Industry Shutdown Rates and Permanent Layoffs: Evidence from Firm-Worker Matched Data*

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Abstract

Turnover within an industry creates a turbulent situation for workers, where a firm's shutdown leads to permanent layoffs. Using data drawn from the Longitudinal Worker File, a Canadian firm-worker matched employment database, we investigate the impact of industry shutdown rates on worker outcomes such as employment status and wages. These worker outcomes vary across industry, firm and worker characteristics. This paper focuses on variation across industries, in terms of shutdown rates, to explain the rate of permanent layoffs and the growth of workers' earnings. Further, we account for selection bias, induced by not observing the employment behaviour of exiting firms, on the effect of shutdown rates on permanent layoffs and wages. Accounting for selection leads to an increase the probability of permanent layoffs and decreases workers' wages.

Key Words: Worker separation; Firm Survival; Selection.
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1 Introduction

The fortunes of firms and workers are inextricably linked. The turnover of firms affects workers as industries with significant amount of firm entry and exit creates uncertainty for workers. Industry expansion or decline leads to increasing or decreasing numbers of both firms and workers. Firm-worker matched datasets allow economists from two major fields, labour economics and industrial organization to analyse and understand the joint interaction of firms and workers. Labour economists usually focus on the determinants of worker outcomes and find that worker and firm characteristics both impact employment stability and the likelihood of employment termination, see Farber (1999) and Anderson and Meyer (1994). A separate literature in industrial organization investigates firm performance through such measures as growth and survival.[1] This paper empirically investigates whether industry instability, measured as firm shutdown rates, affects worker outcomes, measured as the probability of worker layoffs and worker wages.

Workers in industries with expanding firms likely experience good labour market outcomes with low layoff rates and rising wages. Alternatively, poor labour market outcomes occur for workers in industries with shrinking and shutting down firms. Shutdown rates provide a measure of firm turnover within an industry. Understanding the labour market interaction of firms and workers requires access to firm-worker matched datasets.[2] Our study utilizes a rich administrative employer-employee dataset called the Longitudinal Worker File (LWF). The LWF simultaneously contains information about firms and workers. The *longitudinal* and matched employer-employee natures of the LWF data provide a means to examine the relative impact of individual worker characteristics (age, tenure, place of residence, etc.), firm characteristics (size, payroll) and industry-specific factors on firm and worker outcomes over time. We focus on industry firm instability as its impact has not received much attention in the literature.[3]

The LWF allows us to follow workers over a number of years and to classify separations as voluntary or involuntary and permanent or temporary. A previous study by Quintin and Stevens (2005) does not distinguish between the type of separations and only contained cross-sectional data.

[1] Firm survival studies include Baldwin, Bian, Dupuy, and Gellatly (2000) and Huynh, Petrunia, and Voia (2010) for Canada; Dunne, Roberts, and Samuelson (1989), Audretsch (1991), and Audretsch and Mahmood (1995) for the United States; Wagner (1994) and Boeri and Bellmann (1995) for Germany; Audretsch, Santarelli, and Vivarelli (1999) for Italy; Fotopoulos and Louri (2000) for Greece; Segarra and Callejon (2002) for Spain; and Mata and Portugal (1994) and Mata, Portugal, and Guimaraes (1995) for Portugal. Firm growth studies include Huynh and Petrunia (2010) for Canada; Evans (1987) and Dunne, Roberts, and Samuelson (1989) for the United States; and Dunne and Hughes (1994) for the UK. Huynh and Petrunia (2015) show that the transition to exit is a relatively quick process.

[2] Work in this literature is driven by collection of administrative data that are usually confidential, see Haltiwanger, Brown, and Lane (2006) for a broad overview.

[3] Job instability has wide ranging financial and other consequences for individuals and families (Jacobson, LaLonde, and Sullivan (1993); Gottschalk and Moffitt (1994) Gottschalk and Moffitt (2009); Beach, Finnie, and Gray (2003); Morissette and Ostrovsky (2005)). Often it signals high earnings uncertainty, which may, in turn, lead to lower consumption Browning and Lusardi (1996) and alter family savings and labour supply decisions (Pistaferri (2003)). It may also affect families' schooling and occupational choices (Guiso, Jappelli, and Pistaferri (2002)) and even their fertility behaviour (Fraser (2001)).

Recent research suggests that in the case of involuntary separations there are large differences in the income losses associated with differences in human capital. Kambourov and Manovskii (2009) argue that many skills acquired by workers during their working careers are job-specific, so high job losses are especially detrimental to workers whose skills are job specific and not easily transferable. Further, high firm shutdown also leads to higher job instability through increases in worker separations (permanent layoffs). Intuitively, employees in industries with high firm instability may anticipate short employment spells and try to advance their careers through changing employers or occupations rather than by acquiring human capital.

Using administrative data on workers in the US, von Wachter, Song, and Manchester (2009) and Song and von Wachter (2014) demonstrate that mass layoffs occurring typically during recessions have long term consequences for workers. von Wachter, Song, and Manchester (2009) find that the annual earnings of workers in relative stable jobs experiencing a surprise layoff during the 1982 recession are still 20 percent lower than their nondisplaced counterparts after more than 20 years. Song and von Wachter (2014) show that the long-term nonemployment rate increase is similar across recessions in the past 30 years even though the long-term unemployment rate increase is higher in the 2008 recession than in previous recessions. Thus, these studies show that a layoff has a long term impact on both a worker's earnings and employment prospects.

One issue to consider when investigating the impact of industry shutdown rates on worker layoff rate is that workers may choose to quit in anticipation of deteriorating industry conditions in order to avoid any negative consequences of being laid-off due. A worker may quit in anticipation of being laid-off or firm shutdown, which may create a possible selection bias when investigating firm layoffs of workers. Given that a random sample of workers forms the basis of the LWF database, we observe separations for workers in the LWF sample, but do not observe separations rates at the firm level. Therefore, we are unable to determine quit rates in the years prior to a firm's shutdown. However, the data contain a measure of firm employment which allows us to look at overall employment activity at firms.

The contribution of this paper is to quantify the effects of industry shutdown rates on: 1) the probability of a permanent layoff for a worker or the extensive margin; and 2) the growth rate of individual worker earnings or the intensive margin. We perform separate analysis on the male and female samples as labour market decisions and outcomes are likely to differ for males and females, see Killingsworth and Heckman (1987). The findings of our study are:

1. The extensive margin captures the number of workers affected by looking at the impact of industry shutdown rates on the probability of a permanent layoff. Industry shutdown rates have a positive and significant effect on the probability of a permanent layoff. For males, a one percent increase in industry shutdown rates means approximately a 0.13 percent increase in the probability of a worker layoff. For females, the marginal effect can be negative or positive and ranges from -0.01 percent at extra small firms to 0.11 percent at small firms to 0.03 percent at medium firms.

2. The intensive margin captures the impact of industry shutdown rates on individual workers through wage growth. The effect of industry shutdown rates on workers' earnings is generally negative for both males and females. The exceptions include males at medium size firms and females at small sized firms.

3. For workers experiencing a permanent layoff, their post-layoff wage prospects vary with the size of firm at which they eventually find employment. Most laid-off workers moving to a larger firm see their wages increase, while most laid off workers moving to a smaller firm see their wages fall. This conditioning on a worker's pre-layoff to post-layoff firm size helps explain the heterogeneity in worker wage outcomes following a layoff.

4. Accounting for selection matters for the extensive margin. Qualitative impacts of industry shutdown rates on the probability of worker layoff move from negative to mainly positive for females after accounting for selection. The results for males indicate these marginal effects are constant across firm size classes after account for selection. When assessing the intensive margin, the marginal effect of industry shutdown rates on worker wage growth does not change greatly when moving from the nonselection model to the selection model.

These results demonstrate the necessity of the joint analysis of firm shutdown with either permanent layoff or worker wages. Industry shutdown rates provide a measure of turbulence and firm turnover within an industry. Without controlling for selection, the analysis ignores a major portion of workers and firms. Higher industry shutdown rates suggest more turbulence within an industry. Substantial hiring and firing costs lead to a desire by continuing firms to keep and not lay-off their workers. These costs factor into a firm's choice between continuing operations and shutting down. Higher hiring and firing costs within an industry also factor into a firm's choice between temporarily shutting down or permanently exiting. Controlling for a firm's shutdown probability allows the industry shutdown rate to fully capture industry turnover which leads to the positive correlation between industry shutdown and the permanent layoff rate. These findings complement the work by Moscarini and Postel-Vinay (2012) who document that the negative correlation between net job creation rates and the unemployment rate is larger for small firms versus large firms.

The rest of the paper is organized in the following fashion: the LWF (firm-worker matched) dataset is described in section 2 while an empirical model of permanent layoffs are discussed in 3. We discuss how firm survival selection plays a role in permanent layoffs in 3.1. Section 4 discusses the effect of firm shutdown rates on workers earnings. Section 5 concludes.

2 The Longitudinal Worker File

Our data are from the Longitudinal Worker File (LWF). The LWF is an annual administrative dataset from 1983 onwards, and contains a 10 percent random sample of Canadians who either

filed a tax return (T1 form) or received a statement of remuneration (T4 form). Appendix A gives a brief description of the LWF data sources and its construction. The LWF has information on individuals' earnings, demographics and occupation, as well as on the the firm of employment. LWF's matched employer-employed structure allows for examining workers' mobility, turnover and earnings dynamics.

We restrict our sample to the period from 1992 to 2007, since the NAICS information is available only after 1991. For the years preceding 1992, the LWF uses the Standard Industry classification (SIC). The differences between SIC and NAICS yield substantial inconsistencies in our sample if we attempt to match the two classifications using the description of the industry codes. The years after 2007 are unusable for our analysis because the industry price index data end in 2007.

Our sample consists of individuals living in the 10 Canadian provinces who are between 25 to 64 years of age. Residents of the territories are excluded. The LWF database's source of firm level information is the Longitudinal Employment Analysis Program (LEAP) database. LEAP contains annual information on firms with at least one dollar in payroll in a given year. This LEAP payroll information allows the identification in year t of continuing firms with a positive payroll versus firms temporarily or permanently (exit) shutting down with a zero payroll. Industry j's shutdown rate in year t, SR_{jt}, is

$$SR_{jt} = SD_{j,t+t}/N_{jt} \tag{1}$$

where $SD_{j,t+t}$ gives the total number of firms in industry j with a positive payroll in year t and a zero payroll in period $t+1$, and N_{jt} gives the total number of firms with in industry j positive payroll in period t. The structure of the LEAP database implies that firm shutdown is not due to merger or acquisition activity. Table 1 provides the list of the 39 industries in the data.

