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The Impact of Minimum Wages on Quit, Layoff and Hiring Rates

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1 Introduction

A voluminous literature exists on the impacts of minimum wages on the labour market. This literature can be seen as having two overlapping goals. The first is to use a purportedly exogenous shift in the price of a key factor to better understand the demand for labour and production decisions more generally. The second is to consider the usefulness of minimum wages as a policy tool. Almost the entire existing empirical literature on minimum wages examines the comparative static effect of a minimum wage change on employment levels and/or the shape of the wage distribution.[1] In this paper, we investigate the underlying question: how do labour market transition rates (quits, layoffs and hires) differ in low versus high minimum wage regimes? Answering this question provides a different set of insights on minimum wages as a policy tool and a new set of facts that sharpen our understanding of the functioning of the labour market.

Recent studies of employment impacts of minimum wages take one of two main approaches. The first is to compare employment levels or rates across jurisdictions with different minimum wages using panel data at the jurisdiction level (e.g., Baker et al. (1999) for Canada, Neumark and Wascher (2007) and the many papers cited therein for the US). The second is to use individual level panel data to examine the impact of an increase in the minimum wage from m_t at time t to m_{t+1} at time t+1. In particular, these latter papers examine the employment rate in t+1 for workers whose wage lies between m_t and m_{t+1} in period t (the group of workers most directly affected by the minimum wage increase). The minimum wage effect is identified by comparing employment changes for the directly affected workers with those for workers in other jurisdictions and at other points in the wage distribution (e.g., Currie and Fallick (1996) and Neumark et al. (2004) for the US; Yuen (2003) and Campolieti et al. (2005) for Canada). Both types of studies tend to find small (negative or positive) effects on employment. Our examination is closest in nature to the second of these two approaches since we study transition rates. However, we differ from those studies in two ways. First, we examine transition rates in periods before and after minimum wage increases not transitions at the time of a change. Thus, returning to our example where the minimum wage increases between t and t+1, impacts measured in the second type of study includes layoffs between times t and t+1, while we compare quit, layoff and hiring rates between t-1 and t (i.e., in the low

[1]See Card and Krueger (1995) and Neumark and Wascher (2007) for comprehensive surveys of the literature.

minimum wage regime) to quit, layoff and hiring rates between t+1 and t+2 (the high minimum wage regime). In fact, to highlight our focus, we "dummy out" transitions spanning a minimum wage increase (transitions between times t and t+1 in this example). In addition, we focus on workers with under a year of job tenure. This means we are explicitly not trying to follow the set of workers directly affected at the time of a hike through their careers. Instead, we are investigating whether new hires who are hired after a minimum wage increase has occurred are treated differently from new hires in lower minimum wage regimes. We also differ from previous longitudinal studies in that they examine whether an affected worker is employed in the subsequent period, regardless of whether they remain with the same employer while we focus on separations from a given employer. Our results could differ from those in these earlier studies to the extent that both separations and hires change with the minimum wage.

The data we use for this exercise is the Canadian Labour Force Survey (LFS). The LFS is a representative, national survey whose main purpose is to generate data for official labour force statistics and is similar in nature to the US CPS. Importantly for us, the LFS contains a consistent question on job tenure asked in every month back to 1976. Like the US CPS, the LFS is actually conducted as a series of short, rolling panels with survey respondents being interviewed in each of six consecutive months. By linking data for an individual across months, we can construct monthly retention rates - the probability a job in existence in, say, March of a year, is still ongoing in April - conditional on the duration of the job up to the initial month. We can also construct monthly hiring rates as the probability a non-employed individual in March has a new job in April. We construct these transition rates separately by province and match movements in the rates to movements in the real minimum wage between 1979 and 2008, taking advantage of the very considerable variation in minimum wages across time and provinces in Canada over this period. We focus on male and female workers aged 15 to 59 with a high school or less education since we believe the minimum wage has less relevance for higher educated workers.

Remarkably, our estimates imply an economically substantial and statistically significant increase in retention rates for low-skilled workers who have been employed for under a year in response to a minimum wage increase. In particular, a 10% increase in the real minimum wage is associated with approximately a 5% decline in the probability a worker separates from his or her job in the next year. In contrast, separation rates for workers with over a year of job tenure do not vary with the minimum wage. When we delineate by type of separation, we find that both quit and layoff rates are lower in high minimum wage regimes but that layoff rates decline more than quit rates and play a larger role in the overall reduction in separation rates. We also find that hiring rates are lower in high minimum wage regimes. Together these imply that the relatively small static employment effects typically measured are actually a reflection of lower hiring and layoff rates after minimum wages are raised.

At first glance, the notion that layoff rates are lower in high minimum wage regimes may seem counter-intuitive. However, in the fourth section of the paper we outline a simple partial equilibrium matching model with wage bargaining which conforms to the main patterns in the data: layoffs are lower for recently hired workers when the minimum wage is higher while hiring rates are lower. In the model, match-specific productivity is revealed after the worker has been with the firm for a probationary period (say, 6 months). Once the match quality is revealed, the firm decides whether to layoff the worker. For some matches (call them minimum wage matches), productivity will be high enough that the firm does not want to terminate the match but low enough that a bargained wage would be below the minimum wage. Such matches earn the firm lower profits than higher productivity matches, and the profitability of such matches is negatively related to the minimum wage. Now consider a firm with a somewhat higher productivity match. The firm compares the profitability of continuing this match with the expected value of terminating the match and opening a new vacancy. Since any new match might turn out to be a minimum wage match, when minimum wages are higher the value of the termination option is lower and layoff rates will decline. Thus, a job in this type of model has a sunk cost feature where the sunk cost of searching is increasing in the minimum wage. In addition, since we focus on less educated workers, one might expect that firms pay the minimum wage during the probationary period, implying a further sunk cost that is also increasing in the minimum wage. Finally, the fact that the expected profitability of creating a new vacancy is declining in the minimum wage implies that hiring rates will decline.[2] Under this model, firms should be less concerned about the impact of minimum wages on the expected profitability of future matches in high inflation periods where the real value of the minimum wage is declining. We find that this implication of the model is strongly confirmed in the data. Nonetheless, it is

[2]We set out a general equilibrium version of the model in an on-line appendix (Appendix B). The conclusions about separations are rendered more ambiguous once we allow for general equilibrium effects but reduced separations in higher minimum wage regimes are still possible.

not our intention to claim that this is the only model that can fit the data patterns we present. We present the model to show that the data patterns can be explained within a reasonable model which incorporates a sunk cost of hiring that is increasing in the minimum wage.

We are aware of two other papers that examine transition rates in a manner similar to what we present. Portugal and Cardoso (2006) use rich worker-firm data to look at separations and hires of teenagers before and after a 1987 increase in the Portuguese minimum wage. They also find a decline in separation rates offset by a decline in hiring. They identify their effects by comparing teenagers with older workers. Our results support their findings using a stronger identification strategy stemming from over 140 minimum wage increases, with identification coming from within-province over-time variation. Dube et al. (2010) use pairs of counties across state borders in the US between 2000 and 2008 to examine minimum wage impacts on transition rates as well as on earnings and employment levels.[3] They also find significant negative effects of the minimum wage on hiring and separation rates, particularly for teenagers and in the restaurant industry. Both papers argue their results fit with a Burdett-Mortensen model, with Dube et al. (2010) providing a formal derivation within such a model. The intuition they present based on that model is that higher minimum wages shift up the wage distribution in equilibrium, leading to more potential workers joining the labour force. Firms are then able to fill more of their vacancies from the unemployment pool, resulting in less raiding of other companies and, hence, fewer separations. The key distinction between our paper and these two is our ability to delineate quits and layoffs. The fact that we find much of the reduction in separations occurs through reduced layoffs does not fit well with an explanation based on the Burdett-Mortensen model. We acknowledge that in equilibrium models separations are usually mutually agreed upon by workers and firms, muddying the distinctions between quits and layoffs (though in our model, with a minimum wage, some separations are clearly layoffs in the sense that the minimum wage is above the flow value of unemployment for some workers whose jobs are terminated). But it is difficult to believe that workers accepting outside offers from other firms would be labeled as layoffs in any data. Further, like us, Dube et al. (2010) find that negative separation effects are stronger at shorter tenure but there is no reason for this to be the case in the model they present while it is a prime feature of matching models with initially unknown match

[3] Dube et al. (2010) find that controlling for county pairs rather than just jurisdiction fixed effects reduces the size of their estimated effects. Given this, our results may be upper bounds on the estimated effects, though it is worth noting that their separation and hiring effect results remain significant when county pair controls are included.

productivity. Nonetheless, the mechanism proposed by Dube et al. (2010) may well provide an explanation for the part of the separation effect that does occur through quits.

Finally, there is a literature that examines minimum wage effects on turnover and wage distributions in the context of structural estimation (e.g., Flinn (2006) and Van den Berg (2003)). These papers adopt a much different empirical strategy relying on few minimum wage changes. We view our work as complementary to those papers in the sense that it indicates directions where further structural modeling may be useful.

The paper proceeds in five sections, including the introduction. In the second section, we describe our data. In the third section, we present our empirical strategy and the main results. In section four, we present a brief theoretical model to aid in understanding the empirical results and present a further specification indicated by the model. Section five contains conclusions.

2 Data

This section contains a brief description of the two main sources of data: provincial minimum wage data and Canadian Labour Force Survey (LFS) data. We also present basic patterns of the key variables of interest.

We use provincial minimum wage data that cover the 1979-2008 period. The minimum wage, as with other labour matters, falls under provincial jurisdiction in Canada.[4] Having each of Canada's ten provinces set their own minimum wage thus provides for a rich source of minimum wage variation. Some provinces have, at various points in time, adopted lower rates for special classes of workers (e.g. students in Ontario). Yet, the evidence shows that firms do not, for the most part, take advantage of these special categories (e.g., Card and Krueger (1995)). As such, this paper focusses on the general adult minimum wage for each province. To match our other data, we focus on monthly frequencies. In particular, we use the minimum wage in force on the 15th of each month as relevant for that month to ensure compatibility with our tenure data.[5]

The key explanatory variable in our regression analysis is the real minimum wage. We construct

[4]Workers under federal jurisdiction (e.g. air transport) were the exception. Prior to 1996, there was a distinct federal minimum wage for those workers. Yet, the federal minimum wage was relevant to only a small subset of workers, and since 1996, the federal rate has adopted the general adult minimum wage of the province where the employer is usually employed.

[5]Tenure information is asked in the week which includes the 15th of the month.

it by deflating the (nominal) minimum wage by the CPI for the same province and month. Figures 1 through 3 show the real minimum wage patterns by province and year.[6] Importantly, the minimum wage shows considerable variation over time within each of the provinces.

The second source of data is the Canadian Labour Force Survey (LFS) master files.[7] The LFS is a large Canadian household survey involving interviews with approximately 50,000 households per month. The focus of the LFS is to gather information on labour market activities of Canadians. A critical variable for this study comes from the LFS tenure question which asks, "When did . . . start working for his current employer". Based on the answer to this question, the LFS records the number of months of employment. What distinguishes the LFS from other Canadian data sets, and American data sets for that matter, is that this question (with no change in wording) has been asked every month since 1976.[8]

We restrict our LFS sample to individuals aged 15 to 59 with a high school or less education over the 1979-2008 period.[9] We focus on high school or less educated individuals since this is the (broad) labour market for which the minimum wage is most relevant. We further exclude full-time students, the self-employed, and those in the military. Full-time students are not part of the study because working is not their main activity. The self-employed and those working in the military are removed because the processes that generate their job tenure spells are very different from (non-military) paid employees. Although LFS data is available as of 1976, we restrict our sample to January 1979 onwards to match our real minimum wage data. Provincial CPI data used to construct the real minimum wage variable is only available as of September 1978.

