The Employment Effects of the Minimum Wage

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Abstract

This paper re-examines the employment effects of a change in the minimum wage for teenagers. Furthermore, the employment effects for adults aged 25-44 are examined. The analysis of this paper follows that of Campolieti et al. (2006). The analysis in this paper shows that the minimum wage has a negative effect on the employment rate of the 15-24 year old age group and the 25-44 year old age group. The employment effect of the minimum wage is larger (in absolute value) for the 15-24 year old age group than for the 25-44 year old age group.

1. Introduction

A legally binding minimum wage is one of the many policy tools aimed at increasing the earnings of low wage workers and tackling the distributional inequality of income. When higher wages are mandated simple, supply-and-demand models predict that employment should fall. However, in the real world the actual employment outcomes may be more complex. Empirical analysis of the minimum wage effect on employment is necessary to evaluate minimum wage legislation against alternative policy measures in order to ensure the most effective and efficient policy is in place.

The employment effect of minimum wage policy is of particular importance in Ontario given the recent changes in minimum wage policy. In 2009 the minimum wage in Ontario was $9.50/hr, while in 1996 it was $6.85/hr; this represents an increase of 38.6 percent in 13 years meanwhile, inflation was about 31 percent over the same 13 year period. Classical labour demand theory suggests a negative employment effect from increasing the minimum wage. Empirical investigation of the employment effects of the minimum wage must be carried out in order to determine whether or not the predictions of classical theory hold true. Once a reliable estimate of the employment effect has been obtained, the effectiveness of minimum wage policy at raising the earnings of low-wage workers can be evaluated.

There are many stakeholders affected by minimum wage policy. About 22 percent of 15-24 year olds and 2.5 percent of 25-44 year olds earned the minimum wage in 2007

in Ontario.[1] For many of these low-wage workers an increase in the legal minimum will mean more income. However, there are also the workers that may face layoffs if the minimum wage is too high for firms to adapt to. Furthermore, there are also the individuals who are currently not in the labour force for whom a higher minimum wage may make it worth their while to join the labour force. There are firms for whom a higher minimum wage means higher operating costs and lower profits; these firms may face the choice of having to make layoffs or increase their expectations of worker performance. The largest group of stakeholders is society as a whole that may face a significant loss of welfare due to potentially higher prices and potentially higher costs as more displaced workers join the unemployment rolls. With all of these parties and more affected by minimum wage policy, proper and careful analysis must be conducted to ensure the best outcome for all stakeholders.

Much of literature on the employment effects of the minimum wage focuses on teenage employment. This paper re-examines teenage employment effects and extends the analysis to the 25-44 year old age group. The employment effect for the 15-24 year old age group was estimated to be –0.244, while the employment effect for the 25-44 year old age group was found to be -0.192. The rest of this paper will proceed as follows; the next section will discuss the important papers in the minimum wage/employment debate. The following section will examine the data that has been used to examine this policy question and the variables that were constructed to facilitate this analysis. The fourth section will introduce the model and the estimation strategy. The fifth section will

[1] The province with the highest proportion of both age groups earning minimum wage was P.E.I in 2007 – 30% of 15-24 year olds and 6.5% of 25-44 year olds; the province with the lowest proportion of both age groups earning minimum wage was Alberta - 1.6% of 15-24 year olds and 0.3% of 25-44 year olds.

discuss the findings of this study, and the final section will summarize the findings and conclude.

2. Literature Review

The articles that were reviewed for this paper were either theoretical or empirical in their scope. The theoretical literature offers predictions of the employment responses to changes in the minimum wage. Following the theoretical review, the empirical literature on the employment effects of the minimum wage will be examined. This body of literature seeks to estimate the employment effects of the minimum wage using a variety of techniques; from time-series and panel studies to the quasi-experimental methods of the new minimum wage research.

In order to understand what is being tested in the empirical literature, one must be familiar with the predictions of dynamic labour demand theory. Dynamic labour demand theory provides the framework for the evaluation of empirical minimum wage policy studies. In this framework two simplifying assumptions are often made: 1) labour is the only input into the production process, and 2) there is no distinction being made between employment and hours of work. Although according to Hammermesh (1993) these assumptions are unrealistic and over-simplify the firm's problem, these assumptions will allow for more convenient analysis of the employment effects of the minimum wage. The dynamic labour demand framework suggests that adjustments to wage shocks take place over a period of time due to adjustment costs experienced by the firm and therefore necessitates the use of time series techniques to analyze demand responses suggested by

dynamic labour demand theory. In fact, many of the empirical studies conducted in Canada use panel techniques to analyze the employment effects of the minimum wage.[2] The model discussed in Hamermesh (1993) is characterized by, among other things perfect markets. For predictions of the employment effect of minimum wage policy in a second-best setting one must look elsewhere. Marceau and Boadway (1994) attempt to define the conditions under which minimum wage policy can achieve the goal of greater income equality amongst workers; in Marceau and Boadway (1994) the authors set out to formally derive such conditions. In a second-best setting that includes non-linear taxes, a minimum wage and unemployment insurance the authors find that income redistribution can be achieved through the instruments of minimum wage and employment insurance in the case where the social planner cannot observe skill levels. The key to understanding this paper is that the analysis is conducted in a second-best setting. The theory examined here seems to suggest that with imperfect competition and second-best solutions the minimum wage may be able to achieve the goal of redistributing income.