A separation occurs in year t, if t is the last year of an individual's tenure in firm j (i.e. the end of a job spell). The LWF database allows for the categorization of employee-employer separations. Quits and layoffs are two such categories. Layoffs are further broken into temporary, worker subject to recall, and permanent, worker not subject to recall, subcategories. These categories allow for the creation of dummy variables. The value of a given separation dummy variable is 1 for any type of the given separation, including, but not limited to, quits and layoffs. For example, the value of the layoff variable is 1 if the Record of Employment (ROE) states the shortage of work as a reason for the separation, i.e. layoff.

2.1 Summary statistics

Table 2 provides summary statistics across industries. There is industry heterogeneity in terms of: (i) workers characteristics of age, gender, tenure, earnings; and (ii) industry characteristics of shutdown rate, permanent layoff rate, number of firms and number of workers. The age range of average worker varies from a low of 37.8 years in the motion picture and recording industry

to a high of 44.0 years in primary metal manufacturing. Females dominate clothing; leather and allied manufacturing at 76 percent of workers but only constitute 10 percent of workers in mining. Tenure ranges from 3.81 years in administrative and support services to 11.45 years in primary metal manufacturing at 11.45 years. Average earnings are the highest in oil and gas extraction at $107,090 per year while earnings in accommodation and food services are $18,800 per year on average. The shutdown rate is the highest in utilities at 16.1 percent and the lowest in fabricated metal product manufacturing at 7.4 percent. Forestry has the highest permanent layoff rate 12.4 percent, while oil extractions has the lowest at 1.5 percent.

Table 3 provides summary statistics on worker characteristics across five firm size classes. We define firm size groupings as: (i) extra small (XS); (ii) small (S); (iii) medium (M); and (iv) large (L). XS size class firms have workers with the lowest tenure and earnings relative to the other size classes but these firms experience the highest shutdown rates. The permanent layoff rate is highest for the firm size classes XS, S and M at around 5 percent while L size class firms have a 2.5 percent layoff rate. Table 4 provides summary statistics for worker characteristics across five regions: (1) Atlantic Provinces; (2) Quebec; (3) Ontario; (4) Prairie Provinces; and (5) British Columbia. Across the regions, average age, proportion of males versus females and exit rate are similar. The eastern Canadian regions of the Atlantic provinces, Quebec and Ontario tend to have longer tenure rates compared to the Prairie provinces and British Columbia. Wage rates range from an average high of $45,780 in Ontario to a low of $29,710 in the Atlantic provinces. The opposite occurs for layoff rate as the Atlantic provinces have the highest permanent layoff rate of 6.7 percent and Ontario has lowest at 3 percent.

2.2 Comparison of continuing and shutting down firms

Figure 1 presents the median employment size and growth for firms in their last three years prior to shutdown. As a comparison, the figure also presents median employment size and growth for rival continuing firms over a similar three year window. Continuing firms tend to be larger and have higher growth than shutting down firms. The median employment size and growth both tend to be flat for continuing firms. Alternatively, shutting down firms experience a drop in size and increasingly negative growth as shutdown approaches.

Tables 6 and 7 provide these comparisons between continuing and shutting down and firms across the industries. Similar results occur at the industry level. The shedding of workers, whether through layoffs or quits, appears to occur in the years leading to firm shutdown.

3 Permanent Layoff - Extensive Margin

Industry shutdown rates measure the short-run performance of firms within an industry. High shutdown rates indicate firms within an industry deem that shutdown is more profitable than

continuing operations. The implication of shutdown is that a firm must become profitable or eventually exit. One method to reduce costs is worker layoffs. Temporary layoffs may lead to permanent layoffs in the long-run.[4] Thus, our analysis focuses on permanent layoffs by firms as a method to analyse the process of shedding workers. We consider the effects of industry shutdown rates along with the other controls to assess the qualitative and quantitative impacts of industry conditions on a firm's decision to permanently layoff workers.

We use the shutdown rate (SR_{jt}) in industry j and time t as a measure of industry instability. We identify shutdowns in year t as those firms transitioning from a positive payroll in year t to a zero payroll in year $t+1$. A firm's shutdown does not imply an exit, as the firm may have a positive payroll in some future period. Our focus on anticipated separations motivates the choice of shutdown rates as a measure of firm instability. The absence of a positive annual payroll in year t signals at least a year-long closure. There is little difference whether the firm will reopen in some future year or not from the worker's point of view. In either case, firm employees anticipate prolonged separations. Thus, there is an expectation workers adjust their labour market decisions. Shutdowns are also more easily identified in the data than firm exits since they only require the knowledge of the firm's payroll in two consecutive periods. For the analysis, we perform separate analysis for male and female workers, and across firms in different size classes. We analyzed the pooled data but found the assumption of homogeneity of effects across males and females is rejected statistically and economically.[5]

3.1 Selection Issues and Identification Strategy

A selection issue arises as the permanent layoff decisions are only observable for continuing firms in year t. In the remainder of the paper, we will refer to *continuing* firms to indicate those firms not experiencing a shutdown at year t. To account for the selection bias, we consider two separate dichotomous variables and allow for correlated disturbances. For worker i at firm k in industry j at time t, we estimate a bivariate probit model (BPWS) with a continuing firm equation (FS) and permanent layoff (PL) equation:

$$\begin{aligned} \mathrm{FS}^{*}_{ikjt} &= \alpha^{FS} + \beta^{FS} SR_{jt} + \gamma^{FS} B_{ikt} + \sum_{j=1}^{J} \psi_j^{FS} I_j + \sum_{t=1993}^{2002} \delta_t^{FS} D_t + \lambda Z_{kjt} + v_{ikjt}, \\ \mathrm{PL}^{*}_{ikjt} &= \alpha^{PL} + \beta^{PL} SR_{jt} + \gamma^{PL} B_{ikt} + \sum_{j=1}^{J} \psi_j^{PL} I_j + \sum_{t=1993}^{2002} \delta_t^{PL} D_t + u_{ikjt}. \end{aligned} \tag{2}$$

[4]The appendix provides a detailed discussion of employment insurance reforms in the early-to-mid 1990's that clearly define that a permanent layoff has ramifications for both workers and employers.

[5]Results are available upon request.

$$v_{ikjt}, u_{ikjt} \sim N(\mu, \Sigma), \mu = \begin{bmatrix} 0 \\ 0 \end{bmatrix}, \Sigma = \begin{bmatrix} 1 & \rho \\ \rho & 1 \end{bmatrix}$$

An indicator variable, PL_{ikjt}, equals one if a worker experiences a permanent layoff with $PL^*_{ikjt} \geq 0$ and zero otherwise. A second indicator variable, FS_{ikjt}, equals one if a firm remains active with $FS^*_{ikjt} \geq 0$ and zero otherwise. SR_{jt} is the annual shutdown rate in industry j in period t. The PL equation includes individual, firm and industry specific control variables: (i) B_{ikt} is a set of worker and/or firm-specific variables, including an age categories, marital status, job tenure and tenure squared, region of residence and earnings in period year $t-1$, union membership; (ii) I_j are industry-specific dummy variables; and (iii) D_t is a set of year-specific dummy variables. The FS equation includes all the relevant variables from PL equation but with Z_{kjt} as the exclusion restrictions both at the firm (k) and industry (j) levels. For a technical discussion of this method please refer to Maddala (1983).

The BPWS model given in equation 2 identifies the impact of selection in two ways: (1) the correlation parameter (ρ) of the joint model; and (2) using exclusion restrictions of variables (Z_{jt}). The correlation parameter achieves identification through functional form. The second method requires at least one variable that affects whether a firm continues or not but not whether a worker experiences a permanent layoff or not, contemporaneously. There are two exclusion restrictions. The first exclusion restriction is the use of industry-level US-Canada bilateral real exchange rate:

$$RER_{jt} = P^{US}_{jt} / P^{CDN}_{jt} \times e_t, \tag{3}$$

where P^{US}_{jt} is the US industry gross output price index, P^{CDN}_{jt} is the Canada industry gross output price index and e_t is the nominal bilateral exchange rate between Canadian and US in year t. The choice of RER_{jt} as the exclusion restriction is motivated by the fact that the United States is the major trading partner of Canada. The real exchange rate affects Canadian export and import propensities with the US. Short-run profits of Canadian firms likely fluctuate with export/import propensities. Thus, real exchange rate movements likely affect the probability of whether a Canadian firm continues to operate or temporarily shuts-down, see for example Huynh, Petrunia, and Voia (2010). Evidence from Campa and Goldberg (2001) shows that real exchange rate movements have effects on wages but have negligible effects on employment and number of jobs. Thus, temporary fluctuations of the real exchange rate are unlikely to affect the contemporaneous probability a worker experiences a permanent separation.

The second exclusion restriction is a relative firm-to-industry variable. We compute the logarithm of the ratio of the wage bill of firm i at time t relative to the average wage bill of firms in industry j and size class k at time t or:

$$\log \overline{\text{wage bill}}_{ikjt} = \log \left(\frac{\text{wage bill}_{it}}{\overline{\text{wage bill}}_{kjt}} \right). \tag{4}$$

This variable is strongly correlated with whether a firm continues operations, as it proxies for how competitive a firm is relative to its industry peers. Controlling for the employment size of a firm, the wage bill provides a measure of firm efficiency/productivity. More productive firms pay higher wages, and thus, have a higher wage bill as discussed in Abowd, Kramarz, and Margolis (1999), Michelacci and Quadrini (2009) and Moscarini and Postel-Vinay (2012), inter alia. From a worker's perspective, they are unable to amass all the relevant information to compute the relative standing of his/her firm's wage bill contemporaneously. More productive firms with higher wage bill should be more likely to continue operations, but should be no more likely to permanently layoff workers.

3.2 Results

The BPWS results provide estimation of the impact of industry shutdown rates on worker layoffs with an additional selection control for whether a firm is active or not. Table 8 presents the estimation coefficients for the probability of a permanent layoff when controlling for firm shutdown selection effects for males while table 9 provides estimates coefficients for females. For both males and females, the bivariate probit model did not converge for the large firms.[6] The descriptive statistics illustrate that there is substantial variation in the shutdown rates across industry and time. Therefore, the impact of industry shutdown rates on permanent layoffs should be well-identified. A likelihood ratio test reveals that selection is statistically significant in all the cases. Therefore, selection via the impact of firm shutdown affects the probability of permanent layoff on a worker. Most of the discussion emphasizes the variable of interest, industry shutdown rates.

With the exception of females at small firms, the coefficient on the shutdown rate is positive and statistically significant for both males and females across the firm size classes. Thus, these coefficients estimates indicate that the qualitative impact of industry shutdown rates are positive on worker layoff rates. Figure 2 provides estimated marginal effect of an increase in industry shutdown rate on the probability of a worker layoff. For comparison, this figure also provides the estimated marginal effect without accounting for selection. For both males and females, these quantitative impacts of the industry shutdown rate on permanent layoff probability change when accounting for selection. After controlling for selection, the quantitative impacts become constant across the firm size classes for males, while the quantitative impacts move from negative to mainly positive for females. The results for males indicate that a one percent increase in industry shutdown rate causes a slightly larger than 0.13 percent increase in the probability of a permanent layoff regardless of firm size class. For females, the marginal effects vary across the firm size classes; a one percent increase in industry shutdown rates implies: (i) a 0.9 percent decrease in the probability of a permanent layoff at extra small firms; (ii) a 0.11 percent increase in the probability of a permanent layoff at small firms; and (iii) a 0.03 percent increase in the probability of a permanent layoff at medium sized firms.