Our main focus in the empirical work is on transition rates in and out of employment. To construct those rates we take advantage of the rotating panel design of the LFS. Individuals remain in the sample for six consecutive months, and every month one-sixth of the panel is replaced. As

[6]For ease of presentation, the figures only show the real minimum wage as of March 15th of each year (unlike our regression analysis where we use all months).

[7]These files were accessed on site at the Carleton, Ottawa, Outaouais local Research Data Centre (COOL RDC). This RDC is run and sponsored by Carleton University, University of Ottawa, Université du Québec en Outaouais, in collaboration with Statistics Canada, Social Sciences and Humanities Research Council, and Canadian Institutes of Health Research.

[8]See Brochu (2006) for a detailed discussion of the limitations of other North American data sets.

[9]Starting in 1990, the LFS introduced some modifications to its education questions. The focus changed from measuring years of education to measuring educational attainment. The December 1989 transitions were excluded from our analysis because the numerator and the denominator are not based on the same question. As a robustness check, we repeated our analysis for those with 10 years or less of education, a group for which the effect of the change were minimal (Gower 1993). The results of our regression analysis are essentially the same.

such, one can link consecutive months of the LFS thereby creating two-month mini panels.[10] With mini panels, the estimation of transition rates is straightforward. The March 2008 layoff rate for Ontario, for example, is estimated using only the March 2008 mini panel (i.e. the linked March-April 2008 data); it is simply the (weighted) proportion of period 1 Ontario workers who were identified as laid-off in period 2 of the panel.[11]

The first variable we investigate is the retention rate, defined as the probability a person on a job in month t is still on that job in month t+1.[12] The second is the quit rate, defined as the proportion of people observed on a job in month t who are observed not to be working in month t+1 and who respond to the question of why they separated from their last job by saying they quit. The key problem with this definition of the quit rate is that it misses anyone who separates from a job and finds a new job before the following month. In our second definition of the quit rate we include in our quits both those captured under the first definition and anyone who was on a job in month t and employed but on a different job in month t+1. The third dependent variable is the layoff rate, defined as the proportion of people employed in month t who are not employed in month t+1 and respond that they separated from their previous job due to a layoff.[13] The fourth dependent variable is the hiring rate, which we define as the proportion of people who are non-employed in month t who are employed in month t+1. Finally, we also present results where we examine changes in hours of work for individuals that continue with the same employer to see if firms adjusted the work of new hires in this dimension.

Figures 4 and 5 show the Canadian layoff, quit and hiring rate patterns for the 1979-2008 period.[14] As expected, quit and hiring rates are cyclical in nature, while the layoff rate tends to be counter-cyclical. Interestingly, the layoff rate is systematically larger than the quit rates, even when using the more expanded definition of quits that includes those who were on a job in month t and employed but on a different job in month t+1. Perhaps the most striking feature of these figures is the rapid and substantial increase in the hiring rate in the late 1990s. This coincides with

[10] A detailed description of how the data was linked can be found in Appendix A.

[11] We use the period 1 LFS weights in estimating each transition rate.

[12] One can also use this data to construct retention rates through a synthetic cohort type methodology (see Brochu (2011)). Our results using this alternate methodology are similar in nature to those presented here.

[13] For the period from 1999 to 2005, the LFS asked job to job switchers why they left their first job. Using that data, we find that 68% of workers who transit directly to a new job by the time of the next monthly survey reported that they quit their previous job. Thus, our second quit definition largely captures actual quitters but clearly also includes a significant number of layoffs.

[14] The monthly rates are averaged over each year.

the surge in the employment rate that occurred in Canada over this period.[15]

Tables 1 and 2 present summary statistics for all years combined. Table 1 shows the average retention, quit, hiring and layoff rates as well as average changes in hours of work conditional on staying with the same employer. Table 2 focuses on hiring rates. For transitions out of employment, initial period tenure levels clearly matter. Workers with lower levels of initial tenure are more prone to quit or to be laid off, and as such, have a lower retention rate. One can also see some important differences in rates across age groups. Younger workers are less likely to continue with the same employer, but they are also more likely to be re-hired.

3 Empirical Specification and Results

For all of our dependent variables, we use the same estimation specification, as follows:

$$y^g_{p,t} = \alpha^g + \sum_{k=0}^{K} \beta^g_k ln(rmin)_{p,t-12k} + X_{p,t}\gamma^g + \epsilon^g_{p,t} \qquad (1)$$

where $y_{p,t}$ is the dependent variable and $ln(rmin)_{p,t}$ is the log of the real minimum wage in province p and period t. Recall that we have the following five dependent variables: the retention rate, the quit rate (two measures), the layoff rate, the hiring rate and hours worked. The vector of controls, $X_{p,t}$, includes a complete set of provincial dummies, a dummy variable which equals 1 if there was a minimum wage change over the upcoming month, and a full set of time dummies, corresponding to every month of every year. We include the dummy variable for a current minimum wage increase in order to allow us to focus on longer term equilibrium type effects rather than immediate adjustments to a minimum wage change. We present results for the cases where $K = 0$ (i.e. no lags) and $K = 1$ (i.e. using the real minimum wage lagged by one year). We have also estimated specifications with higher lags and report on them where relevant. We use lags specified in years rather than months because we want to examine the possibility of long term adjustments to minimum wage changes. All our estimations are performed using weighted least squares where the weights are the inverse of the number of individuals in the relevant "at risk" group in order to account for the fact that, for example, the number of workers in the province of Prince Edward Island in a month is less

[15]Campolieti (forthcoming) finds the same patterns when applying Shimer (2007)'s more indirect method of calculating the hiring rate to Canadian data.

than 1.5% percent of the number of workers in Ontario. We employ the g subscript in equation (1) to emphasize that we provide separate estimates for a variety of sub-groups defined by gender, education and age.

In Table 3, we provide our base results, showing the impact of minimum wages on the retention rate for different initial period tenure levels. For brevity, we do not present the large set of estimated coefficient on the province, time and current period minimum wage change dummy variables. The first panel shows results for males and females combined. The first column presents results not conditioned on initial tenure level and it is apparent that the minimum wage has no impact on retention rates for all workers combined. However, once we examine the impact for workers with less than one year of job tenure, we find a strongly statistically significant coefficient of .035 on the log real minimum wage variable. This implies that a 10% increase in the real minimum wage leads to a statistically significant 0.0035 increase in the retention rate for workers with high school or less of education who have been with the same employer less than one year (where a typical one-month retention rate for this group is on the order of 0.93). At first glance, this may appear small but even apparently small changes at the monthly level imply relatively large effects on an annual basis. Thus, the probability a job continues for a year if the monthly retention rate is 0.93 and there is an equal probability of retention in each month is 0.42. If, instead, the monthly retention rate increased to 0.934 (as the estimate suggests would arise from a 10% increase in the minimum wage), the retention rate becomes 0.44 - an approximately 5% increase in the annual retention rate. What is perhaps even more striking about the estimate, though, is its sign. While basic reasoning from a standard demand and supply model might lead one to expect that retention rates will be lower in high minimum wage jurisdictions, our estimate indicates the opposite effect. As we will see, a positive effect on the retention rate is consistent with other standard theories of the labour market.

The second set of rows in Table 3 report on a specification including the one year lag of the real minimum wage variable. The coefficient on this lag variable is economically insubstantial and far from statistically significant at any conventional significance level. The implication is that long term adjustments do not reverse the effect of minimum wages in enhancing retention rates. In the third and fourth columns in the table we repeat our estimations (with and without the one year lag) for workers whose initial tenure is under six months and workers whose initial tenure is between 6 and 11 months. The results from these exercises reveal that the positive impacts of the minimum wage for workers of under one year of job tenure displayed in column 2 are entirely due to workers with tenure of under 6 months. The estimated effects are neither economically substantial nor statistically significant for workers with 6 to 11 months of job tenure.

The tenure pattern in Table 3 matches well with regulations on notice requirements for employment termination in Canada. Most workers fall under provincial jurisdiction in terms of labour market regulations. Termination notice varies by length of service in most provinces with many of them having no required notice for short durations. Thus, British Columbia and New Brunswick require no notice for jobs that have so far lasted less than 6 months, and Alberta, PEI, Ontario, Quebec and Saskatchewan require no notice for jobs of less than 3 months duration. For all jurisdictions, the required notification period (when one is required) for jobs of under a year duration are either one or two weeks (Kuhn 1993). Firms are required to pay a lump sum equal to the wages for the notification period if notice is not given. Whether or not these regulations are enough to induce changes in firm layoff behaviour, the law certainly acknowledges what is effectively a probationary period during which there is little or no implication from laying off a worker, and the results in Table 3 indicate that minimum wage impacts on terminations occur mainly within this termination period.

In the second and third panels of Table 3, we repeat all of these estimations separately for men and women. The key result from these estimations is that the effects of minimum wages on retention are nearly identical for men and women. Given this, we will continue with a combined male and female sample for the remainder of the paper.[16]

In Table 4, we present results for three different age groups: ages 15-19, 20-24 and age 25-59. The previous literature has tended to focus on teenagers as a group for whom one expects the minimum wage to be directly relevant. In this data, we observe the strongest impacts for teenagers but only to some extent. We observe significant effects even for the "All Tenure" sample of teenagers compared to essentially zero effects for "All Tenure" for other ages. Interestingly, though, the effects

[16] In order to test for gender differences in the minimum effect, we re-estimated equation (1) using both male and female retention rates and adding a full set of gender interaction terms. We used a t-test for the no lag model (where we tested the significance of the gender-minimum wage interaction term) and an F-test (where we tested the joint significance of the two gender-minimum wage interaction terms). We repeated the same tests for workers with less than one year of tenure, with 6 to 11 months of tenure and with less than 6 months of tenure. In all cases we could not reject the null hypothesis that the minimum wage effect is the same for men and women (the p-values of all test statistics exceeded 0.7).

for workers with under 6 months of tenure for all age groups is substantial and similar in size to that observed for teenagers. This may arise because low educated workers who are starting a new job tend to be low wage workers (and thus workers for whom the minimum wage is relevant) regardless of their age.[17] The more substantial "All Tenure" group effect for teenagers may then just reflect that a much larger proportion of teenagers has under a year of tenure.

Table 5 contains the main results in our paper: the impact of minimum wages separately for quits and layoffs. In the first panel, we present results for our conservative definition of quits (including only those workers who responded that they were not working in month t+1 because they quit the job they had in month t).[18] For workers, with less than 1 year of job tenure, the specification not including any lags of the minimum wage reveals a negative estimated effect of the minimum wage on quits. This fits with our Table 3 results (since retention and separation rates are the inverse of one another) but the estimated effect is only one-tenth the size of what we observed there and is not statistically significant at any conventional level. Interestingly, when we allow for a lagged effect, the estimated coefficient on the one year lag of the minimum wage is larger and statistically significant (though still only about 1/3 the size of the overall retention effect).[19] Moreover, in contrast to our overall results, the largest and most significant effects are for workers with 6 to 11 months of tenure.

In the second panel of Table 5, we expand our definition of quits to include direct job to job transitions. When we do this, the estimated minimum wage effect when no lags are included are statistically significant, negative, and correspond in size to about 1/2 of the overall retention effect. Once again, the estimated effect is larger for those with under 6 months of tenure, though now the effect for those with 6 to 11 months is also statistically significant. As in the first panel, when we include a lag of the minimum wage, only the lag enters significantly.[20] It is worth recalling that some of the separations counted as quits in this definition may in fact be layoffs, implying that these results will bear more resemblance to results based purely on layoffs. Nonetheless, this definition

[17]The average wage for workers in our 2008 sample that have under 6 months of job tenure was \$14.05 while for all other levels of tenure it was \$18.62.