Results from the "New Minimum Wage Research" literature have found employment effects that are often contrary to the predictions of classical labour demand theory. When examining the results from this approach to estimating the employment effect one must be aware of the phenomenon of monopsony or monopsonistic competition in the labour market. Bhaskar and To (1999) propose a model of monopsonistic competition in the labour market with the feature that an increase in the

[2] The fact that minimum wage falls under provincial jurisdiction and exhibits considerable variation makes the Canadian minimum wage experience all the more suited to these panel studies.

minimum wage can actually lead to increased employment in surviving firms. The model in this paper does not state that an absolute industry wide increase in employment will result, but rather that some firms will employ more labour and other firms will exit the industry. Free entry and exit of firms is the main characteristic that separates the model of Bhaskar and To (1999) from models of pure monopsony and models of oligopsonistic labour markets. Manning (2003) examines the role of monopsony in explaining the observed phenomenon of a spike in the wage distribution around the minimum wage and of the empirical findings of quasi-experimental studies that increasing the minimum wage has led to no or positive employment effects. The author stresses that in competitive markets a spike in the wage distribution has implications that undermine the notion of firms being price-takers in the labour market. Also, he stresses the importance of the effects of the minimum wage around the spike and at other points in the wage distribution – the spillover effects. In reference to the employment effects Manning (2003) questions the non-competitive models that predict employment increases from increasing the minimum wage. Manning (2003) does not rule out such results but cautions that the potential upside of a well selected minimum wage rate pale in comparison to the potential downside of a minimum wage set too high.

While classical labour demand theory with perfect markets predicts a decrease in employment following an increase in the minimum wage, the extensions of this model that examine outcomes in a second-best setting allow for minimum wage policy to be a potentially effective tool of income redistribution. Meanwhile, monopsony models or models of monopsonistic competition in the labour market offer an alternative set of

predictions to classical labour demand theory. These models suggest that under certain conditions increasing the minimum wage can cause employment increases at the individual firm level and possibly have ramifications for workers much higher up on the wage distribution. The review of literature will continue by looking at the findings from empirical minimum wage studies.

Swidinsky (1980) examines the impact of the minimum wage on teenage employment in Canada. Swidinsky (1980) looks at both the workers displaced by the minimum wage and their subsequent decision to remain unemployed or withdraw from the labour force and the decision of workers previously not in the labour force to attempt to find work at the new, higher rate. The author concludes that the usual approach of estimating dis-employment effects will likely overstate the effect of the minimum wage on the unemployment rate. Brown et al. (1982) survey the minimum wage literature in an attempt to discover what, if anything, minimum wage scholars of the time reach a consensus on. Brown et al. (1982) concludes that the adverse employment effect for teenagers is among the only consensus that can be reached in the minimum wage literature. One further minor point of agreement was found to be the notion that some adults could in fact enjoy less competition from displaced teens in minimum wage labour markets after an increase has put the teens out of work and possibly even out of the labour force. This paper seems to suggest that at least at the time it was written, most scholars took a classical view of labour markets with emphasis on different levels of marginal productivity leading to some groups losing while others remaining employed

following a change in the minimum wage policy.[3] Brown (1983) examines the low-wage teenage labour market in the U.S. in the 1980's. Brown (1983) expresses surprise at the seemingly small magnitude of the employment effects and suggests that even though their may be possible benefits from manipulating wages through a binding minimum that the upside is not enough to persuade many economists to interfere in what he believes are fairly efficient markets.

Johnson and Browning (1983) use a simulation model calibrated to U.S. data to determine the redistributive effects of the minimum wage. The authors are looking to determine who wins and who loses when minimum wages are changed or imposed. According to the results from their simulations, the authors discovered that increases in the minimum wage have a harmful effect on the majority of low-wage households but help a small portion of high-wager households. Shaafsma and Walsh (1983) use panel techniques to examine the employment effects of the minimum wage in Canada. The authors reached the conclusion that the minimum wage had negative effects on the majority of the age-sex classification along which they divided workers. Wellington (1991) addresses the effects of an increase in the minimum wage on youth employment. Wellington (1991) concludes that previous estimates of the employment effects for teens may be too high and she found no appreciable effect on the employment of young adults. The results of the minimum wage research conducted through the 1980's and into the early 1990's seems to suggest that changes in minimum wage levels have adverse effects for the workers that earn the minimum wage.

[3] Presumably, the adults are facing less competition from teens because the managers of the firm can recognize the higher productivity workers (i.e. adults) and adjust there employment patterns to equalize marginal productivity with marginal revenue from their employees.

During the early 1990's the quasi-experimental approach to estimating the employment effects of the minimum wage gained momentum.[4] Card (1992a) uses regional variation in wages to examine the effects of the 1990 increase in the federal minimum wage. Card (1992a) concludes that the increase in the minimum wage has increased teenage earnings while leaving their level of unemployment more or less the same. In a similar fashion, Card (1992b) examines the 1988 increase in California's state minimum wage. Using quasi-experimental techniques to perform his analysis, Card (1992b) concludes that the low-wage workers of California have experienced wage increases and that the negative employment effects often associate with increasing the minimum wage are basically non-existent. Katz and Krueger (1992) examine the Texas fast-food industry after a change in the federal minimum wage. Katz and Krueger (1992) find that the employment effects they estimated are inconsistent with the classical competitive model predictions of decreased employment when faced with higher wages. Similarly, Card and Krueger (1994) conduct a similar type of analysis on the New Jersey fast food industry after the 1992 increase in the state minimum wage above the federal minimum. The authors conducted telephone interviews before and after the increase and compared the results with the baseline of Pennsylvania – New Jersey's neighbour. The authors concluded that relative to Pennsylvania, there was no evidence of employment decreases as a result of the increase in the minimum wage. In fact, the evidence from their study seemed to suggest modest increases in employment for the New Jersey fast-food industry. The findings of Card and Krueger (1994) generated many replies from

[4] An excellent survey of the recent developments in this field can be found in Neumark and Wascher (2006). This paper examines the approach itself (quasi-experimental), the major finding of some of the most influential studies in this emerging field and the potential short-comings and difficulties associated with this type of analysis.