[6]There was insufficient shutdowns at the large firm sizes in order to capture the selection effect; thus, we are unable to report results for the large firms.

Returning to tables 8 and 9, coefficients on the other control variables remain fairly constant across the firm size classifications and qualitatively identical for males and females. The probability of a permanent layoff falls with a worker's income. Tenure effects are concave in shape. Married workers have a lower probability of permanent layoff separation, while unionised workers have a higher permanent separation probability. Across the regions, workers in the Atlantic provinces experience the highest probability of a permanent layoff, where the lowest permanent layoff separation probability occurs for workers in the Prairie provinces. Tables 8 and 9 also report the coefficients on the log of the firm's wage bill and the log of the real exchange rate, which are our exclusion restriction variables in the selection equation. The coefficient on the wage bill variable is always positive and significant. This result likely captures the effect of firm size on firm survival as larger firms tend to have higher survival rates. The coefficient on the log of the real exchange rate varies between negative and positive. It is only statistically significant with a negative value for the males and females at the extra small firms. For males, the correlation in the error terms between the two equations is approximately -0.45. The negative correlation implies that a positive shock to a firm remaining active has a negative impact on the probability of a male worker being permanently laid-off. This situation also occurs for female workers except at the medium sized firms.

4 Earnings Transitions - Intensive Margin

The previous section discusses permanent layoffs or the extensive margin of employment. In this section, we discuss workers earnings transitions or the intensive margins of permanent layoffs by looking at the earnings growth for those workers experiencing a permanent layoff. We do not use the identification strategy found in Abowd, Kramarz, and Margolis (1999), where the worker and firm fixed effects enter additively. The LWF allows us to follow the worker transitions from a separation (layoff) to possible employment to a another firm. Eeckhout and Kircher (2011) provide motivation for using transitions. They show the estimated worker and firm fixed-effects from the log-linear wage equation do not directly identify the underlying worker skill and firm productivity heterogeneity. In particular, the correlation between the estimated worker and firm fixed-effects does not identify sorting in the matching between worker skill and firm productivity.

4.1 Earnings and Selection

Similar to the previous selection problem, the estimated earnings growth model must account for selection effects due to firm shutdown. To deal with this selection problem we estimate the effect of the transitions on the change in log-wage using a Heckman-selection model. Again, the selection equation describes the probability of a firm continuing (FS^*_{kjt}), while the outcome equation describes

the log-wage ($\log w^*_{ikjt}$)of a specific transition:

$$\begin{aligned} \text{FS}^*_{ikjt} &= \alpha^{FS} + \beta^{FS} SR_{jt} + \gamma^{FS} B_{ikt} + \sum_{j=1}^{J} \psi^{FS}_j I_j + \sum_{t=1993}^{2002} \delta^{FS}_t D_t + \lambda Z_{kjt} + v_{ikjt}, \\ \Delta \log w^*_{ikjt} &= \alpha^{w} + \beta^{w} SR_{jt} + \gamma^{w} B_{ikt} + \sum_{j=1}^{J} \psi^{w}_j I_j + \sum_{t=1993}^{2002} \delta^{w}_t D_t + u_{ikjt}. \end{aligned} \tag{5}$$

where $\Delta \ln w_{ikjt}$ is wage growth of worker i from firm k in industry j at time t, an indicator variable, FS_{ikjt}, equals one if a firm remains active with $FS^*_{ikjt} \geq 0$ and zero otherwise, the errors u_{ikjt} and v_{ikjt} are normally distributed with zero means and correlation ρ, and SR_{jt} is the annual shutdown rate in industry j in period t. The model specification includes: (i) B_{ikt} is a set of worker and/or firm-specific variables, such as an age polynomial, marital status, tenure, region of residence and earnings in period year $t-1$ and union membership; (ii) I_j are industry-specific dummy variables, and (iii) D_t is a set of period-specific dummy variables. The analysis examines wage growth as a way to control for potentially unobservable factors. For example, there maybe wages differentials due to: job risk, education or occupations with higher lay-off rates. The analysis includes industry, location and firm size variables which partially capture some of these differentials. Further, these unobservable-time invariant worker or job characteristics are unlikely to affect wage growth. The analysis of wage growth provides a method to difference out these unobservable factors. In contrast to the BPWS model, the exclusion restriction only includes the firm-to-industry relative wage ($\log \overline{\text{wage bill}}_{ikjt}$). The specification does not include the relative real exchange rate as an exclusion restriction. Campa and Goldberg (2001) study shows an impact of the real exchange rate on wages, which justifies this change from the previous worker separation analysis.

Tables 10 and 11 present the coefficient estimates for the earnings regression accounting for selection effects for males and females, respectively. The selection parameter (λ) is significant for all size classes except small size category for males, and small and large size category for female.[7] This result is due to the small correlation (ρ) between the two equations. For comparison purposes, figure 3 provides coefficient estimates on the industry shutdown variable for the selection and nonselection models. For males, the coefficient on the industry shutdown rate variable becomes positive and statistically significant for workers at medium sized firms, while the coefficients remain negative, statistically significant and increase slightly in magnitude for workers at other size classes when moving from the nonselection to the selection model. For females, there is no change in the qualitative findings and little change in the quantitative effects of the industry shutdown rate after accounting for selection. Thus, the impact of selection effects of firm shutdown is small when examining worker earnings growth. With the exception of males at medium sized firms, the correlation between the error terms in the two equations, ρ, is positive. Positive correlation indicates

[7] In a full-information maximum likelihood estimation the selection parameter is a function of correlation and variance (σ) or $\lambda = \rho \times \sigma$.

that firms with unexplained increases in the probability of remaining active also have unexplained increases to wages paid.

The change in the logarithm of worker wages measures the wage growth for a worker. Thus, the coefficient on the industry shutdown rate variable gives the response of worker wage growth to changes in the industry shutdown rate. Equivalently, this coefficient gives an elasticity or the percentage change in worker earnings in response to a one percent change in the industry shutdown rate. The estimated coefficient values indicate economic significance in that worker wage growth is highly responsive to industry shutdown rates. For males, extra small firms show the least response of wage growth to industry shutdown rates with a coefficient of -0.98, while small firms have the most response with a coefficient of -2.00. For females, workers at the extra small firms have the largest response as the coefficient estimate indicates a one percent increase in industry shutdown rate causes a three percent decrease in worker wage growth.

The coefficients on the other variables indicate similar patterns across firm size classes and genders. Earnings growth falls with age and rise with being married or part of a unionised firm. The effect of job tenure is nonlinear. Wage growth initially falls with tenure, but begin to rise after approximately eleven years at a job.

4.2 Accounting for firm size class switches

We investigate worker earnings while controlling for the possibility the firm size class associates with the worker changes. There are two potential reasons for a worker's firm size class to change. First, the worker moves to a different firm belonging to a different size class. Second, the worker stays at the same firm, but the firm moves to a different firm size class. Our analysis focuses on the former group, who move to a different firm following a permanent layoff.

Figure 4 present the cumulative distribution function (CDF) for $\Delta log(wage_{ikjt})$ for those male and female workers, respectively, who experience a permanent layoff but move to a different firm. Each figure shows CDFs for three subgroups: (i) switch down - worker moves to a firm in a smaller size class; (ii) switch to same size - worker moves to a firm in the same size class; and (iii) switch up - worker moves to a firm in a larger size class. For both males and females, the wage growth CDFs for the switch down, switch to the same size and switch up are left, middle and right, respectively. These figures indicate that workers who transition to larger sized firms do better than workers who move to a firm in the same size class, while workers who move to smaller sized firms do worse. An asymmetry results when comparing the distributions across the three groups. For negative values of wage growth, the lower tail for the switch down group of workers is much fatter than for the other two groups, while the lower tail looks similar for the switch to same size and switch up groups. For positive values of wage growth, the opposite occurs. The distribution switch down and switch to same size groups have similar upper tails while the switch up group has a fatter upper tail.

This unconditional analysis ignores the rich characteristics of firms and workers. So, we amend

the wage model with selection (5) to include the firm-size class switches. The switchers are treated as exogenous as we focus only on involuntary separations or permanent layoffs.The following specification combines adds workers experiencing a firm size class switch with the selection wage model with selection:

$$\begin{aligned} \mathrm{FS}^{*}_{ikjt} &= \alpha^{FS} + \beta^{FS} SR_{jt} + \gamma^{FS} B_{ikt} + \sum_{j=1}^{J} \psi_j^{FS} I_j + \sum_{t=1993}^{2002} \delta_t^{FS} D_t + \lambda Z_{kjt} + \sum_{i \in m} \eta^{FS} SW_{it} + v_{ikjt}, \\ \Delta \log w^{*}_{ikjt} &= \alpha^{w} + \beta^{w} SR_{jt} + \gamma^{w} B_{ikt} + \sum_{j=1}^{J} \psi_j^{w} I_j + \sum_{t=1993}^{2002} \delta_t^{w} D_t + \sum_{i \in m} \eta^{w} SW_{it} + u_{ikjt}. \end{aligned} \tag{6}$$

where SW_{it} are a series of indicator variables for individuals across various firm size transitions between time $t-1$ and t, and η^w are the corresponding coefficients on the indicator variables. Firm size transition classes, m, are: (i) extra small to small (XS-S); (ii) small to extra small (S-XS); (iii) small to small (S-S); (iv) small to medium (S-M) (v) medium to small (M-S); (vi) medium to medium (M-M); (vii) medium to large (M-L); (viii) large to medium (L-M); and (ix) large to large (L-L). Table 12 provides estimates for the earnings regressions controlling for firm size class changes. Industry shutdown rate continues to have a negative impact on worker earnings even with the additional control for switching firm size class. The coefficients on the switching variables have the expected sign. An increase in the firm size class of a worker sees the worker's earnings increase, while a decrease in firm size class sees the worker's earnings fall. Switching from extra small to small sized firm causes wages to increase by 0.22 percent for males and 0.18 percent for females. The magnitude is not as great in the reverse direction as switching from small to an extra small sized firms causes male earnings to fall by 0.19 percent and female earnings to fall by 0.14 percent. A movement from medium to large sized firms causes male worker earnings to increase by 0.11 percent and female worker earnings to increase by 0.06 percent, while a movement from large to medium sized firms causes male and female workers earnings to fall by 0.08 and 0.01 percent, respectively. Those workers not changing firm size class generally do not see changes in their earnings. The exception to this rule is male workers at medium sized firms who see a statistically significant increase in earnings of six percent.

