panels A and B (C) are standard deviations (standard errors). Standard errors in panel C are clustered by province. \*\*\* denotes significant at 1% level.

LICO and report earning 26% or more of household income range is 0.03% or 0.04%. These figures offer some suggestive evidence that teens contribute significantly towards household income for families below Low Income Cut Offs.

Panel C contains some more rigorous analysis through difference-in-difference regressions for each wave. The dependent variable is a 1/0 dummy denoting whether an individual earns 26% or more of household income. Dummies are used to denote whether an individual is a teen, beneath the LICO, male, and the province of evidence. The key covariate is the interaction between the teen and LICO dummies. The resulting coefficient estimate yields the marginal effect of a teen who is beneath a LICO relative to a teen at or above the cut-off.

Empirical estimates are remarkably similar across waves. As expected, being a teen is significantly and negatively correlated (at the 1% level) with earning 26% or more of household income. On the other hand, an individual beneath a LICO is more likely to report earning a significant amount of household income. Gender is also important, as being a male is significantly (at the 1% level) and positively correlated with the dependent variable. Most important, the interaction between the teen and LICO dummies is positive and statistically significant (at the 1% level) across all waves. The specific coefficient estimates imply that a teen beneath the LICO is 0.13–0.15 more likely to report earning a significant amount of household income relative to a teen at or above the LICO, controlling for all else. Therefore, the above analysis presents some compelling trends, which support the view that teen employment may have some rather significant consequences to family income for households that are below Low Income Cut Offs.

## 6. Conclusion

Does an increase in the minimum wage make lower income households better or worse off? We address this question by estimating the effects of the minimum wage on teen employment and the percentage of families beneath Low Income Cut Offs, using data across Canadian provinces and over time from 1981 to 2004. There are a limited number of studies that have estimated the effects of the minimum wage on poverty. While many studies have focused on the impacts of the minimum wage on teen employment, few have addressed the potential for simultaneity bias. Further, relative to other Canadian research, we employ more recent data over a longer time-series for each province. Finally, we attempt to establish a link between teen unemployment and the probability of a household falling beneath a specific measure of poverty.

OLS and IV estimates yield minimum wage elasticities (between –0.3 and –0.5) that are similar to those obtained by previous studies. OLS results with respect to the effects of the minimum wage on the percentage of families falling beneath Low Income Cut Offs, imply elasticities between 0.4 and 0.6. These findings can be reconciled with data from the 1993, 1995, and 1998 waves of the Survey of Consumer Finances, which reveal that income earned by teens constitutes a non-trivial portion of total family income among low-income households.

From a policy perspective, a common argument has been that even if a higher minimum wage does result in lower employment for some, the corresponding welfare costs are low since the number of minimum wage earners as a proportion of the labour force is relatively low. Further, the effects of unemployment (from a minimum wage hike) may not be severe as a significant majority of minimum wage earners live with another family member. Therefore, a higher minimum wage should unambiguously make lower wage earners better off through higher earnings, and therefore, a reduced incidence of poverty.

Our results suggest the contrary. The ‘negative’ effects of an increase in the minimum wage might not be restricted to higher teen unemployment. A higher minimum wage may paradoxically result in more poverty as teen unemployment results in a drop in household income among low-income families. Therefore, the negative spillovers of a higher minimum wage may be significant and mitigate the benefits of higher earnings to the working poor who remain employed.

As noted in Benjamin (2001), Stigler (1946, 358) set out the relevant yardsticks for policy debate on the minimum wage: “The popular objective of minimum wage legislation—the elimination of extreme poverty—is not seriously debatable. The important questions are rather (1) Does such legislation diminish poverty (2) Are there Efficient Alternatives?”. A conservative interpretation of our results is that low-income households may not necessarily benefit from an increase to the minimum wage. They of course, do not imply that the 2007 Fair Minimum Wage Act will definitely result in more teen employment and poverty – especially given that the Act was only passed after tax cuts to small businesses were approved, in order to ameliorate the potential negative impacts of a higher minimum wage. However, in agreement with Benjamin (2001), our results do imply that a higher minimum wage may be a blunt tool to alleviate poverty incidence. At the very least, the results of this study suggest the need for more research on the nexus between the minimum wages and poverty.