[18]Given that minimum wage effects tended to be statistically insignificant and economically insubstantial for job tenure over a year in the previous tables, we mainly focus on results for workers with under one year of job tenure for the remainder of the paper.

[19]When we allow a second year lag in the real minimum wage, the coefficient on this additional lag is not statistically significant and the pattern presented in the table remains.

[20]Once again, the second lag of the minimum wage does not enter significantly when it is introduced.

of quits is closer to one that fits with the Burdett and Mortensen type model used in Dube et al. (2010) since that model emphasizes job to job transitions. In that sense, the results here may fit with the Dube et al. (2010) model, where reductions in quits are ultimately due to a rightward shift induced by the minimum wage increase and where that shift takes some time to develop. But it is worth emphasizing that minimum wage effects operating through quits at best account for 1/2 of overall retention rate movements (and for much less if we use the clean quits measure in the first panel), and, unlike in their model, the effects are not present for all tenure levels.[21]

The third panel of Table 5 contains the results using the layoff rate as the dependent variable. When no lags are included in the estimation, the minimum wage coefficient is negative, highly statistically significant and approximately 2/3 to 3/4 of the size of the effect on the overall retention rate. When a single lag is included, the estimates are nearly identical in size to those from the overall retention rate in the initial period but the lagged value coefficient is larger and positive (though not statistically significant at any conventional significance level). This suggests that minimum wage effects on layoff rates are reduced by about 1/4 over the longer run. Moreover, one could account for the pattern in the overall retention rate as due entirely to layoff effects in the shorter term with offsetting and smaller effects from quits and layoffs in the longer term. We argue, based on these patterns, that the main focus should be on layoffs in any attempt to understand the impact of minimum wages on the retention rate.

The top panel in Table 6 contains elasticities calculated from the minimum wage effect estimates in Table 5. In particular, we calculate the total number of separations resulting from either quits or layoffs for the province of Ontario in September of 2007 by multiplying average quit and layoff rates times employment in Ontario in that month. We then use the estimates in Table 5 to compute the change in quit and layoff rates that would arise from a 10% increase in the real minimum wage, multiplying these by the employment level in Ontario in September, 2007 to get an estimate of the change in the number of separations that would result from a minimum wage increase. The entries in the table show these calculated changes in separations as a proportion of the total number of separations. The first panel carries out this exercise using the first definition of quits while the second repeats the exercise for the definition of quits that includes job to job transitions.[22]

[21] In the estimation using the second definition of quits with no minimum wage lags for workers from all tenure levels, the minimum wage coefficient is -.0011 with a standard error of .0013.

[22] As mentioned earlier, data from the 1997-2005 period indicates that 68% of job to job transitions recorded in the

The total elasticity (quits and layoffs) implies that a 10% increase in the minimum wage implies approximately a 2.6% reduction in separations from jobs with less than one year of tenure and approximately a 1% decline in separations from jobs of all tenures.[23] Of this, at least two-thirds (and for most tenure length- quit definition combinations a much larger proportion) is due to the effect on layoffs. A reasonable characterization of the results in Table 6 is that an increase in the minimum wage has non-trivial effects in reducing separations (especially at short tenure) and that the majority of these effects happen through reductions in layoffs.

The second panel of Table 6 repeats this exercise for teenagers. As in the retention rate results in Table 4, we see here that the results for teenagers and the all-age results are very similar for tenure under 1 year but the teenage results are much larger for the all tenure sample. As in the first panel, layoffs account for approximately 90% or more of minimum wage effects when we use the most restrictive quit definition and approximately 60% of effects when we use the (adjusted) broader quit definition.

In Table 7, we examine results for other employment related outcomes. In the top panel, we examine the impact of minimum wages on hiring rates for various demographic groups. The both genders combined results in the first column indicate that increasing the minimum wage reduces hiring rates by an economically substantial and statistically significant amount. The second set of rows show that the lagged minimum wage does not have an economically substantial or statistically significant coefficient. Thus, what we are capturing is a long run move toward lower hiring rates after a minimum wage is raised. In the specification without a lagged minimum wage, the negative hiring effect appears to be substantially smaller for females but this gender difference disappears once we include a lag. Again, the data seem to point toward similar impacts by gender. The negative hiring effects of a higher minimum wage regime are, however, much stronger for teenagers. Thus, in a higher minimum wage regime, teenagers have both substantially higher retention rates and substantially lower hiring rates relative to other workers. The fact that the age differential in hiring rates appears to be larger than that in retention rates fits with results in the literature

data are quits while the rest are layoffs. We apportion the calculated change in separations for quit2 to quits and layoffs based on this. Even without this reapportioning, layoffs constitute 60% of separations when using the quit2 results.

[23] Note that when we use the first quit definition, job to job transitions are not counted among the separations and so the denominator in the calculations - the total number of separations - is smaller. This is the reason the calculated elasticities are approximately the same even though the estimated coefficients for quit2 are larger.

showing that minimum wages have negative effects on employment levels for teenagers but not for older workers.

In the lower panel of Table 7, we show estimates of impacts on average weekly hours of work for workers with different levels of tenure. One might hypothesize that minimum wage impacts show up to some extent in reductions in weekly hours rather than in employment changes. In fact, the table indicates that there is no evidence of an impact on hours in higher minimum wage regimes. This is true regardless of the individual's tenure level.

3.1 Employment Rate Implications

A natural question is the implication for the overall employment rate of the changes in separation and hiring rates induced by a change in the minimum wage. To answer that, we can consider two regimes - one with average hiring, layoff and quit rates for Ontario for the year 2007 and one where we use the estimated effects from Tables 5 and 7 in conjunction with a 10% real increase in the minimum wage to calculate new, counterfactual rates of separation and hiring. We then use the rates from both scenarios to construct the average level of the employment rate in each regime and, from that, the impact of the minimum wage increase on the employment rate.

We calculate the employment rate as the equilibrium rate under the assumption that flows into employment equal flows out. Thus, the equilibrium rate equals hr/(hr + sr), where hr is the hiring rate and sr is the separation rate. We compute the separation rate as the sum of the layoff rate plus the quit rate. Specifically, we use what we call the quit1 rate that does not include direct job to job transitions since we only need flows out of employment. For all ages, the implied employment rate in the base scenario is 69%. This compares favourably with the actual employment rate of 66.6% for high school dropouts and graduates aged 15 to 54 (both sexes) in Ontario in 2007. The calculated minimum wage impact implies that a 10% increase in the real minimum wage generates a 0.76% decline in the employment rate with an associated standard error of 0.50. In comparison, for teenagers, the calculated minimum wage effect is -1.7% with a standard error of 0.9.[24]

To check on the comparison of these calculated minimum wage impacts with more standard estimates for Canada, we implemented a standard specification using Canadian provincial data for

[24] The implied base equilibrium employment rate for teenagers is 62%, which is higher than the average employment rate of 50.7% for high school grads and dropouts aged 15 to 24 in Ontario in 2007. The fact that we drop full-time students in our sample but they are included in the published statistics could account for this difference.

our same sample period (1979 to 2008). Specifically, we regressed age specific employment rates on the real minimum wage, a lag of the minimum wage variable, and a complete set of year and province dummies. For the regressions for teenagers we also included the proportion of the provincial population who were teenagers and the adult male unemployment rate. This specification has been used in numerous previous papers (see Neumark and Wascher (2008) for a recent comprehensive survey of the minimum wage literature). The results from these estimations implied that a 10% increase in the minimum age would lead to a statistically significant 2.5% decline in the teenage employment rate and a statistically insignificant 0.5% decline for the overall employment rate. These are in substantial agreement with earlier estimates in the literature and fit well with our calculated impacts on the equilibrium rate. Our results indicate that the small net effect on the overall employment rate reflects offsetting negative effects of a minimum wage increase on hiring and layoff rates. For teenagers, the more substantial negative net effect reflects the fact that, for them, the negative impact on hiring substantially outweighs the negative effect on layoffs.

4 An Illustrative Model

To this point, we have found, examining a substantial amount of data on quits, layoffs and hires, that both separation and hiring rates are lower in higher minimum wage regimes. Importantly, the reduction in separations occurs mainly in the first 6 months of a job and mainly through a reduction in layoffs. In this section, we briefly describe a partial equilibrium model of firm decision making which captures these main features of the data and provides some intuition for them. The model is a search and matching model similar in spirit to Flinn (2006) but with endogenous separations. In an on-line (Appendix B), we present a general equilibrium version of the model to emphasize that the main effects of higher minimum wages set out here are also present in general equilibrium. Since the main intuition is easier to see in the partial equilibrium setting, we present the more restrictive model here and provide a brief description of general equilibrium results afterward.

Consider a matching model in which each operating firm employs one worker. Workers and firms meet according to some matching technology but do not know the ultimate productivity of the match when they first meet. The productivity, η, which is a random variable with associated cumulative distribution function F, is match specific and is not revealed until after the worker has worked for the firm for a brief probationary period. During the probationary period, workers are paid a function of the minimum wage, m, denoted as c(m). Once the match quality is revealed, the match is dissolved if the productivity is sufficiently low. Otherwise it continues and the firm and worker bargain over a wage to divide the match specific surplus according to a Nash bargaining rule. Firms also pay a flow cost of posting a vacancy, z, and firms and workers face a common discount rate, r. In the partial equilibrium setting, we will discuss the separation decision as if it is made unilaterally by the firm and call the separations layoffs. As we discuss later, in general equilibrium, the decision to dissolve a match is, in fact, jointly agreed upon in most, but not all, situations.

The matching function determining firm and worker meetings is a function of labour market tightness, $\theta = \frac{V}{U}$ (V = the number of vacancies and U = the number of unemployed workers). The matching probability implies a probability of a firm filling a vacancy, ϕ, and a probability of an unemployed worker meeting a vacancy, ψ. There is no on-the-job search. Matches end according to an exogenous probability, δ, but will also be terminated endogenously when η is revealed in some cases. In the partial equilibrium version of the model, we will take θ as fixed.

The key intuition in the model can be obtained by examining the firm Bellman equations, with the equation corresponding to a vacancy for any firm being given by

$$r\Pi_v = -z + \phi_F(\Pi_e^e - \Pi_v) - \phi c(m) \tag{2}$$

where, Π_v is the value of a vacancy and Π_e^e is the expected value of a filled job. Note that the training cost, $c(m)$, is only incurred if there is a match and, therefore, is multiplied by ϕ. Note, also, that ϕ_F is the probability a match is made and continues. That is, $\phi_F = \phi \times Probability$ (the match specific productivity is high enough to warrant continuing).

Workers are assumed to be heterogeneous with respect to their flow value of being unemployed, b_j, where j indexes the worker. This is reflected in each worker having a reservation wage, w_j^*, such that he or she prefers the unemployed state to being employed with a wage below w_j^*. Because of this, the bargaining solution, and with it, profits, will vary with the specific worker with whom the firm matches. The value of a vacancy filled by worker j and with a realized draw, η, is determined by

$$r\Pi_{ej}(\eta) = \eta - w_j(\eta) + \delta(\Pi_v - \Pi_{ej}(\eta)) \tag{3}$$

where $w_j(\eta)$ is the wage bargained when a firm meets worker j. $w_j(\eta)$ is replaced by m in the value function when $w_j(\eta) < m$.