minimum wage scholars on both sides of the New Minimum wage debate. One reply of particular interest to this paper was from Burkhauser et al. (1996) which attacked the distributional analysis in Card and Krueger's book *Myth and Measurement: The New Economic of the Minimum Wage.* Burkhauser et al. (1996) question the effectiveness of the minimum wage to achieve redistribution of income and whether or not the estimated employment effects were insignificant. The findings from the empirical studies that use quasi-experimental techniques are often contrary to the predictions of the classical labour demand model. The unconventional findings of this line of research have fuelled debate amongst minimum wage scholars on the validity of the quasi-experimental approach to estimating employment effects.[5]

Neumark and Wascher (1995) examines the minimum wage effects on employment and school enrollment for youth. The authors conclude that increasing the minimum wage causes employers to substitute away from lower-productivity teens in favour of higher productivity workers. Furthermore, these lower productivity teens are often not enrolled in school and the minimum wage increase has the effect of creating a group of lower-productivity teens who are neither employed nor enrolled in school. DiNardo et al. (1996) use CPS data on the U.S. labour market to construct wage distributions and analyze what effects various labour market institutions have on the wage distributions. The authors reach the conclusion that minimum wages can affect the wage distribution and that labour market institutions are as important to consider as supply and demand when examining the distribution of wages. DiNardo et al. (1996) find

[5] Card, Krueger and Katz are among the proponents of the quasi-experimental approach, while Neumark and Wascher are critical of the work being done by the quasi-experimental researchers.

that the minimum wage has much greater consequences for low-wage states and regions than in higher wage states.

Bell and Wright (1996) conduct an empirical analysis of the effects of the Wage Boards and Councils on the low-wage workers under their jurisdiction. The authors concluded that since there was little evidence that the Wage Boards and Councils had the effect of increasing the covered wages above the non-covered wages that there would likely be little effect on the employment levels in the event of a nation-wide binding minimum wage. Machin and Manning (1996) examine the possible employment effects that may be experienced in Britain if a universal system of minimum wages were to be imposed.[6] The authors investigated the common arguments made amongst policy analysts in regards to minimum wage policy and decided that any effects of an over-arching minimum wage policy are likely to be small. In an attempt to determine the potential employment effect of a proposed universal minimum wage in the U.K. Freeman (1996) examines the minimum wage experience in the U.S. to determine what factors, if any, have influenced employment outcomes. Freeman (1996) finds that the differences in the employment effect experienced in the two countries can be largely attributed to two key factors; the rents earned by businesses and shorter unemployment duration in the U.S.

Currie and Fallick (1996) use the National Longitudinal Survey of Youth to examine the employment effects of the minimum wage on youth. The authors conclude that the increase in the minimum wage in 1979 and 1980 caused employed youth to be

[6] At the time in Britain there existed a series of Wage Boards and Councils that acted as overseers for the wages of a very specific industry or class of workers.

less likely to be employed the following year. Baker et al. (1999) examine the effects of the minimum wage on teenage employment in Canada. Using time-series techniques to conduct their analysis, the authors conclude that there exists a significant negative effect of the minimum wage on teenage employment and that the effect comes with a considerable lag.

Yuen (2003) uses Canadian panel data to estimate the effects of the minimum wage on low-wage workers. The author comes to the conclusion that youth employment suffers most. The author goes on further to acknowledge the paradox that exists for low-wage workers in light of minimum wage policy; higher wages but less work leading to potentially adverse effects from a policy that was intended to help them. Neumark et al. (2004) examine the labour market responses to the minimum wage. Changes to the minimum wage can affect workers along two margins; the intensive margin and the extensive margin[7]. Neumark et al. (2004) examine the impact of the minimum wage on these margins. The authors conclude that workers whose wage rate is below the new minimum will experience wage gains. However, due to adjustments along the intensive margin (fewer hours) or the extensive margin (job loss), changes in the minimum wage are likely to have adverse effects for low-wage workers. Campolieti et al (2005) examine the minimum wage effects on youth employment transitions in Canada. Using a longitudinal framework the authors reach the same conclusion as Currie and Fallick (1996) that affected youths are less likely to be employed the year following the increase in the minimum wage. Campolieti et al. (2006) is the basis for the model and subsequent

[7] The intensive margin is the number of hours worked, while the extensive margin is whether or not a worker actually works.

analysis to be conducted in this paper. Campolieti et al. (2006) follows the model of Neumark (2001). Neumark's paper was a pre-specified research design that was intended to circumvent the problem of data mining by researchers; that is, excluding any data that may prevent the model from producing the desired outcomes. The model in the paper regresses the ratio of employed persons to population for the teens and young adults on the minimum wage index; the ratio of minimum wage to the average wage, by province. The model includes a host of controls for year, region and prime aged unemployment rate. Campolieti et al. (2006) find substantial negative employment effects for youth workers and find that these effects occur with a lag.

The articles examined in this literature review all lend something unique to the analysis to be conducted in this paper. From the studies examining the distributional impacts of the minimum wage we learn who is most likely to be affected by the minimum wage changes and whether these effects are likely to be positive or negative. From the quasi experimental studies we learn that the question of employment effects is not as clear cut as it once seemed; it may be the methods of inference that lead to negative impacts rather than the data itself. Finally, from all of the empirical research on the employment effects of the minimum wage we are able to use previous findings to select a model that is best suited to investigating the question at hand; when the minimum wage rate changes what are the employment effects of those at risk? The next section will discuss the model and the estimation strategy.