## Appendix A

Legislative changes to the nominal minimum wage (\$ per hour).

Province	Month year (nominal minimum wage \$ per hour)
Alberta	Year End 1980 (3.50), May 1981 (3.80), September 1988 (4.50), April 1992 (5.00), October 1998 (5.40), April 1999 (5.65), October 1999 (5.90).
British Columbia	Year End 1980 (3.65), July 1988 (4.50), October 1989 (4.75), April 1990 (5.00), February 1992 (5.50), April 1993 (6.00), March 1995 (6.50), October 1995 (7.00), April 1998 (7.15), November 2000 (7.60), November 2001 (8.00).
Manitoba	Year End 1980 (3.25), March 1981 (3.35), September 1981 (3.55), July 1982 (4.00), January 1985 (4.30), April 1987 (4.50), September 1987 (4.70), March 1991 (5.00), July 1995 (5.25), January 1996 (5.40), April 1999 (6.00), April 2001 (6.25), April 2002 (6.50), April 2003 (6.75).
New Brunswick	Year End 1980 (3.35), October 1982 (3.80), September 1986 (4.00), April 1989 (4.25), October 1989 (4.50), October 1990 (4.75), October 1991 (5.00), January 1996 (5.25), July 1996 (5.50), January 2000 (5.75), July 2001 (5.90), August 2002 (6.00).
Newfoundland and Labrador	Year End 1980 (3.25), April 1981 (3.45), January 1983 (3.75), January 1985 (4.00), April 1988 (4.25), April 1991 (4.75), September 1996 (5.00), April 1997 (5.25), October 1999 (5.50), May 2002 (5.75), November 2002 (6.00).
Nova Scotia	Year End 1980 (3.25), October 1981 (3.30), October 1982 (3.75), January 1985 (4.00), January 1989 (4.50), October 1991 (4.75), January 1992 (5.00), January 1993 (5.15), October 1996 (5.35), February 1997 (5.50), October 1999 (5.60), October 2000 (5.70), October 2001 (5.80), October 2002 (6.00), October 2003 (6.25).
Ontario	Year End 1980 (3.25), April 1981 (3.30), October 1981 (3.50), March 1984 (3.85), October 1984 (4.00), October 1986 (4.35), October 1987 (4.55), October 1988 (4.75), October 1989 (5.00), October 1990 (5.40), November 1991 (6.00), November 1992 (6.35), January 1994 (6.70), January 1995 (6.85).
Quebec	Year End 1980 (3.65), April 1981 (3.85), October 1981 (4.00), October 1986 (4.35), October 1987 (4.55), October 1988 (4.75), October 1989 (5.00), October 1990 (5.30), October 1991 (5.55), October 1992 (5.70), October 1993 (5.85), October 1994 (6.00), October 1995 (6.45), October 1996 (6.70), October 1997 (6.80), October 1998 (6.90), February 2001 (7.00), October 2002 (7.20), February 2003 (7.30).
Saskatchewan	Year End 1980 (3.65), January 1981 (3.85), July 1981 (4.00), January 1982 (4.25), August 1985 (4.50), January 1990 (4.75), July 1990 (5.00), December 1992 (5.35), December 1996 (5.60), January 1999 (6.00), May 2002 (6.35), November 2002 (6.65).

Source: <http://srv116.services.gc.ca/wid-dimt/mwa/index.aspx?report=report2&dec=2> and authors' calculations. Minimum wages typically change on the first of each month. Changes that occur on the 31st are recorded as occurring on the 1st of the subsequent month. Newfoundland minimums apply to ages 16 and older.