We will assume a specification for firm entry that follows Fonseca et al. (2001) (and Beaudry et al. (2011)). In particular, we assume that each worker has a probability of turning into an entrepreneur, Ω. If a worker becomes an entrepreneur, she draws a value for the fixed cost of creating a vacancy from a cumulative distribution function, G. Entrepreneurs with a fixed cost below π_v will open a vacancy and search for a worker to fill it. This model allows for free entry in the sense that entrepreneurs enter until the marginal entrant has zero expected profits, but the value of a vacancy is not driven to zero by competition, which will be important in the considerations that follow.

Given that Π_{ei} is increasing in η while Π_v is not a function of η, we can define reservation values of η, η_j^*, such that a match with worker j is terminated if $\eta < \eta_j^*$. In particular, define η_j^* as the value of η at which $\Pi_{ej} = \Pi_v$ with a wage just equals j's reservation wage, w_j^*. Returning to (3), this implies that η_j^* is defined by,

$$\eta_j^* = r\Pi_v + w_j^* \tag{4}$$

i.e., η_j^* is the productivity level that just covers the sum of the worker and firm outside options.

Understanding how the minimum wage affects terminations reduces to understanding its impact on the η_j^*'s. In our partial equilibrium examination of firm actions, we take w_j^* as fixed, and so movements in η_j^* are determined by movements in Π_v.

In Appendix B, we derive an expression for Π_v. From (2), Π_v depends crucially on the expected value from a filled position, Π_e^e. Profits from an actual match and expected profits from potential matches depend, in turn, on the type of worker a firm meets. In particular, it is relevant to divide workers into two types: those with a flow value of unemployment that implies that their reservation wage is below the minimum wage and those with a reservation wage above the minimum wage. For the first group, m replaces w_j^* in (4), implying a common value for the reservation productivity, η_m^* for all matches with this group.[25] We can also define $\hat{\eta}_j$ as the value of η_j such that a firm and

[25] As a side point, there will be some matches for this group with $\eta < \eta_m^*$ where firms and workers would agree to

worker j would just bargain a wage equal to m. Thus, for $\eta_m^* \leq \eta_j < \hat{\eta}_j$ the match will continue with the worker receiving the minimum wage.[26] These matches will be generate lower flow profits for the firm than non-minimum wage matches.

Now we are in a position to discuss the impact of an increase in the minimum wage on firm separation decisions. For all firms, an increase in the minimum wage reduces Π_e^e, the expected profits from a filled vacancy (and with it the value of opening a vacancy) both because they must pay all minimum wage workers more and because some matches where the value of η implied the bargained wage was formerly above m will now be covered by the minimum wage. Moreover, the cost of paying a new worker during the probationary period increases with m, further reducing the value of opening a new vacancy. To understand the implications of this, we need to distinguish between two types of matches. For matches with high reservation wage ($w_j^* > m$) workers, the minimum wage is not directly relevant since the worker would not stay in a match with a wage as low as m. This means a minimum wage increase only has an indirect impact through the reduction in the value to the firm of terminating the current match and opening a new vacancy.[27] Returning to (4), the reduction in Π_v implies a reduction in η_j^* and, with it, in terminations. Essentially, having already matched with a worker and having sunk the cost of paying for the probationary period, the higher is the minimum wage, the more likely is the firm to want to maintain the current match than go back, re-pay the probationary period costs and potentially end up in a lower profit, minimum wage match.

The second type of matches are those with low reservation wage workers. In this case, the marginal match will be one which pays the minimum wage. Thus, an increase in the minimum wage will have both the indirect effects (through a reduction in Π_v) and a direct effect on the flow profits of the marginal match. The latter effect will imply an increase in η_m^*, as can be seen by replacing w_j^* with m in (4). The direct effect should dominate, implying an increase in layoffs

continue the match with a wage below m if they were allowed to do so. However, with firms constrained to pay m, they terminate the match. In this case, the separation is clearly a layoff since the worker would prefer to continue with the match given that $m > w_j^*$.

[26] $\hat{\eta}_j$ is indexed by j since it depends on the worker's value of unemployment.

[27] It is at this point that the firm entry specification becomes relevant. In standard versions of search models there is a perfectly elastic supply of potential firms and Π_v is always driven to zero. In that case, there would be no possibility of a change in m changing Π_v. With the specification set out here, the elasticity of supply of entrepreneurs is determined by the shape of the G distribution. If the supply is less than perfectly elastic then Π_v is non-zero and can be affected by m. Beaudry et al. (2011) present evidence that the supply of entrepreneurs, and with it the job creation curve in a standard search model, is relatively inelastic with respect to changes in wage costs.

for this group when m rises. Whether the ultimate impact on layoffs is negative or positive then depends on the relative numbers of matches of each type and is an empirical matter.

In general equilibrium, we allow for changes in both θ and w_j^* in response to a minimum wage increase. The impact on worker reservation wages will be positive as low reservation wage workers will benefit directly from the higher value for m and all workers benefit indirectly because they are able to bargain for better wages with firms who, as we have seen, have weakened outside options. This effect makes workers pickier, which tends to reduce θ as workers stay unemployed longer. At the same time, with a reduced value for vacancies, fewer vacancies are created, which also drives θ down. Thus, in equilibrium, the model predicts a lower observed probability of unemployed workers matching with firms (what we called the hiring rate in the empirical work earlier). In terms of the η_j^* values, the implications become more uncertain in general equilibrium. While firms, as described above, have an increased inclination to continue with matches, the improved outside option for workers implies that they are more likely to want matches to terminate. Again, the actual outcome in terms of separations is an empirical matter.

4.1 An Empirical Implication

The model has a simple empirical implication which can be checked in the data. An increase in the minimum wage has two, offsetting effects on layoffs in the model. The first is a direct effect whereby less productive matches are eliminated (η_m^* increases), leading to an increase in layoffs. This is an immediate effect stemming from comparisons of the current minimum wage to productivity draws on the current job. The second is the effect through reducing expected profits from future matches if the current match is dissolved and the firm opens a new vacancy. This effect reduces layoffs and it is about expectations. The latter effect will be smaller if minimum wages are expected to be lower in future, which would be the case in high inflation periods. Thus, the model predicts that inflation will reduce layoffs through the direct channel (because the current real minimum wage is lower) but should also diminish the expectations related effects of the minimum wage. We already capture the first channel because we use the real minimum wage in our estimation. The second inflation effect would be reflected in an interaction between the inflation rate and the real minimum wage variable. The coefficient on that interaction should be positive: in high inflation periods the layoff reducing effect of minimum wage increases should be lessened. This is not an implication of other potential models of minimum wages and transitions.[28]

Table 8 contains the results from specifications involving the inflation interaction. The inflation rates used in the estimation are province specific. Given the inclusion of a full set of time dummies, the effect of this interaction is identified from relative differences in inflation within provinces over time. We include the inflation rate both directly and in interaction with the real minimum wage variable. The inflation rate on its own results in statistically significant increases in the retention rate and declines in the layoff rate. Its impact on the quit rate is smaller than for the layoff rate and generally not statistically significantly different from zero at conventional significance levels. These results fit broadly with a model in which firms cannot easily cut nominal wages and higher inflation allows for declines in real wages that can result in firms not laying off workers. The interaction term implies a strongly statistically significant effect of inflation in the direction of mitigating the positive effect of the real minimum wage on the separation rate. Again, this effect arises almost entirely through layoffs, with higher inflation periods being associated with a less negative impact of the real minimum wage on the layoff rate. The fact that the inflation impact occurs through layoffs but not, for the most part through quits, fits with the model, which provides an explanation for this interaction based on firm layoff behaviour. There is no apparent reason why quits should respond to the inflation regime in this way and, in that sense, these results lend more support to models that emphasize layoffs rather than quits as the channel through which minimum wages reduce the separation rate.

The results in Table 8 imply very substantial impacts of the real minimum wage on layoff rates in low inflation regimes. Thus, for example, with an inflation rate of 2% (close to Canada's average over the last decade), a 10% increase in the real minimum wage implies a 3.9% decline in the separation rate due to layoffs for jobs with tenure under 1 year. This compares to the overall average of a 2.3% decline shown in Table 6 and to a zero effect if the inflation rate reaches approximately 10%. Thus, the results in this table both provide support for the model and imply that the impact of minimum wages on layoffs are even more substantial in recent times than what is shown in the earlier tables.

[28]For example, in the Burdett-Mortensen type model presented in Dube et al. (2010), the negative effect of a minimum wage increase on separations occurs because it induces a greater supply of applicants for high wage firms. This, in turn, reduces their need to raid lower wage firms for workers, reducing separations from the latter firms. There is no reason within the model for this effect to vary with the inflation rate, assuming the minimum wage variable is already properly deflated.

While the inflation interaction results fit with the implications of our model, we would not argue that the matching model presented here is the only model capable of predicting our data patterns. In an efficiency wage model, for example, an increase in the ratio of the minimum wage to the average wage in the economy could reduce shirking and, therefore, terminations associated with a worker caught shirking. Whether this would be associated with an increase or decrease in hiring is unclear without putting more structure on the model.[29] Other models may also serve to rationalize our empirical results.[30] The key point is that standard models can imply that minimum wages shift the equilibrium in a labour market in such a way that the nature of flows into and out of employment are altered even if the net impact on the employment rate is small.

5 Conclusion

In this paper, we investigate whether and how employment transitions differ in high versus low minimum wage regimes. We do this using data from the Canadian Labour Force Survey which has a consistent question on job tenure throughout our sample period (1979-2008). This allows us to take advantage of the fact that the minimum wage is set at the provincial level in Canada, resulting in over 140 minimum wage changes in our period. We focus on low educated workers throughout. Working with this data, we find that higher real minimum wage regimes are associated with lower job separation rates and lower hiring rates, with both effects being economically substantial and statistically significant. Our most important result is that the reduction in separation rates is driven mainly by a reduction in layoffs rather than quits. We also find that this reduction occurs mainly in the first six months of a job and that the size of the effect at the outset of a job is similar across age groups (including teenagers) and between genders. In the fourth section of the paper, we present a search and matching model which implies that firms operating in the low skilled labour market reduce layoffs because their expected profits from terminating the current match and starting a

[29] Rebitzer and Taylor (1995) examine minimum wage effects in an efficiency wage model. In their model there is a reduction in shirking but, because they assume that the proportion of shirkers who are caught is decreasing in the size of the firm, it also implies an increase in hiring.

[30] Acemoglu (2001) investigates a search and bargaining model in which firms can create one of two types of vacancies: lower productivity-low wage jobs (bad jobs) or higher productivity-high wage jobs (good jobs). A minimum wage above the bad job sector wage but below the wage in the good sector will reduce relative profits in the bad job sector and cause a shift in composition toward good jobs. Such a model might be extended to include more investment by firms in workers in good jobs and, with it, lower layoffs similar to the mechanism in Acemoglu and Pischke (1999).

new one are lower when the minimum wage is higher. This model has an implication for differences in the minimum wage effect with the inflation rate which we find is supported in our data. Once those inflation effects are taken into account, we find that a 10% increase in the real minimum wage when the inflation rate is 2% (which is near the rate for Canada for the last decade) implies a decline in separations occurring through layoffs of 3.9%.