Figure 5 present the CDFs of the residuals from the regressions in Table 12 for males and females. As in Figure 4, these workers are broken into three categories based on pre-layoff to post-layoff size class transition of their firms. The conditioning removes a significant amount of the difference between the distributions across the three categories. Further, the asymmetries at the tails of the distributions across the three categories disappear after the conditioning. A worker does not necessarily end up in a worse position with a lower earning job after being permanently laid off. However, almost 60 percent of those laid off workers who move to smaller or similarly sized firms see a fall in wages. In contrast, less than 50 percent of laid off workers eventually moving to a larger sized firm see their earnings fall. Thus, the type of firm a worker ends up at after being

laid off explains a significant amount of the resulting wages.

5 Conclusions

We quantify the effect of industry shutdown rates on worker outcomes such as involuntary separations or permanent layoffs (extensive margin) and wage earnings (intensive margin). Our empirical work shows that, when controlling for individual and firm-specific characteristics, industry shutdown rates generally have a positive and significant effect on the probability of a permanent worker layoff. For wage growth, shutdown rates have a negative effect but the effects are amplified for smaller firms. The unique structure of the LWF database allows us to differentiate among different industries in our analysis. We find substantial differences across industries in the roles of individual and firm level attributes on permanent layoff and wage growth. Our analysis controls for firm selection effects on worker outcomes due to firm shutdown. Accounting for selection effects does alter the estimated impact of industry shutdown rates on worker outcomes.

Determining the relative contribution of worker, firm, industry and time factors to the overall employment instability is an essential step in developing training programs to counter the adverse effects of employment loss. If job instability is mostly determined by differences in individual human capital then future policies may focus on providing opportunities for workers to improve their education or skills. If, on the other hand, job instability is mostly a reflection of market instability or, more specifically, firm instability then education and skill development programs may not be as effective. Hence, understanding the relative impact of individual and firm characteristics on worker turnover is important in determining the effectiveness of specific training and skill-development programs provided both privately and publicly. In the light of the recent economic downturn that affected many Western countries including Canada, the costs and benefits associated with such programs are likely to remain subject to intense policy discussions in the foreseeable future.

Our empirical results show that the process of job turnover has a richer set of dynamics that cannot necessarily be explored with reduced-form methods. As suggested by Postel-Vinay and Robin (2006), they highlight the role for modeling job turnover using frictional models of unemployment. In these models, job turnover is a dynamic process that involves explicitly laying out the microfoundations. However, there is an important opportunity for further research on voluntary separations or a worker quitting their job to find a new one. Recent work by Lise, Meghir, and Robin (2013) allows for matched agents to undertake on-the-job search and illustrates the complexity of labour outcomes in terms employment prospects and earnings. A fruitful extension would consider both involuntary and voluntary quits.

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Table 1: Industry Classification by NAICS

Industry	NAICS
Crop and animal production	111, 112
Forestry and logging; fishing, hunting and trapping	113-115
Oil and gas extraction	211
Mining (except oil and gas)	212
Support activities for mining and oil and gas extraction	213
Utilities	22
Construction	23
Food manufacturing; beverage and tobacco product manufacturing	311, 312
Textile mills; textile product mills	313, 314
Clothing manufacturing; leather and allied product manufacturing	315, 316
Wood product manufacturing	321
Paper manufacturing	322
Printing and related support activities	323
Chemical manufacturing	325
Plastic and rubber products manufacturing	326
Non-metallic mineral product manufacturing	327
Primary metal manufacturing	331
Fabricated metal product manufacturing	332
Machinery manufacturing	333
Computer and electronic product manufacturing	334
Electrical equipment, appliance and component manufacturing	335
Transportation equipment manufacturing	336
Furniture and related product manufacturing	337
Miscellaneous manufacturing	339
Wholesale trade	41
Retail trade	44-45
Air, Rail, Water, Touristic and support transportation	481-483, 487, 488
Truck transportation	484
Transit and ground passenger transportation	485
Warehousing and storage	493
Publishing; information services and data processing services	511, 516, 518, 519
Motion picture and sound recording industries	512
Broadcasting and telecommunication	515, 517
Finance and insurance; real estate and rental and leasing	52, 53
Professional, scientific and technical services	54
Administrative and support services	561
Arts, entertainment and recreation	71
Accommodation and food services	72
Other services (except Public Administration)	81

Note: The North American Industry Classification System (NAICS) is a standard classification used by Statistics Canada to classifying business establishments for the purpose of collecting, analyzing, and publishing statistical data. More information is available at `http://www.statcan.gc.ca/concepts/industry-industrie-eng.htm`

Table 2: Summary Statistics by Industry

Industry	Age	Female	Tenure	Earnings	SR	PL	Firms	Workers
Crop and animal production	41.7	0.41	5.76	21,530	0.132	0.073	8,610	13,530
Forestry and logging; fishing, hunting and trapping	41.1	0.20	5.49	30,840	0.138	0.124	4,485	9,540
Oil and gas extraction	41.2	0.29	6.92	107,090	0.125	0.015	375	3,560
Mining (except oil and gas)	43.9	0.10	9.92	66,030	0.115	0.026	400	6,235
Support for mining, oil and gas extraction	39.0	0.14	4.56	59,380	0.121	0.076	1,295	6,050
Utilities	43.4	0.26	10.46	69,290	0.161	0.015	365	11,330
Construction	41.0	0.15	5.25	39,610	0.136	0.114	30,530	64,965
Food; beverage and tobacco manufacturing	41.3	0.39	7.04	38,390	0.099	0.035	2,855	26,970
Textile mills; textile product mills	41.7	0.42	7.14	34,090	0.111	0.039	755	3,825
Clothing; leather and allied manufacturing	43.0	0.76	6.29	22,950	0.160	0.055	1,800	8,095
Wood product manufacturing	41.1	0.15	7.67	46,720	0.118	0.036	1,945	13,670
Paper manufacturing	43.2	0.18	9.66	58,110	0.087	0.017	405	10,230
Printing and related support activities	41.0	0.41	6.68	41,240	0.102	0.031	2,135	7,715
Chemical manufacturing	41.2	0.36	6.82	56,900	0.100	0.020	875	8,170
Plastic and rubber products manufacturing	40.1	0.32	7.03	43,500	0.089	0.026	1,320	12,310
Non-metallic mineral product manufacturing	42.3	0.16	7.85	47,050	0.091	0.041	930	5,905
Primary metal manufacturing	44.0	0.11	11.45	62,970	0.095	0.015	340	8,735
Fabricated metal product manufacturing	41.1	0.18	6.70	44,670	0.074	0.046	3,950	15,360
Machinery manufacturing	40.6	0.18	6.67	51,500	0.081	0.034	2,445	12,660
Computer and electronic product manufacturing	39.8	0.35	6.67	60,660	0.111	0.032	965	8,415
Electrical, appliance and component manufacturing	41.7	0.31	6.98	49,000	0.093	0.041	550	4,855
Transportation equipment manufacturing	41.6	0.20	9.01	57,060	0.094	0.018	1,070	23,765
Furniture and related product manufacturing	40.4	0.24	6.17	33,600	0.106	0.040	1,975	7,975
Miscellaneous manufacturing	40.5	0.42	6.25	36,360	0.096	0.041	1,870	5,620
Wholesale trade	40.9	0.35	6.34	47,120	0.110	0.032	19,720	66,045
Retail trade	40.4	0.56	6.02	29,950	0.126	0.022	35,605	117,410

Note: SR is the shutdown rate while PL is the permanent layoff rate.

Table 2: Continued: Summary Statistics by Industry

Industry	Age	Female	Tenure	Earnings	SR	PL	Firms	Workers
Air, Rail, Water, Touristic and support transportation	42.0	0.28	8.75	52,860	0.146	0.021	2,410	20,420
Truck transportation	41.6	0.16	5.06	37,810	0.144	0.037	6,695	16,385
Transit and ground passenger transportation	44.9	0.33	7.92	34,530	0.125	0.026	1,525	9,550
Warehousing and storage	40.7	0.27	6.06	41,410	0.097	0.033	430	2,485
Publishing information and data processing services	40.1	0.49	6.35	51,060	0.136	0.020	1,690	12,220
Motion picture and sound recording industries	37.8	0.40	4.26	40,670	0.159	0.092	875	2,995
Broadcasting and telecommunication	40.0	0.45	8.85	58,120	0.147	0.009	635	17,530
Finance, insurance, real estate	41.1	0.61	7.18	51,840	0.118	0.017	16,340	81,690
Professional, scientific and technical services	39.6	0.49	4.98	50,860	0.131	0.035	23,005	58,470
Administrative and support services	39.7	0.48	3.81	28,300	0.133	0.049	12,440	55,515
Arts, entertainment and recreation	39.5	0.50	4.86	29,440	0.123	0.059	4,895	14,865
Accommodation and food services	38.8	0.62	4.23	18,800	0.152	0.035	25,745	61,130
Other services (except Public Administration)	41.4	0.56	5.34	30,380	0.137	0.031	27,360	53,125

Note: SR is the shutdown rate while PL is the permanent layoff rate.

Table 3: Summary Statisics by Size of Firms

Firm Size	Age	Gender	Tenure	Earnings	SR	PL	Firms	Workers
XS	41.8	0.47	4.83	25,730	0.130	0.050	110,540	126,095
S	40.5	0.43	5.18	32,110	0.128	0.054	83,935	136,265
M	40.1	0.39	5.34	37,960	0.125	0.049	47,845	176,995
L	40.8	0.41	7.22	48,890	0.121	0.025	9,305	449,955

Note: The firm size classes are: (1) less than 5 employees; (2) 5-19 employees; (3) 20-49 employees; (4) 50-99 employees; (5) 100-199 employees; (6) 200-499 employees; and (7) greater than or equal to 500 employees. SR is the shutdown rate while PL is the permanent layoff rate.

Table 4: Summary Statistics by Region

Region	Age	Gender	Tenure	Earnings	SR	PL	Firms	Workers
Atlantic	40.7	0.42	6.47	29,710	0.127	0.067	19,535	61,775
Quebec	41.0	0.41	6.52	36,170	0.124	0.042	63,165	213,585
Ontario	40.7	0.43	6.30	45,780	0.122	0.030	86,550	350,570
Prairies	40.4	0.41	5.67	41,720	0.126	0.034	44,830	147,625
BC	40.9	0.42	5.79	41,070	0.127	0.043	37,520	115,445

Note: The five regions are: (1) Atlantic Provinces; (2) Quebec; (3) Ontario; (4) Prairie Provinces; and (5) British Columbia. SR is the shutdown rate while PL is the permanent layoff rate.