## References

- Addison, J.T., Blackburn, M.L., 1999. Minimum wages and poverty. *Industrial and Labor Relations Review* 52 (3), 393–409.
- Alatas, V., Cameron, L., 2008. The impact of minimum wages on employment in a low-income country: a quasi-natural experiment in Indonesia. *Industrial and Labor Relations Review* 61 (2), 201–223.
- Baker, M., Benjamin, D., Stanger, S., 1999. The highs and lows of the minimum wage effect: a time-series cross-section study of the Canadian Law. *Journal of Labour Economics* 17 (2), 318–350.
- Becker, G., 1983. A theory of competition among pressure groups for political influence. *The Quarterly Journal of Economics* 98 (3), 371–400.
- Benjamin, D., 2001. Minimum wages in Canada. In: Berry, Albert (Ed.), *Labor Market Policies in Canada and Latin America: Challenges of the New Millennium*. Kluwer Academic Publishers, pp. 187–220.
- Besley, T., Case, A., 2000. Unnatural experiments? Estimating the incidence of endogenous policies. *The Economic Journal* 110, 672–694.
- Brown, C., 1999. Minimum wages, employment, and the distribution of income. In: Ashenfelter, O., Card, D. (Eds.), *Handbook of Labor Economics*, vol. 3B. Elsevier Science, North Holland: Amsterdam, New York and Oxford, pp. 2101–2163.
- Burkhauser, R., Finegan, T.A., 1988. The minimum wage and the poor: the end of a relationship. *Journal of Policy Analysis and Management* 8 (1), 53–71.