Taken as a whole, these results imply that a higher minimum wage regime is associated with significantly lower hiring rates and lower layoff rates, particularly in the first six months of a job. For the workforce as a whole, these effects almost exactly offset one another, resulting in no net impact on the employment rate. This fits with standard estimations of the impact of minimum wage changes on the overall employment rate for all age groups. Policy makers then face a choice between a high minimum wage regime where workers take longer to find a job but have greater job stability once they match with a firm versus a low minimum wage regime where workers move more quickly through both unemployment and employment spells. Based on this, the key question becomes which regime is associated with higher welfare. The answer to that will depend in part on worker preferences about job stability versus being unemployed. It will also depend on whether greater job stability is associated with greater investment in firm specific human capital. The ultimate welfare impact is beyond the scope of this paper, but the similarity of the estimated impacts across age and gender groups imply that these welfare implications are important for the entire spectrum of low skilled workers. In contrast, estimations focusing just on the net employment rate impact (and ignoring impacts on the underlying gross transition rates) would lead one to conclude that minimum wages have little impact on most workers older than teenagers.

Appendix A

In this appendix we provide more details information on the LFS, and in particular, the construction of our mini panels.

The LFS has a rotating panel design where households remain in the sample for six consecutive months. Every month 1/6 of the sample is replaced by households in a similar area. Although it has panel features, it is not a panel data set per se; the LFS is officially designed to produce cross sectional samples. As such, it follows dwellings, and not individuals (households). If an individual changes dwelling, he is out of the reach of the survey.

The LFS also does not have a single person identifier variable. Fortunately, we can uniquely identify individual across monthly files using a combination of variables—all of which are provided by the LFS. Changes over time in geographical identifiers (e.g. EI regions) have meant that different identifying variables must be used for different periods. We provide both a short description of the variables and also its name (in capital letters) as identified in the LFS codebook. For the 1976 to 1983 period, one must use the month, the regional office (REGOFF), the unique household identifier within a regional office (DOCKET), and the unique person identifier within a household (LINE) variables. For 1984 to 1986, one must rely on the month, the economic regions (ERTAB), the census metropolitan areas and urban centres (CMATAB), the REGOFF, the DOCKET, and the LINE variables. For 1987 to 1995, it is the month, the ERTAB, the CMATAB, the unemployment insurance region (UIRTAB), the REGOFF, the DOCKET, and the LINE variables. Finally, for 1996 onwards one must use the month, the one-digit province code (PROV1), the pseudo UIC regions (PSEUDOUI), the regional strata (FRAME), the super-stratum (STRAFRAM), the sample design type (TYPE), the first-stage sampling unit (CLUST), the rotation number (ROTATION), the number assigned to dwellings within a cluster (LISTLINE), the multiple dwelling code for structures that have more than one dwelling (MULT), and the LINE variables.

We dropped individuals that had incompatible tenure spells across the two periods of the panel. For an individual that worked in period 1, she must have one more month of tenure in period 2 (i.e. continued with the same employer), one month of tenure in period 2 (i.e. started a new job), or no job tenure in period 2 (i.e. is out of work). Finally we also dropped that transitioned to self-employment.

Appendix B: Theoretical Model (For Online Publication Only)

The Environment

Consider an environment in which there is a fixed set of firms, with each active firm hiring one worker. When a firm matches with a worker, there is a match-specific productivity draw, η, of a mean zero random variable with associated CDF, F. Importantly, the value of η is not revealed until after the firm pays a fixed training cost. We will think of that cost as corresponding to a period in which workers add nothing to output but must be paid the minimum wage, m, though we model it simply as a fixed cost, $c(m)$. Firms also pay a flow cost of posting a vacancy, z, and firms and workers face a common discount rate, r.

Firms and workers meet according to a matching function which is a function of labour market tightness, $\theta = \frac{V}{U}$ (V = the number of vacancies and U = the number of unemployed workers). The matching probability implies a probability of a firm filling a vacancy, ϕ, and a probability of an unemployed worker meeting a vacancy, ψ. There is no on-the-job search. Matches end according to an exogenous probability, δ, but will also be terminated endogenously when η is revealed in some cases.

Workers are heterogenous with respect to their flow value of utility while unemployed, b, where $b \epsilon \left[\underline{b}, \overline{b}\right]$ and has an associated CDF, H.

The Bellman equation corresponding to a vacancy for a firm is

$$r\pi_v = -z + \phi_F(\pi_e^e - \pi_v) - \phi c(m) \tag{5}$$

where, π_v is the value of a vacancy and π_e^e is the expected value of a filled job. Note that the training cost, $c(m)$, is only incurred if there is a match and, therefore, is multiplied by ϕ. Note, also, that ϕ_F is the probability a match is made and continues. That is, $\phi_F = \phi \times Probability$ (the match specific productivity is high enough to warrant continuing), where the latter equals $\phi_F = \phi \int_{\underline{b}}^{\bar{b}} \int_{\eta_j^*}^{\infty} dF dH$, and η_j^* is the reservation value of η such that matches with $\eta < \eta_j^*$ are terminated. We will discuss the notion that this problem is characterized by having a reservation property in the next section.

The value of a vacancy filled by worker j and with a realized draw, η, is determined by

$$r\pi_{ej}(\eta) = \eta - w_j(\eta) + \delta(\pi_v - \pi_{ej}(\eta)) \tag{6}$$

where $w_j(\eta)$ is the wage bargained when a firm meets worker j. We assume the wage is determined by a Nash bargaining solution to the problem of dividing the surplus from a match. Note that the firm's profits are indexed by j because different workers have different outside options, implying different surpluses from the match.

For workers, the Bellman equation corresponding to unemployment is given by,

$$rV_{uj} = b_j + \psi_F \left[V_{ej}^e - V_{uj}\right] \tag{7}$$

where $V_{uj}$is the value of being unemployed, V_{ej}^e is the expected value from employment, ψ is the probability the worker meets a vacancy, and $\psi_F = \psi \int_{\eta_j^*}^{\infty} dF$ is the probability a worker meets a match that is ultimately completed.

The Bellman equation related to employment is

$$rV_{ej}(\eta) = w_j(\eta) + \delta \left[V_{uj} - V_{ej}\right] \tag{8}$$

The total surplus to the match is,

$$S_j(\eta) = \pi_{ej}(\eta) + V_{ej}(\eta) - \pi_v - V_{uj} \tag{9}$$

Since the worker's and firm's outside options are independent of η and the benefits to the match are increasing in η, there exists an η_j^* at which the match surplus is zero. Matches with $\eta < \eta_j^*$ are terminated.

Using (6) and noting that rV_{uj} defines a reservation wage, w_j^*, for worker j, we can write,

$$r\pi_v = \eta_j^* - w_j^* \tag{10}$$

That is, if a firm just pays the worker his or her reservation wage, η_j^* is the productivity of the match where flow profits just equals the flow value of the firm terminating the match and opening a new vacancy. Note that the left hand side of (10) does not have a j subscript so any increase in w_j^* (i.e., rV_{uj}) is exactly offset by an increase in η_j^*

Partial Equilibrium Impacts of the Minimum Wage on Terminations

Within this model, the interesting termination activity relates to the endogenous decision not to continue with matches where η is below η_j^*. Our interest, in particular, is in the impact of the minimum wage, m, on terminations, which reduces to understanding its impact on η_j^*. Apart from its role in determining the costs of training, the minimum wage is only relevant in bargaining if it is higher than rV_{uj} for at least one worker, and we assume this is the case.

We begin by considering effects in partial equilibrium (where θ is constant), and proceed by substituting an expression for $r\pi_v$ in terms of basic parameters into (10). Returning to (5), this involves getting an expression for π_e^e. To do this in the presence of a minimum wage, we need to consider two types of workers: those whose reservation wage is above and those whose reservation wage is below m. Thus, define $b_m$as the value of b_j such that $rV_{uj} = m$, (given current market conditions). Then, we can write,

$$r\pi_e^e = \int_{\underline{b}}^{b_m} \left[\delta\pi_v + E(\eta \mid \eta > \eta_m^*) - m\frac{F(\hat{\eta}_l) - F(n_m^*)}{1 - F(\eta_m^*)} - E(w \mid \eta > \hat{\eta}_l)\frac{1 - F(\hat{\eta}_l)}{1 - F(\eta_m^*)} \right] dH \tag{11}$$

$$+ \int_{b_m}^{\bar{b}} \left[\delta\pi_v + E(\eta \mid \eta > \eta_l^*) - E(w \mid \eta > \eta_l^*) \right] dH - \delta\pi_e^e$$

where, η_m^* is the reservation productivity draw that allows a firm to just cover the minimum wage plus $r\pi_v$. Notice that this is the same for all pairs where $rV_{uj} < m$ and implies more layoffs than would arise without a minimum wage. $\hat{\eta}_l$ is the value of η_l such that a firm and worker l would just bargain a wage equal to m. Thus, for $\eta_m^* \leq \eta_l < \hat{\eta}_l$ the match will continue with the worker receiving the minimum wage. $\hat{\eta}_l$ is indexed by l since it depends on the worker's value of unemployment.

For workers with $b > b_m$, the minimum wage does not have a direct effect on decisions because no such worker would ever be paid that minimum wage (since it is below his or her reservation wage). η_j^* in this case is defined in (10). Note that m will still have an indirect effect for matches involving these workers since it will affect V_{uj} and π_v. Substituting (11) into (5) and rearranging, we get:

$$r\pi_v = \frac{r + \delta}{r + \delta + \phi_F}(-z - \phi c(m)) + \tag{12}$$

$$\frac{\phi_F}{r + \delta + \phi_F} \left[\left\{ \int_{\underline{b}}^{b_m} E(\eta - m \mid \eta > \hat{\eta}_l) \times \frac{F(\hat{\eta}_l) - F(n_m^*)}{1 - F(\eta_m^*)} + E(\eta - w_l \mid \eta > \eta_l^*)\frac{1 - F(\hat{\eta}_l)}{1 - F(\eta_m^*)} dH \right\} \right] +$$

$$\frac{\phi_F}{r + \delta + \phi_F} \int_{b_m}^{\bar{b}} E(\eta - w_l \mid \eta > \eta_l^*) dH$$

Now, consider matches involving a worker with $b < b_m$. In this case, rearranging 6) gives

$$\eta_m^* = r\pi_v + m \tag{13}$$

which implicitly defines η_m^*. We are interested in

$$\frac{\partial \eta_m^*}{\partial m} = r\frac{\partial \pi_v}{\partial \eta_m^*}\frac{\partial \eta_m^*}{\partial m} + r\frac{\partial \pi_v}{\partial m} \mid_{\eta_m^*} + 1$$

Therefore

$$\frac{\partial \eta_m^*}{\partial m} = \frac{1 + \dfrac{\partial \pi_v}{\partial m} \mid_{\eta_m^*}}{1 - r\dfrac{\partial \pi_v}{\partial \eta_m^*}} \tag{14}$$

First, consider $\dfrac{\partial \pi_v}{\partial \eta_m^*}$. An increase in η_m reduces the value of a vacancy because it means more initial matches are rejected (after incurring the search and training costs) but increases that value because the expected value of ongoing matches is now higher. By the envelope theorem, these effects will offset each other, implying $\dfrac{\partial \pi_v}{\partial \eta_m^*} = 0$ and,

$$\frac{\partial \eta_m^*}{\partial m} = \frac{\partial \pi_v}{\partial m} \mid_{\eta_m^*} +1$$

Now,

$$\frac{\partial r\pi_v}{\partial m} \mid_{\eta_m^*} = -\frac{r+\delta}{r+\delta+\phi_F}\phi\frac{\partial c}{\partial m} + \frac{\phi_F}{r+\delta+\phi_F}\frac{\partial A}{\partial m} \tag{15}$$

where A is the term [] in (12) which equals $(r+\delta)\pi_e^e$. Since hiring costs, c, are increasing in m, the first term on the right side of (15) is negative. In addition, expected profits for a firm will decline as it both must pay all minimum wage workers more and some matches where the value of η implied the bargained wage was formerly above m will now be covered by the minimum wage. Combined, these imply that $\frac{\partial r\pi_v}{\partial m} < 0$. Thus, the sign of $\frac{\partial \eta_m^*}{\partial m}$ is uncertain. On one side, the increase in m implies the marginal η that just covers m plus the outside option of the firm is now higher. On the other side, once a match is formed (and the training cost paid), a rise in m implies a lower outside option for the firm since dissolving the current match means incurring the new, higher training cost when the new vacancy is filled. This will push the value for η_m^* down. In general, we would expect the direct effect to be larger than the second, indirect effect and, therefore, $\frac{\partial \eta_m^*}{\partial m} > 0$.