3.1 The Model

The model used in this paper was taken from Campolieti et al. (2006) which was taken from Neumark (2001). The base model that was estimated was:

$$E^a_{it} = \alpha + \beta MWI_{it} + \gamma MWI_{it-1} + \delta SHARE^a_{it} + \lambda UR^{2554}_{it} + \Omega X_{it} + \varepsilon^a_{it} \quad \textbf{(1)}$$

The subscripts i, t and a refer to province, year and age group, respectively. E^a_{it} is the ratio of employed persons to population for each age group and province. This variable captures the provincial employment rate by age group for each year. MWI_{it} is the minimum wage ratio. This variable enters equation (1) both contemporaneously and with a one year lag. In the base model this ratio was calculated with the average provincial wage in the denominator. $SHARE^a_{it}$ is the proportion of each age group under study in the working age population. This variable can be seen as the relative importance of a particular age group in the provinces' labour force. UR^{2554}_{it} is the unemployment rate for prime aged male workers; it is thought that this variable captures labour market trends that are specific to each province and that have not been captured by the provincial or time dummies. X_{it} is a set of additional control variables that capture regional and time effects. The variables in X_{it} are dummy variables for the year and the province.

An additional version of equation (1) was estimated. The additional specification has the minimum wage and average wage entered as separate regressors. Campolieti et al. (2006) employ this technique and credit it to Card et al. (1994); their rationale for having

done this was to combat any possible correlation between the average wage and the minimum wage.

The model in this study uses three constructed variables. These variables are the ratio of minimum wage to the average industrial wage, the share of each age group in the working age population, and the proportion of employment by age group relative to the total population of the respective age group. The first two variables are used as the explanatory and control variables, respectively, while the third variable is used as the dependent variable.

3.2 Estimation Strategy

The equation was estimated for the two age groups 15-24 and 25-44; the age groups contain both male and female workers. Heteroskedasticity is likely to be problematic due to characteristics such as differences in the size of the labour force in each province – in 2009 there were more 15-24 year old males working in Ontario than there were inhabitants of P.E.I.; or due to regional phenomenon such as persistently high unemployment in the Maritime provinces or the effects of the Oil Boom in Alberta. In order to correct for heteroskedaticity the model has been estimated with robust standard errors.

Several robustness checks were performed as well. These checks included estimating the model without the provincial and year dummies; estimating the model without the share variable; and, estimating the model without the unemployment rate

variable. The results from these regressions are presented in the Appendix. Campolieti et al. (2006) add a variable called the prime aged-male skilled employment rate. This variable could not used in this study. It should be noted though that in Campolieti et al (2006) the authors found their results to be invariant to the addition or exclusion of this variable from the model so its omission here should be inconsequential. The next section will discuss the data.

4.1 The Data

The data for this paper was drawn from four sources. The Survey of Labour and Income Dynamics (SLID), the Labour Force Survey (LFS), the Average Industrial Wage for Canada and the Provinces from the CANSIM database, and the Human Resources and Skills Development Canada (HRSDC) minimum wage Database.

The SLID was used to calculate the proportions of each age group earning the minimum wage; Table 2 in the Appendix presents these proportions. The SLID follows individuals for a period of six years with half of the panel changing every three years. This survey was chosen for calculating the proportions because it contains the age, province and wage data necessary to calculate the proportions of each age group in each province that earn the minimum wage. The SLID was selected over the LFS for wage data because the LFS data did not provide wage information delineated by age and region necessary for this study. There were entries in the wage variable that seemed too large to

be plausible; $999.99/hr. These implausibly high values were left in the sample since there was no way to validate these (or any other) wage values.[8]

Employment, unemployment and population data were drawn from the LFS. The LFS is conducted monthly and provides a snap-shot of the current labour force conditions. The LFS is the standard source for employment, unemployment and labour force participation data in Canada. Each of the variables used was collected by age and province. Also, the Canadian unemployment rate by age was retrieved from this survey. Annual data for the years 1992-2009 was used. The average wage rate used in the denominator of the minimum wage index was drawn from the Average Industrial Wage table from CANSIM.[9] The average industrial wage rate was taken for Canada and the Provinces. The average industrial wage variable limited the length of the sample used for this study; all of the other data was available from 1976-2010 while the average industrial wage was available only from 1991-2009.[10] The minimum wage data was drawn from the HRSDC minimum wage database. This source provided a complete record of the minimum wage changes over the relevant time period. In some years a given province experienced more than one change in the minimum wage rate. In this event the minimum wage rate that would have been in effect at the end of the year was chosen. There was no theoretical reason for this decision rather it was made for the sake of consistency.

[8] Proportions were calculated by excluding these $999.99/hr values and due to the fact that relatively few entries have this value, the results were not changed in any significant way.
[9] CANSIM table 281-0030.
[10] 1991 was lost due the lagged Minimum Wage Index (MWI) variable.

The sample for this study consisted of 180 observations. The sample spanned 18 years for all ten provinces. The length of the sample size was limited by the availability of the average industrial wage. This measure was only available from 1991 to 2010; the first year was lost due the lagged minimum wage variables included in the model. All regressions and descriptive statistics were calculated for the entire sample of 180 observations.

4.2 Descriptive Statistics

Table 1 provides the descriptive statistics for the data used in this study. The variable MWI_{it} is the minimum wage index; this variable is entered contemporaneously and with a lag. MWI_{it} is constructed with the minimum wage for each province and the average industrial wage for that province. The minimum wage rate and the average industrial wage for the Provinces appear in the descriptive statistics table contemporaneously and with a lag. These variables are similar to those used in Campolieti et al. (2006). In fact, the minimum wage variable was drawn from the same data base as in Campolieti et al. (2006) but for different years. In Campolieti et al. (2006) the other wage variable that the authors used is the average adult wage which they construct from the Survey of Consumer finances. The average industrial wage used in this study is taken directly from a CANSIM table. Although the two measures are not identical, examination of the descriptive statistics for the two wage measures suggest that they are at least qualitatively similar.

Employment and Population are the level of employment and population, respectively for each age group and province by year. The similar variable in Campolieti et al. (2006) is the employment rate of 16 – 24 year olds and is significantly lower than the rate that appears in this study. The Employment Rate was the dependent variable in this study and was calculated with the employment and population levels for each age group and province by year. Examination of the descriptive statistics lead to the conclusion that the data used in this study is qualitatively similar to that of Campolieti et al. (2006) and although not directly comparable due to differences in the data sources should lead to estimates that are comparable in nature. The next section of this paper will discuss the results and the robustness checks.