Table 5: Size Comparison of Shutting Down and Continuing Firms

	Shutting Down in t						**Continuing in t**					
Industry	*mean*			*median*			*mean*			*median*		
	t	t-1	t-2	t	t-1	t-2	t	t-1	t-2	t	t-1	t-2
Crops and animal prod.	0.9	1.3	1.5	0.4	0.6	0.7	3.4	3.5	3.5	1.3	1.3	1.3
Forestry, fishing, etc.	1.3	2.6	3.0	0.5	0.9	1.0	6.0	6.3	6.6	1.7	1.8	1.9
Oil and gas	5.7	7.7	7.6	0.8	1.4	1.5	45.8	42.9	40.1	1.6	1.6	1.6
Mining (except oil and gas)	6.1	10.5	11.0	0.8	2.3	2.6	102.7	98.6	95.5	10.3	10.3	10.0
Support for mining	2.5	6.0	6.1	0.5	1.0	1.1	21.2	20.1	18.3	1.7	1.8	1.7
Utilities	5.9	10.0	10.1	1.3	2.6	2.5	235.9	231.8	227.3	8.0	7.6	7.1
Construction	1.5	2.7	3.0	0.6	1.1	1.2	9.2	8.9	8.5	2.7	2.6	2.6
Food, beverage, etc	3.7	8.7	9.6	0.8	2.0	2.2	58.5	58.6	58.7	6.0	6.0	6.0
Textile, etc	4.6	12.7	15.2	0.9	2.1	2.5	25.8	27.6	29.1	6.1	6.4	6.5
Clothing, etc	4.6	10.8	13.4	1.1	2.9	3.7	23.8	25.8	27.3	6.4	6.9	7.2
Wood	3.8	9.4	11.1	0.8	2.2	2.4	45.8	47.6	47.9	10.2	10.6	10.4
Paper	7.2	19.7	24.6	2.0	3.5	4.2	175.1	182.7	190.1	20.6	21.1	21.4
Printing, etc	2.8	5.9	6.6	0.8	1.7	1.8	19.7	20.5	21.0	4.5	4.8	4.9
Petroleum and coal	2.2	5.0	5.8	1.2	1.7	1.4	316.6	299.1	288.2	8.8	8.3	7.7
Chemical prod.	3.7	8.3	8.4	0.8	1.8	2.1	64.5	64.4	63.4	8.7	8.7	8.7
Plastic and rubber	9.2	22.3	23.6	1.6	3.5	4.4	77.5	79.9	80.5	17.8	17.8	17.3
Non-metallic	2.6	5.5	6.3	0.7	1.6	2.2	39.0	39.1	38.8	7.4	7.4	7.2
Primary metals	9.0	22.9	33.1	1.3	3.8	4.4	156.4	161.1	163.5	19.9	20.5	20.5
Fabricated metal	3.6	8.0	9.3	0.9	2.0	2.3	25.8	25.8	25.6	8.7	8.5	8.3
Machinery	4.3	9.9	11.7	0.9	2.0	2.3	35.1	34.8	34.3	9.2	9.3	9.2
Computers, etc	4.0	9.6	11.1	0.8	1.7	2.2	49.1	49.0	49.9	8.2	8.2	8.1
Electrical equipment, etc	4.9	8.7	9.8	0.9	1.7	1.8	49.4	49.5	50.5	8.6	8.4	8.1
Vehicles	7.3	18.0	26.1	1.0	2.2	2.5	135.3	140.3	142.6	10.5	10.6	10.7
Furniture	4.5	9.6	10.8	1.0	2.1	2.4	24.6	25.2	25.3	6.9	6.9	6.8
Miscelleneous Manu	2.2	4.4	5.4	0.6	1.3	1.5	13.0	13.0	12.8	3.9	3.9	3.7
Wholesale	2.1	4.3	4.8	0.7	1.3	1.5	18.7	18.7	18.6	4.3	4.4	4.3
Retail	2.3	4.6	5.1	0.9	1.9	2.1	23.1	22.4	21.7	4.4	4.4	4.3

Table 5: Continued: Size Comparison of Shutting Down and Continuing Firms

	Shutting Down in t						**Continuing in t**					
Industry	*mean*			*median*			*mean*			*median*		
	t	t-1	t-2	t	t-1	t-2	t	t-1	t-2	t	t-1	t-2
Air transport, etc	2.7	5.3	6.0	0.7	1.4	1.6	39.9	39.7	39.0	3.9	3.8	3.7
Truck	1.8	3.3	3.5	0.6	1.1	1.2	9.3	9.1	8.9	1.8	1.9	1.9
Transit	2.7	4.6	5.1	0.9	1.6	1.7	40.1	39.1	38.0	4.0	4.0	4.0
Pipeline	1.2	3.1	4.1	0.3	0.9	0.9	86.4	81.4	76.8	1.8	1.7	1.7
Warehousing	3.9	7.3	8.5	1.3	2.7	2.9	42.8	41.0	39.0	6.6	6.8	6.7
Information, etc	3.1	6.0	6.7	0.8	1.6	1.8	38.4	37.8	38.2	4.1	4.1	4.1
Motion pics	1.8	3.3	4.5	0.5	0.9	1.0	11.1	11.0	11.0	1.4	1.4	1.4
Broadcasting	4.6	8.1	8.4	0.9	1.8	1.9	150.8	151.0	154.7	5.6	5.5	5.0
Finance, etc.	1.6	3.0	3.4	0.6	0.9	1.0	18.1	17.8	17.5	1.9	1.9	1.9
Professional, etc	1.2	2.2	2.5	0.5	0.9	1.0	8.7	8.5	8.2	1.6	1.7	1.7
Admin, etc	2.6	4.7	5.2	0.7	1.3	1.5	22.3	21.5	20.5	3.1	3.1	3.0
Waste management	2.3	4.3	5.2	0.7	1.5	1.7	17.2	16.6	16.0	4.0	3.9	3.9
Arts, etc	2.4	4.2	4.6	0.7	1.3	1.4	17.4	17.1	16.7	3.2	3.2	3.1
Accomodations, etc	3.8	7.0	7.8	1.5	3.3	3.7	20.9	20.7	20.4	6.8	6.9	7.0
Other services	1.0	1.8	1.9	0.4	0.7	0.7	6.3	6.3	6.2	1.8	1.9	1.9
All	2.1	3.9	4.4	0.6	1.2	1.3	20.5	20.2	19.9	2.8	2.8	2.8

Note: This table provides a comparison between shutting down firms in year t with continuing firms. For these two groups of firms, the table provides the median and average employment size in the three years prior to firm shutdown in the former group.

Table 6: Growth Comparison of Shutting Down and Continuing Firms

	Shutting Down in t						**Continuing in t**					
	mean			*median*			*mean*			*median*		
	t/t-1	t-1/t-2	t-2/t-3	t/t-1	t-1/t-2	t-2/t-3	t/t-1	t-1/t-2	t-2/t-3	t/t-1	t-1/t-2	t-2/t-3
Crops and animal prod.	-6.4	23.2	23.5	-22.3	-4.7	-3.0	11.0	12.2	33.4	-2.2	-2.3	-1.0
Forestry, fishing, etc.	-1.7	34.3	42.5	-37.7	-7.9	-3.8	12.3	13.7	29.3	-3.7	-3.3	-2.0
Oil and gas	8.9	39.6	126.5	-30.2	-2.1	4.3	25.4	33.3	63.8	-0.8	0.6	2.6
Mining (except oil and gas)	-21.0	17.3	55.0	-54.1	-4.8	-3.2	20.2	20.1	39.1	1.6	1.4	2.8
Support for mining	-13.6	59.2	156.1	-41.0	-5.3	3.4	32.4	32.6	68.3	-0.6	1.9	7.3
Utilities	-23.0	40.1	41.5	-33.7	-1.8	5.8	28.3	28.7	76.9	1.2	1.7	3.6
Construction	-1.9	46.5	94.2	-40.4	-4.4	3.5	26.6	26.2	131.7	1.7	2.9	5.3
Food, beverage, etc	31.5	5.2	40.8	-47.6	-7.3	0.1	11.3	12.9	31.5	0.4	0.2	2.9
Textile, etc	-35.4	170.4	34.2	-48.5	-11.7	-3.9	24.9	12.6	25.9	-4.1	-2.2	-0.2
Clothing, etc	-33.5	4.4	44.3	-55.0	-13.2	-5.3	6.4	11.2	22.7	-5.8	-3.6	-2.4
Wood	309.6	24.0	175.0	-50.0	-9.2	-2.1	6.2	10.7	30.7	-1.5	0.9	3.1
Paper	-44.2	-0.4	23.2	-51.0	-8.9	1.8	3.3	3.3	28.9	-2.8	-1.3	2.8
Printing, etc	-9.8	28.2	60.5	-45.7	-8.1	-4.3	10.4	12.9	23.6	-4.1	-1.7	-0.9
Petroleum and coal	-7.0	11.1	33.4	-44.5	4.3	5.8	13.0	12.9	20.4	2.5	1.8	2.1
Chemical prod.	-37.2	9.2	40.3	-48.6	-4.0	-2.8	6.7	12.1	29.9	-1.0	0.2	0.6
Plastic and rubber	-31.9	0.6	70.6	-51.6	-6.8	-0.3	31.1	8.3	28.8	-0.6	1.0	3.1
Non-metallic	-31.3	31.9	40.1	-45.4	-9.9	-4.6	18.7	19.6	26.8	0.8	1.5	3.1
Primary metals	-43.1	-1.2	70.8	-47.2	-9.6	1.6	10.2	12.0	29.3	-0.8	2.0	2.8
Fabricated metal	-24.6	1.2	38.8	-47.1	-7.4	-1.0	11.8	17.7	34.2	0.7	1.7	2.0
Machinery	-17.9	6.0	62.7	-49.6	-9.7	-3.5	12.8	15.0	33.6	-0.9	0.6	2.6
Computers, etc	-30.8	-3.0	30.3	-47.3	-10.1	-6.1	9.1	14.5	60.8	0.1	-0.2	0.7
Electrical equipment, etc	-31.5	4.3	23.7	-41.6	-7.6	2.9	658.5	659.1	675.7	2.4	1.9	4.0
Vehicles	-33.0	10.5	93.2	-47.9	-6.7	-1.9	7.6	11.6	143.0	-1.9	0.4	1.1
Furniture	-26.9	7.6	45.8	-48.8	-6.9	-1.3	9.6	12.9	32.7	-0.5	1.3	2.3
Miscelleneous manufacturing	-31.3	7.5	52.2	-45.3	-6.9	-2.2	8.4	12.0	33.3	-0.1	1.1	1.8
Wholesale	-26.0	305.2	547.3	-44.1	-7.1	-1.9	34.3	17.0	31.4	-0.8	0.3	1.5
Retail	-7.6	7.6	49.9	-45.4	-4.4	0.4	54.6	57.2	89.3	0.6	1.4	2.7