Alternatively, for workers with $b > b_m$, rearranging (10) yields,

$$\eta_j^* = r\pi_v + w_j^* \tag{16}$$

Then,

$$\frac{\partial \eta_j^*}{\partial m} = r\frac{\partial \pi_v}{\partial \eta_j^*}\frac{\partial \eta_j^*}{\partial m} + \frac{\partial \pi_v}{\partial m} \mid_{\eta_j^*} + \frac{\partial w_j^*}{\partial \eta_j^*}\frac{\partial \eta_j^*}{\partial m} + \frac{\partial w_j^*}{\partial m} \mid_{\eta_j^*}$$

Therefore,

$$\frac{\partial \eta_m^*}{\partial m} = \frac{\dfrac{\partial w_j}{\partial m} \mid_{\eta_j^*} + \dfrac{\partial \pi_v}{\partial m} \mid_{\eta_j^*}}{1 - \dfrac{\partial w_j}{\partial \eta_j^*}} \tag{17}$$

where we assume all agents recognize that η_j^*will increase for all matches.

We already have an expression for π_v, but to evaluate $\dfrac{\partial \eta_j^*}{\partial m}$, we need an expression for $w_j^* = rV_{uj}$ as well. This is done in a similar fashion to obtaining to obtaining $r\pi_v$ and involves getting an expression for V_{ej}^e

$$V_{ej}^e = \frac{\delta}{r+\delta}V_{uj} + \frac{1}{r+\delta}E(w_j \mid \eta > \eta_j^*)$$

therefore

$$rV_{uj} = \frac{r+\delta}{r+\delta+\psi_F} b_j + \frac{\psi_F}{r+\delta+\psi_F} E(w_j \mid \eta > \eta_j^*). \tag{18}$$

Note that since we are considering workers with $b > b_m$, they will never be paid m and therefore an increase in m will have effects through changes in the probability of finding a job (ψ_F) and on the bargained wage. With the value of a vacancy falling as m increases, workers will be able to bargain higher wages.

For the first of these effects,

$$\frac{\partial w_j^*}{\partial \eta_j^*} = \frac{\partial w_j^*}{\partial \psi_F}\frac{\partial \psi_F}{\partial \eta_j^*} + \frac{\partial E(w_{ij} \mid \eta > \eta_{ij}^*)}{\partial \eta_j^*} \tag{19}$$

with,

$$\frac{\partial w_j^*}{\partial \psi_F} = \frac{r+\delta}{r+\delta+\psi_F}\left[-b_j + E(w_{ij} \mid \eta > \eta_{ij}^*)\right]$$

The expected value of wages in matches that are continued will exceed b_j and therefore this derivative is positive. An increase in η^* will imply a lower probability of a continuing match so $\frac{\partial \psi_F}{\partial \eta^*} < 0$. Thus, the term before the plus sign on the right of (18) is negative. The second term will be positive but less than 1. Together these imply that $\frac{\partial w_j^*}{\partial \eta^*} < 0$. This implies the denominator of (17) is positive. In the numerator, the $\dfrac{\partial \pi_v}{\partial m} |_{\eta_m^*}$ term is the same as before: expected profits from a new match will decline both because of rises in training costs and because firms will get less profit from matches with low b workers. In fact, this negative impact on $r\pi_v$will arise even if training costs are not a function of m. On the other side, the expected value of employment would rise for workers (holding η^* constant), implying that w_j^* will increase. Thus, the net effect of a rise in m on η^* is ambiguous but it is certainly possible that firm concerns about future hiring costs may dominate and drive η^* down. This contacts with effects for low b workers where we would expect more layoffs (a higher η^*). Finally, a rise in m implies a rise in b_m and more workers in the latter category, moving the overall average effect toward more layoffs. Ultimately, though, which effect dominates is an empirical matter.

Determining Tightness and Hiring

We next turn to considering the problem in general equilibrium. This means allowing labour market tightness to be endogenous. To do this, we first make the environment richer by adding assumptions about workers and entrepreneurs, who will determine job creation. Assume there are L workers in the economy each endowed with a value of b. Workers have an option of staying out of the labour market which has a value of zero. Thus, only workers with rV_u>0 will enter the work force. This endogenously defines the value $\underline{b}$, which is the value of the unemployment benefit which makes the value of unemployment just equal to zero. Further, workers turn into entrepreneurs with probability Ω in a given period. Each entrepreneur then draws a cost of opening a vacancy from the CDF, G. Free entry will imply that only entrepreneurs whose cost of a creating a vacancy is less than or equal to π_v will actually do so. Together this implies that the number of jobs created in a period, J, can be written as,

$J = L\Omega G(\pi_v)$,

Rearranging this gives, $\pi_v = G^{-1}(\frac{J}{L\Omega})$. The number of filled jobs in a period equals ϕ_FJ and so the number of vacancies equals (1 - ϕ_F)J. Then, defining $U = uL$, we get,

$$\pi_v = G^{-1}(\frac{V}{U}\frac{u}{\Omega(1-\phi_F)}) = G^{-1}(\theta\frac{u}{\Omega(1-\phi_F)}) \tag{20}$$

Recall that equation (13) defines the reservation productivity for minimum wage jobs as a function of m and π_v. Substituting equation (20) into (13) yields,

$$\eta_m^* = G^{-1}(\theta \frac{u}{\Omega(1-\phi_F)}) + m \tag{21}$$

Equation (21) defines a line in η_m^* - θ space that represents the free entry condition/job creation condition in the model. Higher values of η_m^* need to be balanced with higher values of π_v according to equation (13). But higher values of π_v mean that more potential entrepreneurs enter the market and create vacancies. This in turn implies higher values of θ. Thus, this schedule is upward sloping.

The other curve needed to determine the equilibrium relates to worker participation decisions. Recall from equation (18) that,

$$rV_{uj} = \frac{r+\delta}{r+\delta+\psi_F} b_j + \frac{\psi_F}{r+\delta+\psi_F} E(w_j \mid \eta > \eta_j^*)$$

For the marginal labour force participant, $rV_{uj} = 0$, and given our assumption that the minimum wage is relevant for at least one worker, the marginal participant will face η_m^* as the relevant reservation productivity. Thus, we can re-write equation (18) for this worker as follows,

$$0 = \frac{r+\delta}{r+\delta+\psi_F} \underline{b} + \frac{\psi_F}{r+\delta+\psi_F} E(w_j \mid \eta > \eta_m^*) \tag{22}$$

Based on earlier arguments, the derivative of the right hand side of (22) with respect to η_m^* will have offsetting components: the increase in the reservation productivity will decrease the probability of an unemployed worker making a continuing match but it will imply that the expected value of the match, conditional on it continuing, will be higher. Since there are a continuum of reservation productivities in the economy, the latter effect seems likely to dominate and thus we expect the derivative of the right hand side of (22) with respect to η_m^* to be positive. This implies that higher values of η_m^* need to be balanced with lower values of $\underline{b}$ to make the equality in (22) hold. In other words, a higher cut-off is associated with more people being interested in entering the work force. This, in turn, implies a larger number of unemployed workers and, thus, a lower value of θ. Thus, this locus is downward sloping.

The intersection of (21) and (22) determines equilibrium values for η_m^* and θ. An increase in the minimum wage shifts the job creation locus up as for any given θ (and therefore π_v), a higher reservation productivity is needed to maintain zero profits for the marginal firm. The participation curve also shifts up with an increase in the minimum wage as for a given reservation productivity, an improvement in the minimum wage leads to an increased value to job search and thus more people entering the labour force. This, in turn implies a decline in θ. Combined these shifts imply an uncertain impact on η_m^* but a decline in θ. Thus, the equilibrium effects imply a decline in job creation (hiring) and uncertain effects for layoffs. Essentially, the impact of a minimum wage increase on the equilibrium reservation productivity will reflect a firm's increased desire to hold onto matches (since their outside option has decreased in value) but also workers' increased desire to terminate matches (because their outside option has improved in value).

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Figure 1: Real Minimum Wage, 1979−2008

Eastern Provinces

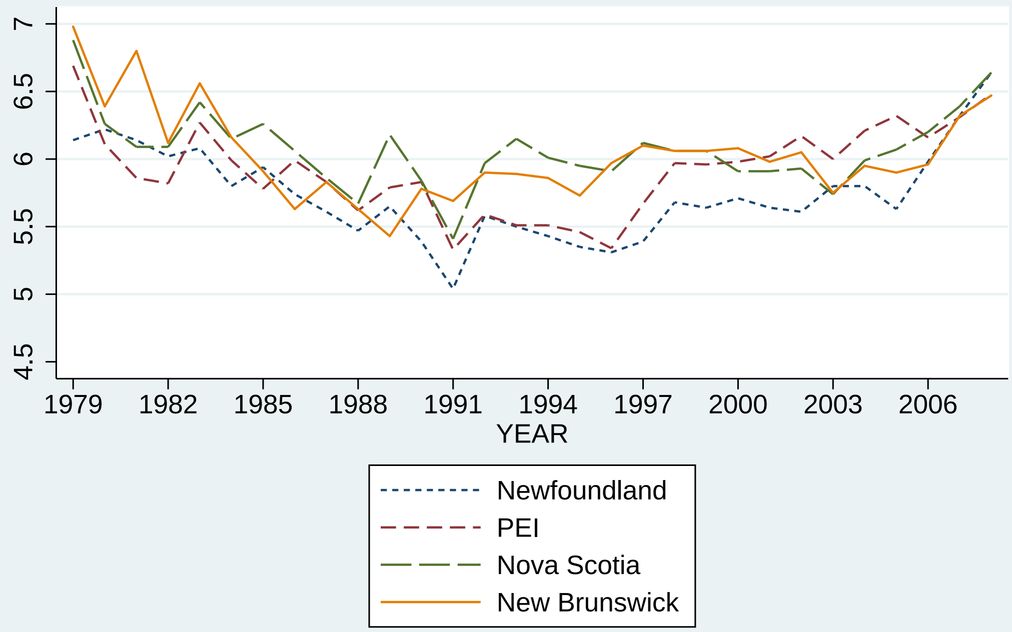
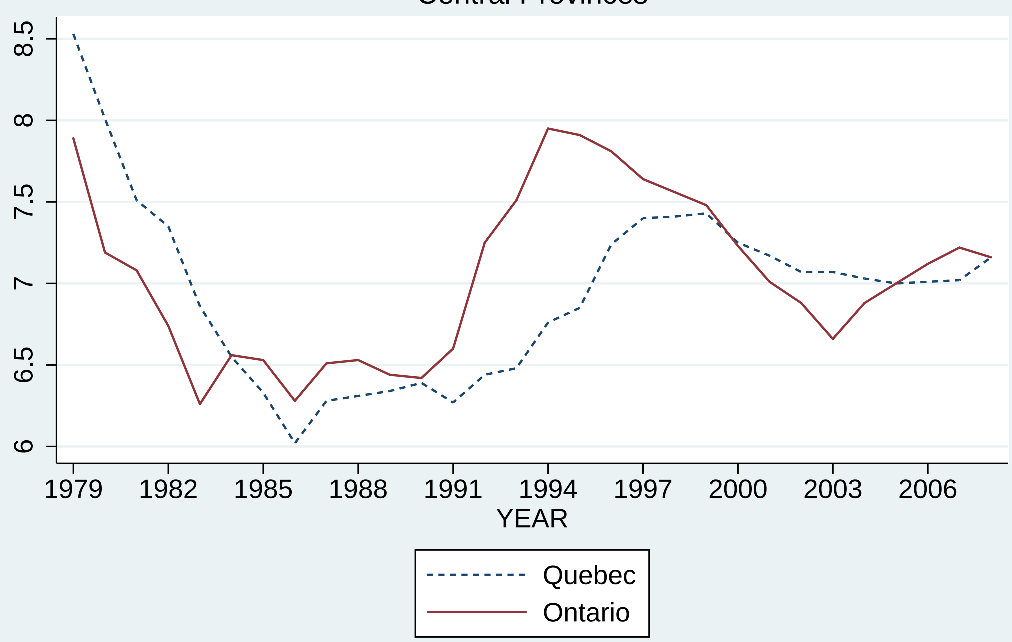