5.1 Results

The estimates from the regression are presented in Table 3. This table presents the contemporaneous and lagged employment effects of the minimum wage index as well as the sum of the two effects; standard errors are in parentheses. The first pair of columns of Table 3 presents the results of the two specifications for the 15-24 year old age group. The second pair of columns presents the results of the two specifications for the 25-44 year old age group.

The results from the first pair of columns will be examined first. Column (1) of Table 3 presents the results from equation (1) estimated for the 15-24 year old age group. For the 15-24 year old age group both the contemporaneous and lagged employment effects of the minimum wage are negative and large. Neither estimate is statistically

significant at the usual levels on its own, though.[11] The combined effect, the sum of the contemporaneous and lagged minimum wage employment effects, is -0.2440 and is statistically significant. Campolieti et al. (2006) lists the "consensus range" as being -0.1 to -0.3; their result for the 16-24 year old age group was -0.2560. The estimate from this model falls in the consensus range and is close to that of Campolieti et al. (2006). The lagged minimum wage effect is smaller than the contemporaneous effect which is somewhat surprising considering the conclusions of Baker et al. (1999) that finds the adjustment of employment levels to the minimum wage occurs with a significant lag. Column (2) of Table 3 presents the results from the specification that entered the minimum and average wage separately. For the 15-24 year old age group the contemporaneous and lagged minimum wage effects were both negative with the lagged effect being larger in absolute value; neither estimate is significant however. When the combined effects are calculated the estimate is -0.0160 and is statistically significant. The comparable estimate from Campolieti et al. (2006) is -0.1800, which is ten times larger than the result presented here. The combined effects of the contemporaneous and lagged minimum wages are modest for this specification. This phenomenon may be related to the fact that there are two extra regressors – the contemporaneous and lagged average wage variables- that were not present in the other specifications.

Columns (3) and (4) of Table 3 present the base specification and the Card et al. (1994) refinement for the 25-44 year old age group, respectively. The estimates in column (3) for the 25-44 year old age group have the contemporaneous effect being

[11] The usual levels of significance are 1%, 5% and 10%.

positive and the lagged effect being negative.[12] The contemporaneous effect is not significant but the lagged effect is. Furthermore, like the estimates for the 15-24 year old age group, the combined effects of the contemporaneous and lagged minimum wage variables is a statistically significant -0.1924. The positive contemporaneous effect is somewhat surprising at first; however, this counter intuitive value may be able to be explained by the migration away from lower skilled (youth) labour alluded to in Brown et al. (1982). The lagged minimum wage effect is negative for this age group. Again, this finding seems to be inline with the Baker et al. (1999)'s finding that the adjustment takes time to occur; recall that Hammermesh (1993) posits that due to adjustment costs firms will adjust input levels gradually over time as opposed to a once-and-for-all adjustment when faced with a price shock. Column (4) presents the results from the specification that entered the minimum and average wage separately. For the 25-44 year old age group the contemporaneous and lagged estimates once again alternate in sign from positive to negative, respectively. The contemporaneous estimate is not significant while the lagged effect is. The significance of the lagged effect of the minimum wage in this specification is not surprising as the lagged minimum wage effect for 25-44 year olds has been the only estimated minimum wage parameter that was significant in its own right. The combined effect fo the minimum wage for 25-44 year olds was found to be -0.0114 and is statistically significant. This estimated value is less in absolute value than the similar estimate for the 15-24 year-old age group.

[12] Since Campolieti et al. (2006) focused only on the employment effects of teens and young adults no direct comparison between the results of this age group and any estimate from their paper is possible.

The estimates for the contemporaneous and lagged MWI employment effects have the interpretation of a β or γ percentage point change in the employment rate (E_{ita}) for a one percentage point change in the MWI. For the 15-24 year old age group a one percentage point change in the contemporaneous MWI leads to a -0.0142 percentage point change in the employment ratio. Similarly, a one percentage point change in the previous year's MWI will have a -0.0101 percentage point change in the employment rate the following year for 15-24 year olds. As for the 25-44 year old age group, a one percentage point change in the contemporaneous MWI will have an effect of 0.0122 percentage points on the employment rate, while a one percentage point change in the previous year's MWI will change the employment rate by -0.0315 percentage points the following year.

In 2009, the minimum wage in Ontario changed from $8.75/hr to $9.50/hr; a change of 75 cents. With an average industrial wage of $19.89/hr in 2009, the minimum wage index changes from 0.4399 to 0.4776; a change of about 3.8 percentage points. In this case, the change in the minimum wage would decrease the employment rate of 15-24 year olds by 0.0054 percentage points. Similarly, for the 25-44 year old age group, the 2009 change in the minimum wage would lead to a 0.0046 percentage point decrease in the employment rate

5.2 Robustness Checks

All of the equations estimated for the analytical portion of this paper included controls for the share of each age group in the working age population, the prime-aged

unemployment rate and dummy variables for the province and the year. The robustness checks in this paper were performed by systematically removing the provincial, year, share and unemployment rate variables. The results from these regressions are presented in the appendix in tables 6 through 13. This section will discuss the sensitivity of the results of the primary and secondary specifications to the exclusion of the aforementioned variables.

For 15-24 year olds, for the specification of equation (1), the combined effects of the contemporaneous and lagged minimum wage coefficients ranged from -0.2758 to 0.3165. Removing the provincial dummy from the equation caused the estimated minimum wage effect to rise to 0.3165. This effect is outside of the consensus range of -0.3 to -0.1. All of the other specifications remained in the consensus range for 15-24 year olds using the minimum wage index specification. For the specification that entered the minimum wage and average wage separately, the results for the 15-24 year old age group ranged from -0.0172 to 0.0036. None of these estimates fell in the consensus range. The result for this age group in the full specification was found to be -0.0160. This estimate lies at the lower end of the range of results from the robustness checks.