Table 6: Continued: Growth Comparison of Shutting Down and Continuing Firms

	Shutting Down in t						**Continuing in t**					
	mean			*median*			*mean*			*median*		
	t/t-1	t-1/t-2	t-2/t-3	t/t-1	t-1/t-2	t-2/t-3	t/t-1	t-1/t-2	t-2/t-3	t/t-1	t-1/t-2	t-2/t-3
Air transport, etc	-19.9	20.8	54.0	-40.9	-5.9	0.9	22.8	24.2	49.9	1.2	2.5	3.9
Truck	-18.6	25.5	56.4	-42.6	-4.8	0.2	36.6	64.5	42.7	-0.1	0.4	2.1
Transit	-0.9	44.1	56.8	-37.3	-4.5	-1.1	21.3	25.1	44.3	0.6	-0.1	1.5
Pipeline	-38.8	21.3	29.2	-53.2	-13.0	-17.2	35.8	56.9	93.2	-1.3	1.5	5.9
Warehousing	-17.1	38.2	45.8	-38.1	-4.0	6.5	16.3	21.4	60.6	-2.7	2.6	7.2
Information, etc	-25.6	10.0	55.1	-40.9	-7.8	0.6	17.1	14.4	49.1	-0.1	-1.0	2.6
Motion pics	-5.2	28.5	241.4	-35.1	-6.8	-3.9	28.6	44.3	48.9	0.0	-1.6	-1.8
Broadcasting	-24.9	31.2	176.5	-43.5	-3.0	4.1	19.4	27.8	62.8	0.1	2.9	4.4
Finance, etc.	123.2	25.1	52.9	-29.2	-4.2	-1.0	17.6	19.2	36.5	0.3	0.0	1.0
Professional, etc	-12.9	105.1	55.8	-38.0	-5.1	0.1	122.8	121.5	130.7	-0.5	0.4	2.6
Admin, etc	179.2	82.9	85.7	-37.7	-4.3	0.2	38.5	51.9	142.1	1.0	1.7	3.0
Waste management	-12.4	21.1	37.6	-45.6	-4.4	0.3	15.3	18.8	38.0	1.8	3.6	5.4
Arts, etc	-17.5	17.4	68.8	-33.7	-5.0	-0.1	15.0	16.8	53.2	0.2	0.7	2.4
Accomodations, etc	-24.6	10.3	64.9	-44.5	-6.3	-1.0	10.9	12.3	46.6	-0.9	-0.5	1.4
Other services	-27.4	10.2	65.7	-40.9	-3.7	0.7	8.4	10.3	41.9	-1.2	-1.0	0.5
All	58.6	52.8	84.8	-39.8	-4.8	-0.3	35.2	35.9	72.9	-0.5	0.1	1.7

Note: This table provides a comparison between shutting down firms in year t with continuing firms. For these two groups of firms, the table provides the median and average employment growth in the three years prior to firm shutdown in the former group.

Table 7: Bivariate Probability of Permanent Layoff: Males

	XS	S	M
Shutdown rate	1.1319	1.1781	1.3252
	(.2694)***	(.2266)***	(.1793)***
Lag of Earnings	-.0892	-.1124	-.1181
	(.0020)***	(.0020)***	(.0018)***
Age 35-49	-.0327	.0488	.0717
	(.0057)***	(.0049)***	(.0044)***
Age 50+	.0393	.1765	.2456
	(.0069)***	(.0060)***	(.0053)***
Married	-.1877	-.1368	-.1229
	(.0052)***	(.0045)***	(.0040)***
Tenure	-.1489	-.1362	-.1316
	(.0018)***	(.0016)***	(.0014)***
Tenure Squared	.0045	.0039	.0039
	(.0001)***	(.00008)***	(.00007)***
Union	.1571	.2080	.2045
	(.0067)***	(.0054)***	(.0043)***
Atlantic	.3809	.3096	.2920
	(.0081)***	(.0080)***	(.0074)***
Quebec	.1292	.0978	.0748
	(.0067)***	(.0058)***	(.0049)***
Prairie	-.1128	-.0512	-.0246
	(.0081)***	(.0069)***	(.0060)***
BC	.0600	.0701	.0643
	(.0079)***	(.0069)***	(.0062)***
Constant	-.1237	.0308	.0824
	(.04107)***	(.0358)	(.0312)***
Firm Active Estimates - Exclusion Restrictions			
$\log \text{RER}_{jt}$	-.1108	-.0573	.0657
	(.0369)***	(.0461)	(.043)
$\log \overline{\text{wage bill}}_{ikjt}$	.4065	.1746	.1184
	(.0023)***	(.0049)***	(.0059)***
ρ (Correlation)	-.4272	-.4545	-.463
	(.0146)***	(.0507)***	(.0474)***
LR-test χ^2 (Selection)	646.01	58.88	68.78
p-value	0	0	0
Observations-censored	78090	32215	26554
Observations	856229	1046321	1464844
$\log L$	-385676.8	-342000.6	-385265.8

Note: The reference group is Ontario for region, 25-35 for age, 2005 for year, and Contstruction for industry. The firm size classes are: (XS) less than 5 employees; (S) 5-19 employees; (M) 20-99 employees; (L) 100+ employees. Standard errors are reported in parentheses. *, **, and *** indicates statistical significance at the 10%, 5% and 1% levels, respectively.

Table 8: Bivariate Probability of Permanent Layoff: Females

	XS	S	M
Shutdown rate	-.1088	1.2718	.4622
	(.3149)	(.2844)***	(.2284)**
Lag of Earnings	-.0642	-.0847	-.0927
	(.0023)***	(.0022)***	(.0021)***
Age 35-49	-.0572	.0154	.0270
	(.0067)***	(.0062)**	(.0058)***
Age 50+	-.0166	.1236	.1524
	(.0081)**	(.0077)***	(.0073)***
Married	-.1738	-.1159	-.0849
	(.0062)***	(.0056)***	(.0052)***
Tenure	-.1015	-.0944	-.0883
	(.0023)***	(.0021)***	(.0019)***
Tenure Squared	.0026	.0025	.0025
	(.0001)***	(.0001)***	(.0001)***
Union	.0775	.1065	.0532
	(.0090)***	(.0083)***	(.0069)***
Atlantic	.4349	.3257	.2766
	(.0096)***	(.0102)***	(.0094)***
Quebec	.2284	.1508	.0845
	(.0076)***	(.0071)***	(.0065)***
Prairie	-.1340	-.0910	-.0517
	(.0096)***	(.0089)***	(.0084)***
BC	.1163	.1069	.1095
	(.0089)***	(.0085)***	(.0080)***
Constant	-.7691	-.6926	-.4260
	(.04906)***	(.0443)***	(.0386)***
Firm Active Estimates - Exclusion Restrictions			
$\log \text{RER}_{jt}$	-.1165	.0167	-.0649
	(.0431)***	(.0614)	(.0627)
$\log \overline{\text{wage bill}}_{ikjt}$	.4257	.1833	.1428
	(.0022)***	(.0055)***	(.0071)***
ρ (Correlation)	-.2913	-.3842	.8955
	(.0175)***	(.0621)***	(.0129)***
LR-test χ^2 (Selection)	244.18	30.85	489.34
p-value	0	0	0
Observations-censored	80672	27214	18571
Observations	791138	806543	979833
$\log L$	-339866.5	-235821.1	-225177.8

Note: The reference group is Ontario for region, 25-35 for age, 2005 for year, and Contstruction for industry. The firm size classes are: (XS) less than 5 employees; (S) 5-19 employees; (M) 20-99 employees; (L) 100+ employees. Standard errors are reported in parentheses. *, **, and *** indicates statistical significance at the 10%, 5% and 1% levels, respectively.

Table 9: Earnings Regression with Selection: Males

	XS	S	M	L
Shutdown rate	-.9794	-2.0136	1.3430	-1.2830
	(.8711)	(.6855)***	(.6136)**	(.3804)***
Age 35-49	-.0737	-.0742	-.0911	-.0779
	(.0182)***	(.0153)***	(.0144)***	(.0122)***
Age 50+	-.1820	-.1965	-.2107	-.2287
	(.0242)***	(.0201)***	(.0184)***	(.0149)***
Married	-.0065	.0414	.0917	.0207
	(.0168)	(.0143)***	(.0133)***	(.0109)*
Tenure	-.1236	-.1629	-.1200	-.1344
	(.0084)***	(.0062)***	(.0061)***	(.0040)***
Tenure Squared	.0055	.0075	.0069	.0047
	(.0006)***	(.0004)***	(.0004)***	(.0002)***
Union	.1109	.1224	.0589	.0825
	(.0220)***	(.0168)***	(.0145)***	(.0122)***
Atlantic	.1431	.1096	-.1151	.0278
	(.0265)***	(.0239)***	(.0225)***	(.0178)
Quebec	.0231	.0058	-.0907	.0113
	(.0244)	(.0196)	(.0170)***	(.0146)
Prairie	.0350	.0296	-.0491	.0579
	(.0296)	(.0233)	(.0208)**	(.0143)***
BC	-.0489	-.0444	-.1370	-.0183
	(.0287)*	(.0235)*	(.0214)***	(.0195)
Firm Active Estimates - Exclusion Restrictions				
$\log \overline{\text{wage bill}}_{ikjt}$	.4872	.2657	.1091	.3131
	(.0054)***	(.0101)***	(.0113)***	(.0062)***
ρ (Correlation)	.0959	.0052	-.6605	.0570
	(.0216)	(.0297)**	(.0192)***	(.0282)***
σ (Variance)	1.2316	1.2336	1.3537	1.2058
	(.0102)***	(.0086)***	(.0099)***	(.0058)***
λ (Selection)	.1182	.0113	-.8942	.0691
	(.0268)***	(.0367)	(.0333)***	(.0155)***
Observations	104317	64708	68134	72452
Observations Censored	81178	31112	25081	17154
$\log L$	-82747.59	-94185.69	-107003.9	-121348.8

Note: The reference group is Ontario for region, 25-35 for age, 2005 for year, and Contstruction for industry. The firm size classes are: (XS) less than 5 employees; (S) 5-19 employees; (M) 20-99 employees; (L) 100+ employees. Standard errors are reported in parentheses. *, **, and *** indicates statistical significance at the 10%, 5% and 1% levels, respectively.