Figure 2: Real Minimum Wage, 1979−2008

Central Provinces



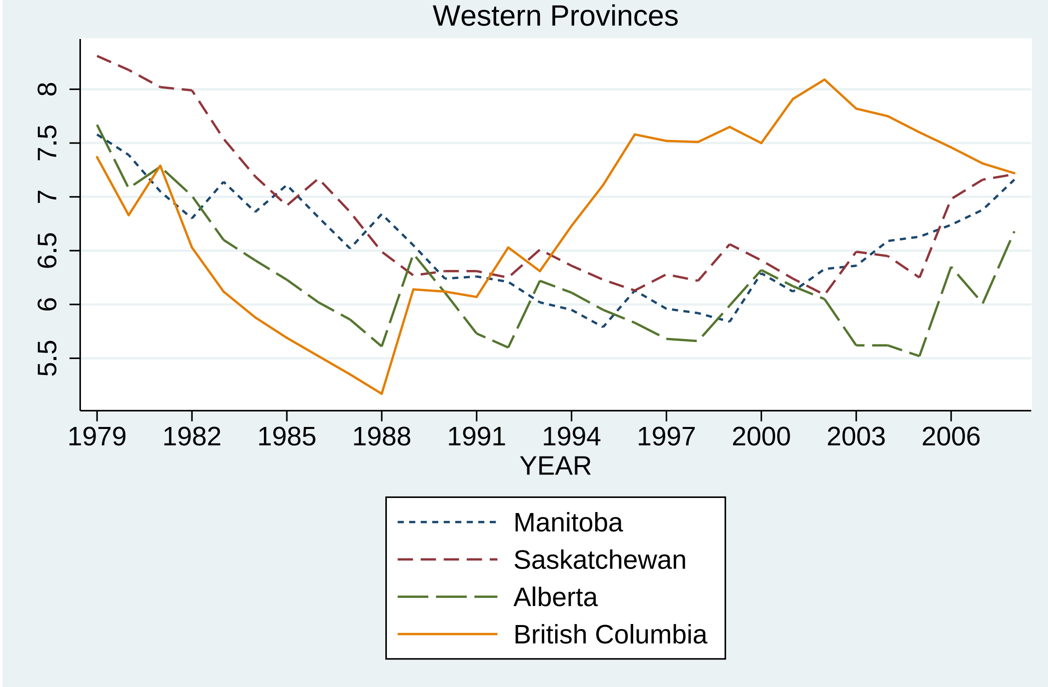


Figure 3: Real Minimum Wage, 1979−2008
Western Provinces

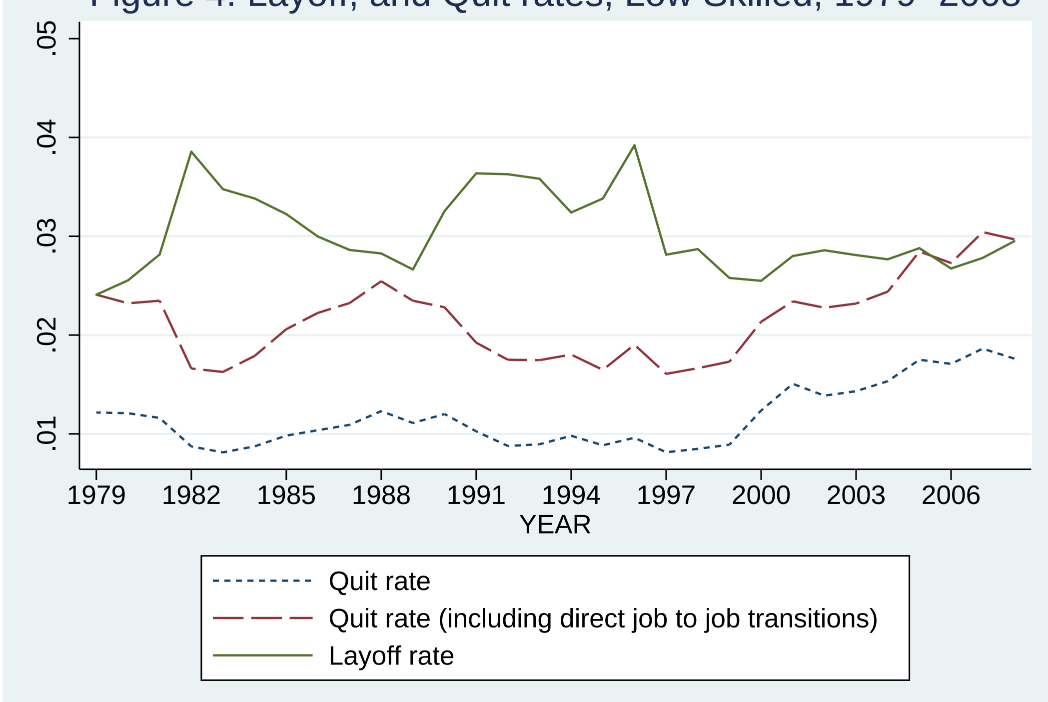


Figure 4: Layoff, and Quit rates, Low Skilled, 1979−2008

Figure 5: Hiring rates, Low Skilled, 1979−2008

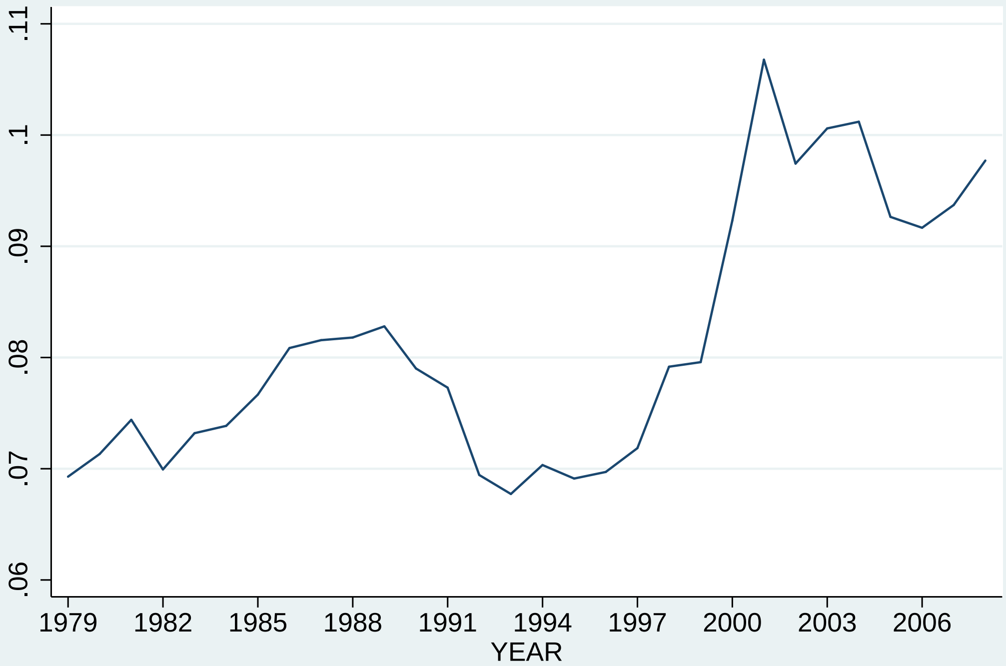


Table 1: Mean Retention, Quits, Layoff Rates and Hours Growth, Low Skilled

	All Tenure	< 1 Year	< 6 Months	6 to 11 Months
Retention				
Overall	.9438	.8679	.8399	.9106
Males	.9419	.8585	.8585	.9036
Females	.9459	.8790	.8514	.9181
Teenagers	.8577	.8293	.7985	.8892
Young Adults	.9142	.8675	.8402	.9092
Older Adults	.9540	.8771	.8513	.9151
Quit				
	All Tenure	< 1 Year	< 6 Months	6 to 11 Months
Overall	.0117	.0257	.0304	.0185
Males	.0096	.0226	.0275	.0150
Females	.0143	.0293	.0342	.0225
Teenagers	.0406	.0474	.0545	.0337
Young Adults	.0221	.0315	.0366	.0236
Older Adults	.0083	.0184	.0216	.0138
Quit Including Direct Job to Job Transitions				
	All Tenure	< 1 Year	< 6 Months	6 to 11 Months
Overall	.0216	.0521	.0637	.0345
Males	.0207	.0528	.0651	.0329
Females	.0228	.0512	.0618	.0362
Teenagers	.0750	.0876	.1022	.0590
Young Adults	.0415	.0623	.0746	.0435
Older Adults	.0151	.0399	.0491	.0266
Layoff				
	All Tenure	< 1 Year	< 6 Months	6 to 11 Months
Overall	.0303	.0742	.0894	.0506
Males	.0337	.0834	.0975	.0598
Females	.0264	.0632	.0789	.0407
Teenagers	.0594	.0747	.0894	.0460
Young Adults	.0396	.0648	.0788	.0432
Older Adults	.0270	.0775	.0931	.0542
Hours Growth				
	All Tenure	< 1 Year	< 6 Months	6 to 11 Months
Overall	-.0030	-.0030	-.0017	-.0050
Males	-.0045	-.0051	-.0038	-.0073
Females	-.0008	.00010	.0017	-.0020
Teenagers	-.0064	-.0056	-.0054	-.0063
Young Adults	-.0036	-.0032	-.0013	-.0060
Older Adults	-.0028	-.0025	-.0011	-.0046

Table 2: Mean Hiring Rate, Low Skilled

Hiring (Conditioning on Being Initially Out of Work)	
Overall	.0814
Males	.1282
Females	.0578
Teenagers	.1611
Young Adults	.1423
Older Adults	.0682

Table 3: Retention Rate, Low Skilled

Males and Females				
No Lags				
	All Tenure	< 1 Year	< 6 Months	6 to 11 Months
lrmin	.0013	.0354	.0420	.0077
	(.0032)	(.0075)***	(.0093)***	(.0090)
R-squared	.77	.75	.70	.56
With 1 Year Lag				
lrmin	.0054	.0408	.0539	-.0033
	(.0054)	(.0125)***	(.0154)***	(.0155)
lrminlag12m	-.0038	-.0037	-.0121	.0159
	(.0055)	(.0125)	(.0154)	(.0155)
R-squared	.78	.76	.71	.57
Males				
No Lags				
	All Tenure	< 1 Year	< 6 Months	6 to 11 Months
lrmin	.0011	.0366	.0408	.0010
	(.0037)	(.0094)***	(.0115)***	(.0120)
R-squared	.75	.71	.64	.56
With 1 Year Lag				
lrmin	.0084	.0445	.0503	.0083
	(.0064)	(.0157)***	(.0192)***	(.0207)
lrminlag12m	-.0073	-.0055	-.0079	.0048
	(.0064)	(.0157)	(.0191)	(.0206)
R-squared	.76	.72	.65	.56
Females				
No Lags				
	All Tenure	< 1 Year	< 6 Months	6 to 11 Months
lrmin	.0015	.0330	.0415	.0066
	(.0037)	(.0092)***	(.0121)***	(.0106)
R-squared	.68	.64	.59	.36
With 1 Year Lag				
lrmin	.0020	.0369	.0555	-.0108
	(.0065)	(.0154)***	(.0201)***	(.0182)
lrminlag12m	.0002	-.0031	-.0160	.0237
	(.0065)	(.0154)	(.0201)	(.0181)
R-squared	.69	.65	.60	.37

Notes. Dependent variable: proportion of workers on a job in month t who are still on that job in month t+1. lrmin is the log of the real minimum wage. All regressions are weighted by the inverse of the number in the at-risk group. The number of observations is 3,590 in specifications without a lag and 3,510 in specifications with a lag. All regressions include a full set of time and province dummies and a dummy equal to one if there was a minimum wage change in the month. Standard errors in parentheses. * p<0.1, ** p<0.05, *** p<0.01.