For 25-44 year olds using the minimum wage index specification, the combined effects of the contemporaneous and lagged minimum wage coefficients ranged from -0.2326 to 0.1319. The result from the primary specification for this age group was -0.1924. The estimates from the robustness checks were of the correct sign and of a reasonable magnitude for all the robustness check except that which removed the

provincial dummy. For the specification that entered the minimum wage and average wage separately, the results for the 25-44 year old age group ranged from -0.0127 to 0.0070. The result for this age group in the full specification was found to be -0.0140. Again, the robustness check results were similar to this estimate in all cases except when the provincial dummy was removed.

The results from the robustness checks performed here seem to indicate that the results from estimating both forms of the model – the minimum wage index specification and entering the minimum wage and average wage separately in levels- are sensitive to the exclusion of the provincial dummy variable. For the others variables, their removal affected the estimates' magnitude but not their sign. Even more telling is the fact that for the 15-24 year old age group, the estimates obtained by removing the share, unemployment rate and year dummy all fell in the consensus range. This concludes the analysis of the various specifications of the equation of Neumark (2001) which was "Canadian-ized" by Campolieti et al. (2006) and updated through the year 2009 in this paper. The following section of this paper will summarize the results of this investigation and conclude.

6.1 Summary of the Key Findings

This paper has estimated the employment effects of the minimum wage for teens and young adults and for the 25-44 year old age group. The effect for teenagers and young adults was estimated to be -0.2440 and -0.0160 for the base specification and Card et al. (1994) refinement, respectively. The estimates from the specifications that included

the lagged and contemporaneous minimum wage index variables returned estimates that fell in the consensus range of -0.1 to -0.3. The effects for the 25-44 year old age group were -0.1924 and -0.0114 for the base specification and the refinement, respectively. In order to get a better idea of the acceptability of the estimates for the 25-44 year old age group in this paper, more analysis will need to be conducted of this age group in order to develop a consensus range for estimates of the employment effect of the minimum wage.

The goal of this paper was to investigate the effects of the minimum wage on employment for two key age groups. The 15-24 year old age group's importance comes from the fact that in all provinces in 2007, this age group represented the highest proportion of workers who earned the minimum wage. As for the 25-44 year old age group, it is these workers who are most likely to be the head of a household or primary earner. If the minimum wage can be found to have an adverse effect on the employment levels of workers of this age group, then a solid argument can be made that the minimum wage may in fact hurt those that it was intended to help.

Investigation into the employment effects of the minimum wage was stated to be necessary in order to conduct proper policy analysis of this instrument of income redistribution. Although considerable attention has been devoted to the employment effects that teenagers and young adults experience as a result of increasing the minimum wage, little work has be done on investigating the minimum wage's effect on the employment levels of adult age groups. The analysis conducted in this paper should

provide a starting point for future research into the employment effects that older workers experience as a result of changes in minimum wage policy.

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Table 1: Descriptive Statistics

Variable	N	Mean	Std. Dev.	Min	Max
Minimum wage					
Contemporaneous	180	6.47	1.16	4.75	9.50
Lagged	180	6.27	1.07	4.50	8.75
Average Industrial Wage					
Provincial					
Contemporaneous	180	15.50	2.30	10.45	22.5
Lagged	180	15.13	2.17	10.34	22.27
Employment					
15-24	180	229,561.10	263,947.80	9,900	972,600
25-44	180	745,731.70	896,571.90	28,100	3,104,100
Share					
15-24	180	0.16	0.01	0.12	0.19
25-44	180	0.44	0.04	0.36	0.52
Prime Aged Male Unemployment Rate	180	8.69	4.00	2.40	19.0
Employment Rate					
15-24	180	0.71	0.07	0.46	0.81
25-44	180	0.78	0.06	0.58	0.86
Minimum Wage Index					
15-24	180	0.42	0.03	0.33	0.49
25-44	180	0.41	0.03	0.33	0.49

Source: Minimum Wage data from HRSDC "Provincial Minimum wage Table; Employment, Unemployment and population data from the LFS; average wage data from CANSIM 281-0030.

Table 2: Proportion of Workers Earning the Minimum Wage		
Province	**16-24**	**25-44**
Newfoundland	0.14	0.04
P.E.I.	0.30	0.06
Nova Scotia	0.07	0.02
New Brunswick	0.17	0.02
Quebec	0.20	0.02
Ontario	0.22	0.02
Manitoba	0.14	0.02
Saskatchewan	0.05	0.01
Alberta	0.02	0.00
B.C.	0.08	0.02

Source: Proportions were calculated from data in the SLID.

Table 3: Employment Effects of the Minimum Wage

	15-24		25-44	
	(1)	(2)	(3)	(4)
Minimum Wage Index				
Contemporaneous	-0.1422	-	0.1226	-
	(0.1229)	-	(0.1240)	-
Lagged	-0.1018	-	-0.3150***	-
	(0.1444)	-	(0.1157)	-
Sum	-0.2440***	-	-0.1924**	-
	(0.0979)	-	(0.0839)	-
Minimum Wage Level				
Contemporaneous	-	-0.0051	-	0.0083
	-	(0.0085)	-	(0.0088)
Lagged	-	-0.0109	-	-0.0198**
	-	(0.0100)	-	(0.0089)
Sum	-	-0.0160***	-	-0.0114**
	-	(0.0063)	-	(0.0055)
Share	-1.256***	-1.359***	-0.7435***	-0.7450***
	(0.2843)	(0.2920)	(0.2733)	(0.2798)
Unemployment Rate	-0.0068***	-0.0069***	-0.0082***	-0.0083***
	(0.0020)	(0.0020)	(0.0015)	(0.0016)
N	180	180	180	180
R^2	0.9413	0.9423	0.9550	0.9547

Standard errors appear in parentheses. ***, **, and * denote significance at the 1%, 5% and 10% levels, respectively.