- Burkhauser, R., Couch, K., Wittenburg, D., 2000. A reassessment of the new economics of the minimum wage literature using monthly data from the CPS. *Journal of Labor Economics* 18, 653–680 (July).
- Burkhauser, R., Sabia, J., 2007. The effectiveness of minimum wage increases in reducing poverty: past, present and future. *Contemporary Economic Policy* 25 (2), 262–281.
- Campolieti, M., Gunderson, M., Riddell, C., 2006. Minimum wage impacts from a prespecified research design: Canada 1981–1997. *Industrial Relations* 45 (2), 195–216.
- Campolieti, M., Fang, T., Gunderson, M., 2005. Minimum wage impacts on youth employment transitions, 1993–1999. *Canadian Journal of Economics* 38 (1), 81–104.
- Card, D., 1992. Do minimum wages reduce employment? A case study of California, 1987–89. *Industrial and Labor Relations Review* 46 (1), 38–54.
- Card, D., Krueger, A., 1995. *Myth and Measurement: The New Economics of the Minimum Wage*. Princeton University Press, Princeton.
- Card, D., Krueger, A., 1994. Minimum wages and employment: a case study of the fast food industry in New Jersey and Pennsylvania. *American Economic Review* 84 (4), 772–793.
- Card, D., Kramarz, F., Lemieux, T., 1999. Changes in the relative structure of wages and employment: a comparison of Canada, France and the United States. *Canadian Journal of Economics* 32, 843–877.
- Dickens, R., Machin, S., Manning, A., 1999. The effects of minimum wages on employment: theory and evidence from Britain. *Journal of Labor Economics* 17, 1–22 (January).
- Dickson, V., Myatt, T., 2002. The determinants of provincial minimum wages in Canada. *Journal of Labor Research* 23 (1), 57–67.
- Dube, A., Lester, T.W., Reich, M., 2010. Minimum Wage Effects Across State Borders: Estimates Using Contiguous Counties. *Review of Economics and Statistics* 92 (4), 945–964.
- Dube, A., Naidu, S., Reich, M., 2007. The economic effects of a citywide minimum wage. *Industrial and Labor Relations Review* 60 (4), 522–543.
- Gindling, T.H., Terrel, K., 2007. The effects of multiple minimum wages throughout the labor market: the case of Costa Rica. *Labour Economics* 14 (3), 485–511.
- Goldberg, M., Green, D., 1999. Raising the floor: the social and economic benefits of minimum wages in Canada. *Canadian Centre for Policy Alternatives*. September.
- Green, D., Harrison K., 2009. Minimum wage setting and standards of fairness. Working Paper, 841 UBC, available at <http://www.econ.ubc.ca/green/homepage.htm>.
- Hammermesh, D., 2002. International labor economics. *Journal of Labor Economics* 20, 709–732.
- Hansen, L., 1982. Large sample properties of generalized method of moments estimators. *Econometrica* 50, 1029–1054.
- Katz, L., Krueger, A., 1992. The effect of the minimum wage on the fast food industry. *Industrial and Labor Relations Review* 46 (1), 6–21.
- Lemos, S., 2005. Political variables as instruments for the minimum wage. *Contributions to Economic Analysis and Policy* 4 (1) 1425–1425, Article 16.
- Machin, S., Manning, A., 1994. The effects of minimum wages on wage dispersion and employment: evidence from the U.K. *Wages Councils*. *Industrial and Labor Relations Review* 47 (2), 319–329.
- McDonald, J., Myatt, A., 2004. The minimum wage effect on youth employment in Canada: testing the robustness of cross-province panel studies. University of New Brunswick Working Paper. May.
- Mascella, A., Teja, S., Thompson, B.S., 2009. Minimum wage increases as an anti-poverty policy in Ontario. *Canadian Public Policy* 35, 373–379.
- Millar, J., Page, M., Spetz, J., 2005. Does the minimum wage affect welfare caseloads? *Journal of Policy Analysis and Management* 24 (2), 273–295.
- Moreira, Marcelo, Poi, B., 2003. Implementing tests with correct size in the simultaneous equations model. *Stata Journal* 3 (1), 57–70.
- Neumark, D., Wascher, W., 2006. Minimum wages and employment: a review of evidence from the new minimum wage research. NBER Working Paper 12663.
- Neumark, D., Wascher, W., 2002. Do minimum wages fight poverty? *Economic Inquiry* 40 (3), 315–333.
- Neumark, D., Wascher, W., 1994. Employment effects of minimum and subminimum wages: reply to Card, Katz, and Krueger. *Industrial and Labor Relations Review* 47 (3), 497–512.
- Neumark, D., Wascher, W., 1992. Evidence on employment effects of minimum wages and subminimum wage provisions: panel data on state minimum wage laws. *Industrial and Labor Relations Review* 46 (1), 55–81.
- Orrenius, P., Zavodny, M., 2008. The effect of minimum wages on immigrants' employment and earnings. *Industrial and Labor Relations Review* 61 (4), 544–563.
- Osberg, L., 2003. Poverty in Canada and the United States: measurement, trends, and implications. *Canadian Journal of Economics* 33 (4), 847–877.
- Phipps, S., 1993. Measuring poverty among Canadian households: sensitivity to choice of measure and scale. *Journal of Human Resources* 28 (1), 162–184.
- Sarlo, C., 2000. *The Minimum Wage and Poverty: A Critical Evaluation*. August. [http://www.crfca.ca/issues/issues\\_current\\_minimumwagesarlo.htm](http://www.crfca.ca/issues/issues_current_minimumwagesarlo.htm) Accessed May 21, 2004.
- Shannon, Michael T., Beach, Charles M., 1995. Distributional employment effects of Ontario minimum-wage proposals: a microdata approach. *Canadian Public Policy* 21 (3), 284–303.
- Singell Jr, L.D., Terborck, J.R., 2007. Employment effects of two northwest minimum wage initiatives. *Economic Inquiry* 45 (1), 40–55.
- Sobel, R.S., 1999. Theory and evidence on the political economy of the minimum wage. *Journal of Political Economy* 107 (4), 761–785.
- Staiger, D., Stock, J.H., 1997. Instrumental variables regression with weak instruments. *Econometrica* 65, 557–586.
- Stewart, M., 2004. The impact of the introduction of the U.K. minimum wage on the employment probabilities of low-wage workers. *Journal of the European Economic Association* 2 (1), 67–97.
- Stigler, George, 1946. The economics of minimum wage legislation. *American Economic Review* 36 (3), 358–365.
- Yuen, T., 2003. The effect of minimum wages on youth employment in Canada: a panel study. *The Journal of Human Resources* 38 (3), 647–672.
- Wolfson, P., Belman, D., 2004. Minimum wage: consequences for prices and quantities in low-wage labor markets. *Journal of Business and Economics Statistics* 22 (3), 296–311.