Table 4: Retention Rate by Age Group, Low Skilled

15 to 19 Years of Age				
No Lags				
	All Tenure	< 1 Year	< 6 Months	6 to 11 Months
lrmin	.0368	.0391	.0476	-.0011
	(.0112)***	(.0145)***	(.0184)***	(.0199)
R-squared	.51	.48	.41	.21
With 1 Year Lag				
lrmin	.0011	.0123	.0260	-.0269
	(.0193)	(.0245)	(.0309)	(.0344)
lrminlag12m	.0417	.0310	.0261	.0307
	(.0193)**	(.0245)	(.0309)	.0345)
R-squared	.51	.47	.41	.21
20 to 24 Years of Age				
No Lags				
	All Tenure	< 1 Year	< 6 Months	6 to 11 Months
lrmin	-.0013	.0171	.0270	-.0057
	(.0062)	(.0109)	(.0145)*	(.0140)
R-squared	.59	.52	.45	.28
With 1 Year Lag				
lrmin	.0064	.0304	.0305	.0170
	(.0107)	(.0186)	(.0247)	(.0243)
lrminlag12m	-.0077	-.0144	-.0040	-.0257
	(.0107)	(.0186)	(.0246)	(.0242)
R-squared	.59	.53	.46	.28
25 to 59 Years of Age				
No Lags				
	All Tenure	< 1 Year	< 6 Months	6 to 11 Months
lrmin	.0001	.0353	.0383	.0115
	(.0031)	(.0090)***	(.0113)***	.0109
R-squared	.75	.74	.68	.56
With 1 Year Lag				
lrmin	.0062	.0460	.0642	-.0091
	(.0054)	(.0150)***	(.0185)***	(.0188)
lrminlag12m	-.0062	-.0088	-.0278	.0283
	(.0054)	(.0149)	(.0185)	(.0187)
R-squared	.76	.75	.69	.57

Notes. Dependent variable: proportion of workers on a job in month t who are still on that job in month t+1. lrmin is the log of the real minimum wage. All regressions are weighted by the inverse of the number in the at-risk group. The number of observations is 3,590 in specifications without a lag and 3,510 in specifications with a lag. All regressions include a full set of time and province dummies and a dummy equal to one if there was a minimum wage change in the month. Standard errors in parentheses. * p<0.1, ** p<0.05, *** p<0.01.

Table 5: Quits and Layoff Rates, Low Skilled

Quits				
No Lags				
	All Tenure	< 1 Year	< 6 Months	6 to 11 Months
lrmin	.0016	-.0035	-.0024	-.0020
	(.0009)*	(.0024)	(.0032)	(.0031)
R-squared	.68	.57	.54	.31
With 1 Year Lag				
lrmin	.0050	.0046	.0034	.0086
	(.0015)***	(.0040)	(.0052)	(.0054)
lrminlag12m	-.0043	-.0101	-.0070	-.0135
	(.0015)***	(.0039)**	(.0052)	(.0054)**
R-squared	.68	.57	.54	.31
Quits Including Direct Job to Job Transitions				
No Lags				
	All Tenure	< 1 Year	< 6 Months	6 to 11 Months
lrmin	-.0011	-.0177	-.0193	-.0086
	(.0013)	(.0035)***	(.0047)***	(.0044)**
R-squared	.74	.63	.60	.33
With 1 Year Lag				
lrmin	.0062	-.0016	-.0062	.0123
	(.0022)***	(.0058)	(.0078)	(.0074)
lrminlag12m	-.0094	-.0205	-.0172	-.0256
	(.0022)***	(.0058)***	(.0078)**	(.0074)***
R-squared	.74	.63	.59	.33
Layoffs				
No Lags				
	All Tenure	< 1 Year	< 6 Months	6 to 11 Months
lrmin	-.0060	-.0260	-.0330	-.0051
	(.0029)**	(.0070)***	(.0084)***	(.0080)
R-squared	.79	.81	.78	.65
With 1 Year Lag				
lrmin	-.0140	-.0404	-.0493	-.0095
	(.0050)***	(.0117)***	(.0140)***	(.0139)
lrminlag12m	.0088	.0151	.0180	.0027
	(.0050)	(.0117)	(.0140)	(.0138)
R-squared	.79	.81	.78	.65

Notes. Dependent variable: proportion of workers on a job in month t who leave the job by each route. lrmin is the log of the real minimum wage. All regressions are weighted by the inverse of the number in the at-risk group. The number of observations is 3,590 in specifications without a lag and 3,510 in specifications with a lag. All regressions include a full set of time and province dummies and a dummy equal to one if there was a minimum wage change in the month. Standard errors in parentheses. * $p<0.1$, ** $p<0.05$, *** $p<0.01$.

Table 6: Impact of a 10% Increase in the Minimum Wage as a Proportion of All Separations, Low Skilled

All Ages				
Using Quit1				
	< 1 Year Tenure		All Tenure	
	Impact	Proportion	Impact	Proportion
Quit	-.0031	.12	.0035	-.36
Layoff	-.023	.88	-.013	1.36
Total	-.026		-.096	
Using Quit2 (taking account of reassigning .32 of quit2 to layoffs)				
	< 1 Year Tenure		All Tenure	
	Impact	Proportion	Impact	Proportion
Quit	-.0011	.34	-.0016	.13
Layoff	-.021	.66	-.011	.87
Total	-.031		-.013	
Teenagers				
Using Quit1				
	< 1 Year Tenure		All Tenure	
	Impact	Proportion	Impact	Proportion
Quit	-.0016	.07	-.0011	.04
Layoff	-.019	.93	-.026	.96
Total	-.021		-.027	
Using Quit2 (taking account of reassigning .32 of quit2 to layoffs)				
	< 1 Year Tenure		All Tenure	
	Impact	Proportion	Impact	Proportion
Quit	-.0011	.39	-.013	.38
Layoff	-.017	.61	-.022	.62
Total	-.028		-.035	

Table 7: Hiring Rate and Hours of Work, Low Skilled

Hiring				
No Lags				
	Both Genders	Males	Females	Teenagers Both Genders
lrmin	-.0291	-.0408	-.0158	-.0814
	(.0054)***	(.0093)***	(.0044)***	(.0154)***
R-squared	.63	.65	.60	.49
With 1 Year Lag				
lrmin	-.0154	-.0129	-.0075	-.0093
	(.0092)*	(.0159)*	(.0075)	(.0258)
lrminlag12m	-.0176	-.0397	-.0103	-.0989
	(.0093)*	(.0159)***	(.0076)	(.0259)***
R-squared	.64	.65	.60	.49
Hours of Work				
No Lags				
	All Tenure	< 1 Year	< 6 Months	6 to 11 Months
lrmin	-.0002	.0016	.0006	.0039
	(.0075)	(.0083)	(.0095)	(.0093)
R-squared	.79	.72	..67	.67
With 1 Year Lag				
lrmin	-.0063	-.0102	-.0134	-.0033
	(.0132)	(.0142)	(.0160)	(.0161)
lrminlag12m	.0077	.0147	.0178	.0086
	(.0132)	(.0141)	(.0160)	(.0161)
R-squared	.79	.72	.67	.67

Notes. Dependent variables: proportion of non-employed workers on a job in month t who find a job in t+1 and the change in average weekly hours. lrmin is the log of the real minimum wage. All regressions are weighted by the inverse of the number in the at-risk group. The number of observations is 3,590 in specifications without a lag and 3,510 in specifications with a lag. All regressions include a full set of time and province dummies and a dummy equal to one if there was a minimum wage change in the month. Standard errors in parentheses. * p<0.1, ** p<0.05, *** p<0.01.

Table 8: Retention, Quits and Layoff Rates with Inflation Interaction, Low Skilled

	All Tenure	< 1 Year	< 6 Months	6 to 11 Months
Retention				
lrmin	.0179	.0660	.0738	.0248
	(.0041)***	(.0098)***	(.0120)***	(.0121)
inf	.0079	.0141	.0149	.0072
	(.0013)***	(.0030)***	(.0037)***	(.0039)*
lrmin*inf	-.0039	-.0064	-.0064	-.0040
	(.0007)***	(.0016)***	(.0020)***	(.0020)***
R-squared	.78	.76	.71	.57
Quits				
	All Tenure	< 1 Year	< 6 Months	6 to 11 Months
lrmin	.0010	-.0013	.0027	-.0048
	(.0011)	(.0031)	(.0041)	(.0042)
inf	-.0001	.0011	.0024	-.0011
	(.0004)	(.0010)	(.0013)*	(.0013)
lrmin*inf	.0002	-.0004	-.0010	.0007
	(.0002)	(.0005)	(.0007)	(.0007)
R-squared	.69	.57	.54	.30
Quits Including Direct Job to Job Transitions				
	All Tenure	< 1 Year	< 6 Months	6 to 11 Months
lrmin	-.0057	-.0226	-.0222	-.0165
	(.0017)***	(.0046)***	(.0062)***	(.0058)***
inf	-.0020	-.0021	-.0010	-.0037
	(.0005)***	(.0014)	(.0019)	(.0019)*
lrmin*inf	.0014	.0014	.0008	.0023
	(.0003)***	(.0008)*	(.0010)	(.0010)**
R-squared	.75	.63	.59	.33
Layoffs				
	All Tenure	< 1 Year	< 6 Months	6 to 11 Months
lrmin	-.0213	-.0570	-.0689	-.0181
	(.0038)***	(.0091)***	(.0109)***	(.0108)
inf	-.0074	-.0144	-.0171	-.0053
	(.0012)***	(.0028)***	(.0034)***	(.0035)
lrmin*inf	.0034	.0064	.0074	.0026
	(.0006)***	(.0015)***	(.0018)***	(.0018)
R-squared	.80	.81	.79	.66

Notes. Dependent variable: proportion of workers on a job in month t who leave the job by each route. lrmin is the log of the real minimum wage. All regressions are weighted by the inverse of the number in the at-risk group. The number of observations is 3,590 in specifications without a lag and 3,510 in specifications with a lag. All regressions include a full set of time and province dummies and a dummy equal to one if there was a minimum wage change in the month. Standard errors in parentheses. * p<0.1, ** p<0.05, *** p<0.01.