Table 4: Regression Results for Primary Specification

	15-24		25-44	
Variable	**Parameter**	**Std. Error**	**Parameter**	**Std. Error**
MWI	-0.1422	0.1229	0.1226	0.1240
MWI Lagged	-0.1018	0.1444	-0.3150***	0.1157
Share	-1.2559***	0.2844	-0.7435***	0.2734
Unemployment Rate	-0.0068***	0.0021	-0.0082***	0.0016
NFLD	-0.1256***	0.0224	-0.1022***	0.0241
PEI	0.0762***	0.0182	-0.0057	0.0153
NS	-0.0050	0.0103	-0.0402***	0.0109
NB	-0.0061	0.0115	-0.0456***	0.0127
QUE	-0.0110	0.0096	-0.0174**	0.0070
MAN	0.0686***	0.0080	-0.0022	0.0059
SASK	0.0490***	0.0112	-0.0094	0.0095
ALB	0.0547***	0.0107	0.0100*	0.0060
BC	0.0105***	0.0079	-0.0150***	0.0052
1992	-0.0096	0.0145	0.0239	0.0265
1993	-0.0184	0.0134	0.0249	0.0252
1994	-0.0239*	0.0124	0.0212	0.0240
1995	-0.0270**	0.0109	0.0211	0.0234
1996	-0.0351***	0.0099	0.0179	0.0229
1997	-0.0498***	0.0103	0.0226	0.0215
1998	-0.0473***	0.0090	0.0225	0.0200
1999	-0.0354***	0.0088	0.0183	0.0182
2000	-0.0253***	0.0083	0.0193	0.0164
2001	-0.0202**	0.0085	0.0126	0.0148
2002	0.0013	0.0093	0.0183	0.0131
2003	0.0052	0.0092	0.0150	0.0113
2004	-0.0030	0.0101	0.0088	0.0101
2005	-0.0029	0.0084	0.0016	0.0099
2006	0.0071	0.0084	-0.0009	0.0090
2007	0.0114	0.0091	0.0000	0.0084
2008	0.0137	0.0100	-0.0018	0.0088
Constant	1.0734***	0.0569	1.2701***	0.1371
N	180		180	
R^2	0.9413		0.9550	

Standard errors appear beside the parameter estimate. ***, **, and * denote significance at the 1%, 5% and 10% levels, respectively.

Table 5: Regression Results for Specification with Separate Minimum and Average Wage

	15-24		25-44	
Variable	**Parameter**	**Std. Error**	**Parameter**	**Std. Error**
Minimum Wage Level	-0.0051	0.0085	0.0083	0.0088
Minimum Wage Level Lagged	-0.0109	0.0100	-0.0198**	0.0089
Average Industrial Wage	0.0079	0.0064	-0.0042	0.0052
Average Industrial Wage Lagged	-0.0058	0.0067	0.0087	0.0055
Share	-1.3590***	0.2921	-0.7450***	0.2798
Unemployment Rate	-0.0070***	0.0021	-0.0083***	0.0016
NFLD	-0.1334***	0.0230	-0.1005***	0.0244
PEI	0.0604***	0.0207	-0.0072	0.0189
NS	-0.0148	0.0124	-0.0399***	0.0130
NB	-0.0161	0.0138	-0.0452***	0.0146
QUE	-0.0159**	0.0099	-0.0173***	0.0075
MAN	0.0623***	0.0100	-0.0023	0.0084
SASK	0.0447***	0.0123	-0.0094	0.0108
ALB	0.0533***	0.0110	0.0108*	0.0063
BC	0.0106	0.0080	-0.0146***	0.0051
1992	-0.0348	0.0250	0.0239	0.0338
1993	-0.0412*	0.0239	0.0246	0.0322
1994	-0.0452*	0.0233	0.0209	0.0308
1995	-0.0486**	0.0224	0.0205	0.0303
1996	-0.0577***	0.0211	0.0178	0.0284
1997	-0.0695***	0.0205	0.0221	0.0274
1998	-0.0671***	0.0185	0.0218	0.0261
1999	-0.0543***	0.0181	0.0178	0.0238
2000	-0.0433***	0.0170	0.0186	0.0217
2001	-0.0347**	0.0174	0.0118	0.0203
2002	-0.0149	0.0165	0.0177	0.0183
2003	-0.0100	0.01480	0.0146	0.0165
2004	-0.0160	0.0151	0.0083	0.0144
2005	-0.0156	0.0125	0.0013	0.0128
2006	-0.0007	0.0114	-0.0014	0.0112
2007	0.0037	0.0110	-0.0002	0.0095
2008	0.0092	0.0105	-0.0020	0.0090
Constant	1.0780***	0.0846	1.1965	0.1306
N	180		180	
R^2	0.9423		0.9547	

Standard errors appear beside the parameter estimate. ***, **, and * denote significance at the 1%, 5% and 10% levels, respectively.

Table 6: Robustness Checks

Variable	(1) Parameter	(1) Std. Error	(2) Parameter	(2) Std. Error
MWI	0.2213	0.2202	0.2886	0.1402
MWI Lagged	0.0953	0.2206	-0.1567	0.1386
Minimum Wage Level	-	-	-	-
Minimum Wage Level Lagged	-	-	-	-
Average Industrial Wage	-	-	-	-
Average Industrial Wage Lagged	-	-	-	-
Share	1.0485	0.2841	-0.3016	0.0997
Unemployment Rate	-0.0119	0.0014	-0.0140	0.0006
Provincial Dummies	NO		NO	
Year Dummies	YES		YES	

Standard errors appear beside the parameter estimate.
(1) 15-24, No Provincial Dummy. (2) 25-44 No Provincial Dummy.