Table 10: Earnings Regression with Selection: Females

	XS	S	M	L
Shutdown rate	-3.4041	.1620	-1.8604	-1.3208
	(1.2645)***	(1.0574)	(.8876)**	(.6972)*
Age 35-49	-.0556	-.0321	-.0446	-.0575
	(.0278)**	(.0250)	(.0236)*	(.0200)***
Age 50+	-.2370	-.1923	-.3059	-.3226
	(.0379)***	(.0339)***	(.0336)***	(.0277)***
Married	-.0207	.0394	.0363	.0384
	(.0256)	(.0238)*	(.0218)*	(.0179)**
Tenure	-.1648	-.1966	-.2136	-.1607
	(.0115)***	(.0116)***	(.0095)***	(.0066)***
Tenure Squared	.0068	.0088	.0095	.0056
	(.0008)***	(.0008)***	(.0006)***	(.0004)***
Union	.1523	.0486	.0450	.0824
	(.0442)***	(.0390)	(.0329)	(.0210)***
Atlantic	.2317	.1793	.1750	.1703
	(.0402)***	(.0416)***	(.0376)***	(.0301)***
Quebec	.1129	.0569	.0349	.0942
	(.0354)***	(.0322)*	(.0285)	(.0242)***
Prairie	.0328	-.0049	.0548	.0612
	(.0438)	(.0376)	(.0352)	(.0262)**
BC	.0372	.0312	-.0467	-.0155
	(.0389)	(.0359)	(.0335)	(.0312)
Firm Active Estimates - Exclusion Restrictions				
$\log \overline{\text{wage bill}}_{ikjt}$	.4743	.2943	.1818	.3699
	(.0064)***	(.0128)***	(.0170)***	(.0071)***
ρ (Correlation)	.0762	.0167	.0506	.0131
	(.0295)**	(.0460)	(.0291)*	(.0315)
σ (Variance)	1.3042	1.3157	1.3277	1.3284
	(.0143)***	(.0141)***	(.0133)***	(.0102)***
λ (Selection)	.0998	.0220	.0671	.0174
	(.0387)***	(.0605)	(.0387)*	(.0419)
Observations	94357	40953	33713	35895
Observations Censored	82961	26855	17872	12210
$\log L$	-48767.82	-48280.89	-48160.96	-60023.98

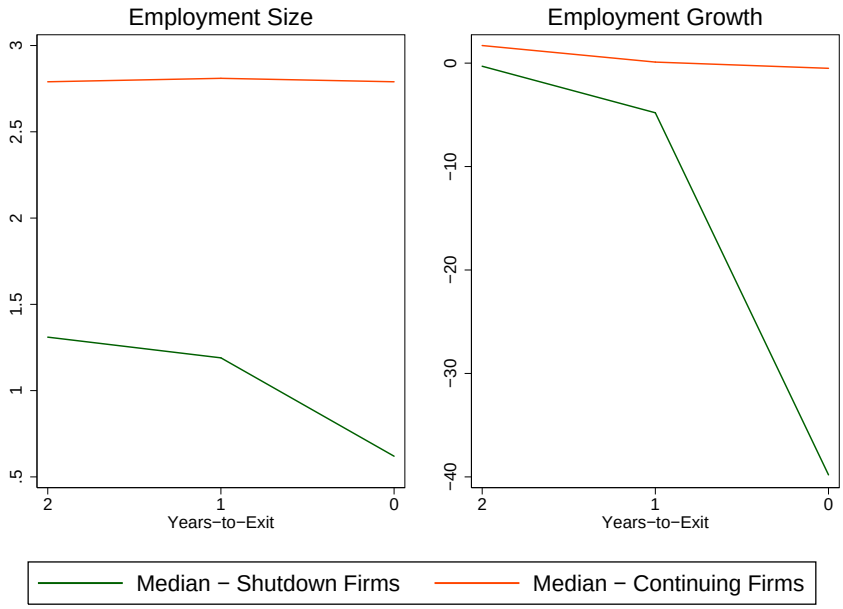
Note: The reference group is Ontario for region, 25-35 for age, 2005 for year, and Contstruction for industry. The firm size classes are: (XS) less than 5 employees; (S) 5-19 employees; (M) 20-99 employees; (L) 100+ employees. Standard errors are reported in parentheses. *, **, and *** indicates statistical significance at the 10%, 5% and 1% levels, respectively.

Table 11: Earnings Switcher Regression with Selection: Pooled

	Male	Female
Shutdown rate	-1.3977	-1.4722
	(.3023)***	(.5271)***
XS-S	.2241	.1781
	(.0201)***	(.0330)***
S-XS	-.1922	-.1334
	(.0197)***	(.0335)***
S-S	.0358	.0493
	(.0179)**	(.0296)*
S-M	.1313	.0606
	(.0186)***	(.0340)*
M-S	-.0501	-.0253
	(.0186)***	(.0349)
M-M	.0600	.0388
	(.0166)***	(.0317)
M-L	.1102	.0635
	(.0173)***	(.0312)**
L-M	-.0837	-.0069
	(.0181)***	(.0375)
L-L	.0430	.0841
	(.0160)***	(.0323)***
Age 35-49	-.0735	-.0436
	(.0079)***	(.0136)***
Age 50+	-.2030	-.2711
	(.0099)***	(.0188)***
Married	.0276	.0230
	(.0072)***	(.0125)*
Tenure	-.1293	-.1682
	(.0029)***	(.0052)***
Tenure Squared	.0050	.0066
	(.0002)***	(.0003)***
Union	.0795	.0506
	(.0084)***	(.0173)***
$\log \overline{\text{wage bill}}_{ikjt}$	.2734	.3213
	(.0024)***	(.0033)***
ρ (Correlation)	.0351	.0325
	(.0117)***	(.0271)
σ (Variance)	1.1708	1.3033
	(.0047)***	(.0075)***
λ (Selection)	.0411	.0424
	(.0138)***	(.0354)
Observations	184249	99220
Observations (Censored)	66200	51490
$\log L$	-288496.2	-139451.6

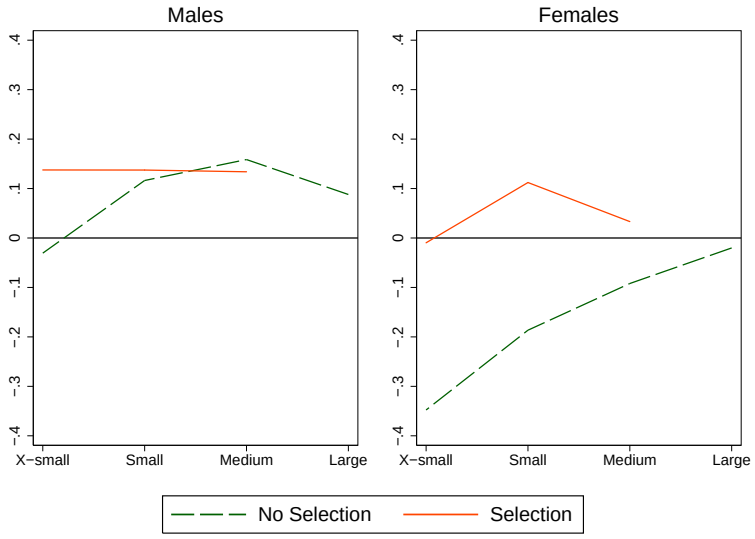
Note: The reference group is Ontario for region, 25-35 for age, 2005 for year, and Contstruction for industry. The firm size classes are: (XS) less than 5 employees; (S) 5-19 employees; (M) 20-99 employees; (L) 100+ employees. Standard errors are reported in parentheses. *, **, and *** indicates statistical significance at the 10%, 5% and 1% levels, respectively.

Figure 1: Comparison of Shutdown and Continuing Firms



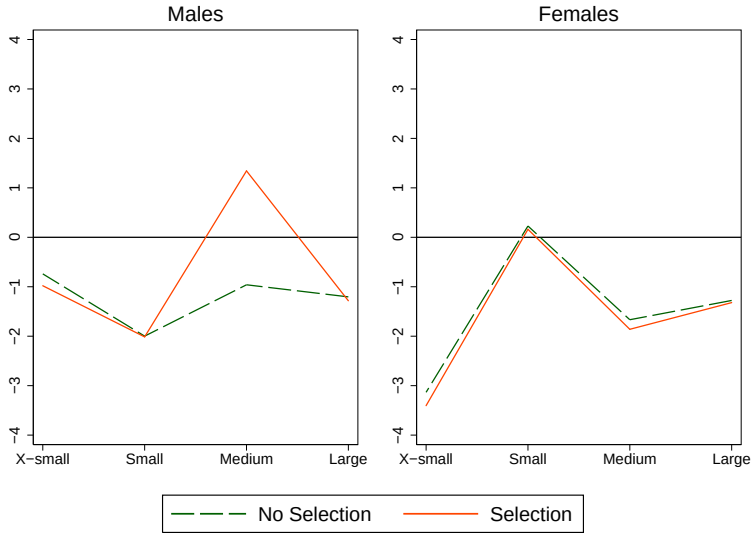
Note: This graph provides a comparison between shutting down firms in year t with continuing firms. For these two groups of firms, the graph provides the median employment size and growth rate in the three years prior to firm shutdown in the former group. For a full comparision by industry, see appendix C

Figure 2: Probability of Permanent Layoff and the Effect of Selection



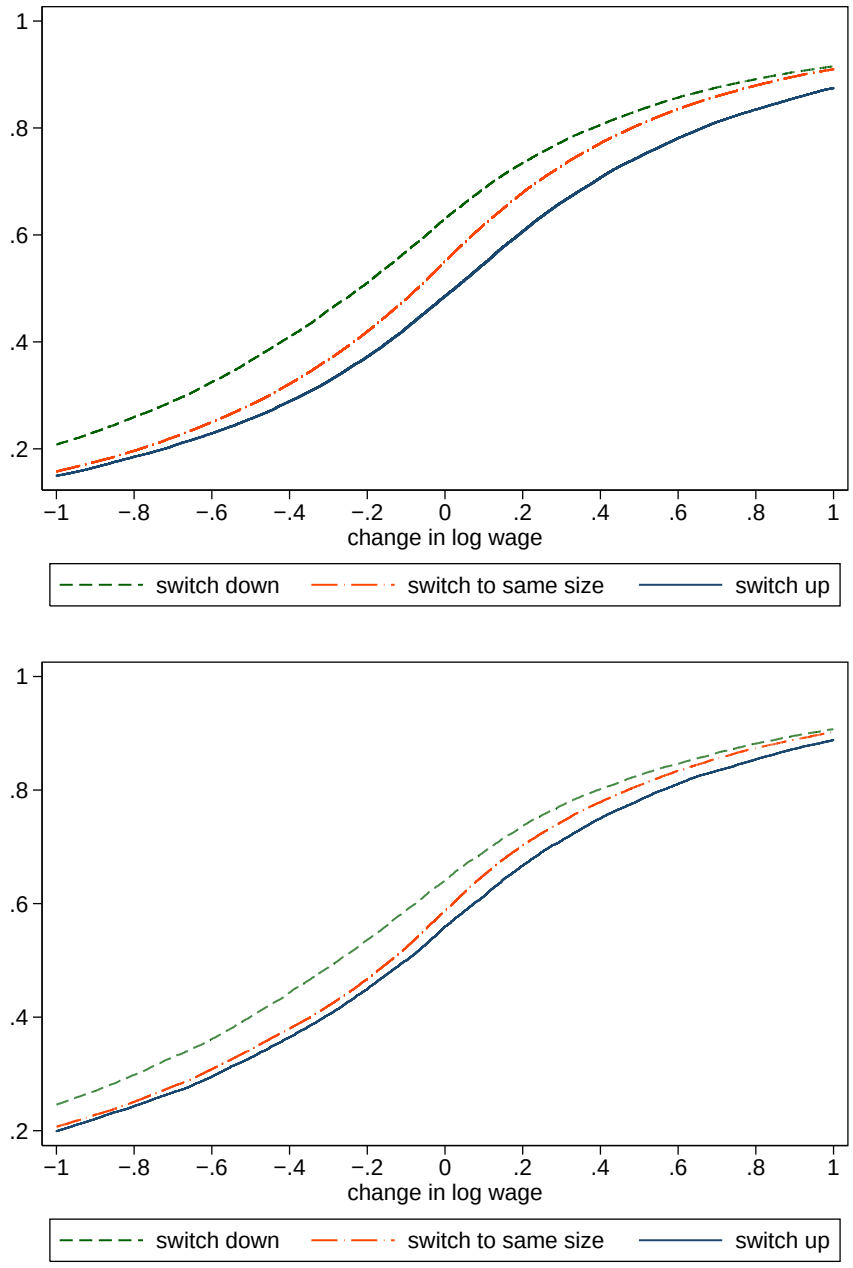
Note: The figure provides the marginal effects of industry shutdown rates on the probability of a permanent layoff for a worker across various size classes of firms. Selection corresponds to estimates from tables 8 and 9 for males and females, respectively. For comparision, No selection are estimates when not accounting for selection effects of continuing or shutdown of a firm.