Table 7: Robustness Checks

Variable	(3) Parameter	(3) Std. Error	(4) Parameter	(4) Std. Error
MWI	0.0866	0.1504	0.0904	0.1046
MWI Lagged	-0.1958	0.1730	-0.2456	0.0997
Minimum Wage Level	-	-	-	-
Minimum Wage Level Lagged	-	-	-	-
Average Industrial Wage	-	-	-	-
Average Industrial Wage Lagged	-	-	-	-
Share	-1.0379	0.2943	-0.4717	0.0650
Unemployment Rate	-0.0118	0.0010	-0.0084	0.0010
Provincial Dummies	YES		YES	
Year Dummies	NO		NO	

Standard errors appear beside the parameter estimate.
(3) 15-24 No Year Dummy. (4) 25-44 No Year Dummy

Table 8: Robustness Checks

Variable	(5) Parameter	(5) Std. Error	(6) Parameter	(6) Std. Error
MWI	-0.0786	0.1397	0.1589	0.1149
MWI Lagged	-0.1972	0.1459	-0.2918	0.1127
Minimum Wage Level	-	-	-	-
Minimum Wage Level Lagged	-	-	-	-
Average Industrial Wage	-	-	-	-
Average Industrial Wage Lagged	-	-	-	-
Share	-	-	-	-
Unemployment Rate	-0.0052	0.0021	-0.0086	0.0016
Provincial Dummies	YES		YES	
Year Dummies	YES		YES	

Standard errors appear beside the parameter estimate.
(5) 15-24 No Share. (6) 25-44 No Share.

Table 9: Robustness Checks

Variable	(7) Parameter	(7) Std. Error	(8) Parameter	(8) Std. Error
MWI	-0.1951	0.1355	0.0321	0.1375
MWI Lagged	-0.0749	0.1571	-0.2647	0.1253
Minimum Wage Level	-	-	-	-
Minimum Wage Level Lagged	-	-	-	-
Average Industrial Wage	-	-	-	-
Average Industrial Wage Lagged	-	-	-	-
Share	-1.0180	0.2846	-0.9347	0.3083
Unemployment Rate	-	-	-	-
Provincial Dummies	YES		YES	
Year Dummies	YES		YES	

Standard errors appear beside the parameter estimate.
(7) 15-24 No Unemployment Rate. (8) 25-44 No Unemployment Rate.

Table 10: Robustness Checks

Variable	(9) Parameter	(9) Std. Error	(10) Parameter	(10) Std. Error
MWI	-	-	-	-
MWI Lagged	-	-	-	-
Minimum Wage Level	0.0116	0.0121	0.0250	0.0083
Minimum Wage Level Lagged	-0.0079	0.0124	-0.0180	0.0080
Average Industrial Wage	0.0014	0.0112	-0.0041	0.0061
Average Industrial Wage Lagged	-0.0207	0.0124	-0.0101	0.0066
Share	0.0546	0.3732	0.3273	0.1315
Unemployment Rate	-0.0169	0.0019	-0.0143	0.0006
Provincial Dummies	NO		NO	
Year Dummies	YES		YES	

Standard errors appear beside the parameter estimate.
(9) 15-24 No Provincial Dummies. (10) 25-44 No Provincial Dummies.

Table 11: Robustness Checks

Variable	(11) Parameter	(11) Std. Error	(12) Parameter	(12) Std. Error
MWI	-	-	-	-
MWI Lagged	-	-	-	-
Minimum Wage Level	-0.0002	0.0098	0.0065	0.0078
Minimum Wage Level Lagged	-0.0135	0.0114	-0.0165	0.0081
Average Industrial Wage	0.0162	0.0063	-0.0051	0.0042
Average Industrial Wage Lagged	-0.0034	0.0073	0.0072	0.0047
Share	-0.4023	0.2950	-0.5858	0.1159
Unemployment Rate	-0.0062	0.0015	-0.0084	0.0010
Provincial Dummies	YES		YES	
Year Dummies	NO		NO	

Standard errors appear beside the parameter estimate.
(11) 15-24 No Year Dummies. (12) 25-44 No Year Dummies.

Table 12: Robustness Checks

Variable	(13) Parameter	(13) Std. Error	(14) Parameter	(14) Std. Error
MWI	-	-	-	-
MWI Lagged	-	-	-	-
Minimum Wage Level	-0.0024	0.0099	0.0107	0.0084
Minimum Wage Level Lagged	-0.0148	0.0108	-0.0189	0.0088
Average Industrial Wage	0.0049	0.0071	-0.0049	0.0052
Average Industrial Wage Lagged	0.0010	0.0072	0.0070	0.0056
Share	-	-		
Unemployment Rate	-0.0052	0.0021	-0.0087	0.0016
Provincial Dummies	YES		YES	
Year Dummies	YES		YES	

Standard errors appear beside the parameter estimate.
(13) 15-24 No Share. (14) 25-44 No Share.

Table 13: Robustness Checks

Variable	(15) Parameter	(15) Std. Error	(16) Parameter	(16) Std. Error
MWI	-	-	-	-
MWI Lagged	-	-	-	-
Minimum Wage Level	-0.0076	0.0097	0.0039	0.0096
Minimum Wage Level Lagged	-0.0089	0.0113	-0.0166	0.0095
Average Industrial Wage	0.0107	0.0067	0.0001	0.0058
Average Industrial Wage Lagged	-0.0072	0.0070	0.0058	0.0067
Share	-1.1023	0.2809	-0.9369	0.3112
Unemployment Rate	-	-	-	-
Provincial Dummies	YES		YES	
Year Dummies	YES		YES	

Standard errors appear beside the parameter estimate.
(15) 15-24 No Unemployment Rate. (16) 25-44 No Unemployment Rate.