Figure 3: $\Delta \log w_{ikjt}$ and the Effect of Selection



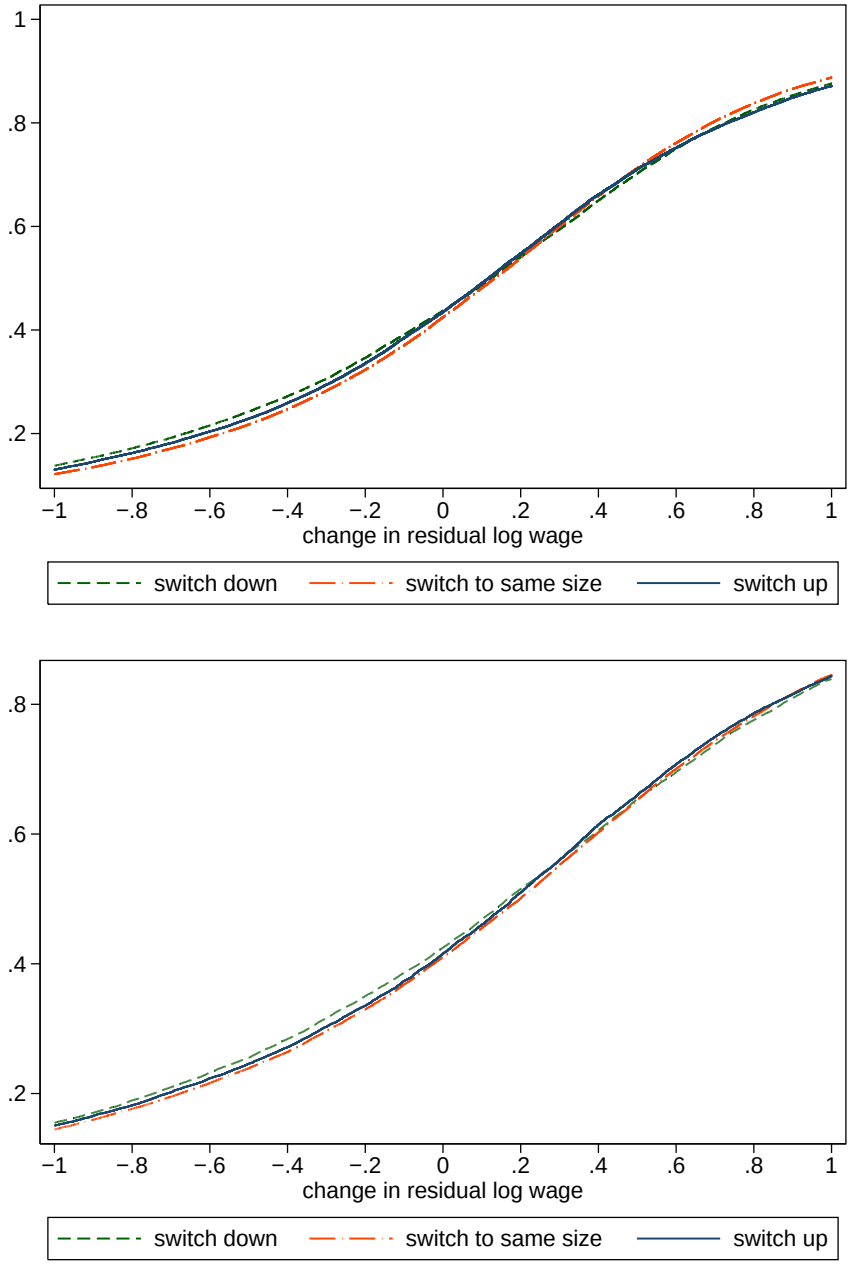
Note: The figure provides the marginal effects of industry shutdown rates on the probability of a permanent layoff for a worker across various size classes of firms. Selection corresponds to estimates from tables 10 and 11 for males and females, respectively. For comparision, No selection are estimates when not accounting for selection effects of continuing or shutdown of a firm.

Figure 4: Unconditional Cumulative Distribution of $\Delta \log w_{ikjt}$



Note: This graph illustrates the unconditional growth rate of wages ($\Delta \log w_{ikjt}$) for male (top graph) and female (bottom graph) workers who experienced a permanent layoff and found a new job. The three lines are for groups of workers that: 1) transition to a smaller size firm (switch down), 2) transition to a larger size firm (switch up) and 3) transition to a same size firm.

Figure 5: Conditional Cumulative Distribution of $\Delta \log w_{ikjt}$



Note: This graph illustrates the conditional growth rate of wages ($\Delta \log w_{ikjt}$) for male (top graph) and female (bottom graph) workers who experienced a permanent layoff and found a new job. The three lines are for groups of workers that: 1) transition to a smaller size firm (switch down), 2) transition to a larger size firm (switch up) and 3) transition to a same size firm. The residual wage growth is generated by the Heckman selection model (6) and results in Table 12.

A Construction of Longitudinal Worker File

The first data source in the LWF is the T4 Supplementary Tax File, which is a random sample of all individuals who received a T4 supplementary tax form and filed a tax return. A T4 supplementary tax form is issued by employees for any earnings that either exceed a certain threshold or trigger income tax, Canada/Quebec Pension Plan (C/QPP) or unemployment insurance premiums. It contains information about the earnings received from an employer in a given year, tax deducted, pension contributions, union dues and other information.

The second data source is the Record of Employment (ROE), which includes employer provided information on separations and their reasons. Canadian employers are by law required to provide such information for any separation that occurs in a firm. A detailed list of reasons for separations includes voluntary and involuntary separations such as the shortage of work, labor dispute, injury or illness, quit, pregnancy and parental leaves, retirement and other reasons. The third data source is the Longitudinal Employment Analysis Program (LEAP), which includes information about the size of the firm for which an employee works and makes it possible to track employees who move from one firm to another. The LEAP covers the entire Canadian economy and includes firms (but not establishments) with at least one dollar in annual payroll. The key information that comes from the LEAP is the firm's employment derived from its payroll using average labor units (ALU). LEAP tracks employees who move from one firm to another. LEAP, and by extension the LWF database, handles mergers and acquisitions in a retrospective manner. Suppose two firms, A and B, merge in year t to create firm C. Within the database prior to year t, a synthetic history for firm C is created by aggregating information from firms A and B, so that only firm C's information appears in the database. Thus, identification of a firm's exit or shutdown imply these are not due to merger activity.Finally, personal income tax files (T1) add demographic variables such as age, sex, family status and area of residence. They also provide information about individuals' income sources other than T4 earnings.

Our data was constructed by using information from the LEAP to classify firm entries and shutdowns and to compute industry-specific shutdown rates. Since the identification of firm entries and shutdowns is based on firm payroll transitions from one year to the next one, firm entries cannot be identified in 1991 and firm shutdowns cannot be identified in 2009. Consequently, industry-specific shutdown rates can be computed only from 1991 to 2008.

We proceed by extracting individual data from the LWF. Since NAICS codes in the LWF are available only from 1992, we used the LWF data from 1992 to 2008. We kept men and women aged 24 to 64. Total earnings in year t were defined as individual's total annual paid employment income (wages and salaries) computed from all T4 forms issued to the individual in year t. All earnings are adjusted to 2007 constant dollars using the Consumer Price Index. For individuals who held multiple jobs in a given year, we then retained only the characteristics of main jobs defined as

jobs with the highest T4 amount in that year.[8] To each individual record in the LWF, we added industry-specific shutdown rates by matching firm identifiers in the LWF to those in the LEAP. We excluded individuals who died and whose employer's industry classification was unknown.

Next, individual employer-employee records from the LWF are matched to industry price information available for the period from 1987 to 2007. US industry prices are taken from Industry Economic Accounts tables available from the Bureau of Economic Analysis, US Department of Commerce (Chain-Type Price Indexes for Gross Output by Industry series). Canadian industry price indexes are computed from the information on gross output and real gross output, by industry (Statistics Canada CANSIM series 383-0022). Although both the US and Canadian industry price indexes are based on the North American Industry Classification System (NAICS) codes there are some differences between the industries available in each series. We identified 42 industries for which a direct correspondence between the two series could be established. Excluded are primarily industries that are most likely to be represented by the public sector, such as, for instance, public administration, education and healthcare. Three industries ('petroleum and coal product manufacturing,' 'pipeline transportation' and 'waste management') had to be excluded because of insufficient sample size. Therefore, our final sample includes 39 industry categories. The list of included industries is given in Table 1. Finally, the LWF records are also matched to annual Canada/US nominal exchange rates necessary to produce real exchange rates used in the study. The rates used in the study are from the G.5 Foreign Exchange Rates series provided by the Board of Governors of the Federal Reserve System (Series ID: *EXCAUS*).

B Employment Insurance

Unemployment benefits provide one consideration in the analysis of job separation. Bills C-113, C-17 and C-12 were three pieces of legislation introduced in 1993, 1994, and 1996, respectively, which resulted in two major reforms to provision of unemployment benefits in Canada. Part of this series of legislation included the renaming of these benefits from Unemployment Insurance to Employment Insurance in 1996. The first reform reduced the paid benefits from 60 percent to 55 percent of wages subject to a cap on maximum insurable wages. As a second reform, employees who quit without just cause or fired due to misconduct were no longer eligible for benefits. Both major reforms reduced the incentives for workers to voluntarily quit their job. Firms can act explicitly or implicitly when choosing to separate from one of its workers. Explicit actions see the firm either fire or lay-off the worker. Implicit actions see the firm making work conditions more difficult for the worker, as to force the worker to quit. These changes to unemployment benefits likely mean that permanant layoffs better capture the firm's desire to separate from the worker given the coverage period for the data analyzed.

[8] A T4 form closely resembles a W-2 form in the United States.