

Southern Economic Journal

July 2009

Post-Injury Work Outcomes Revisited

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SECTION: Pg. 47 Vol. 76 No. 1 ISSN: 0038-4038

LENGTH: 7899 words

ABSTRACT

We use data for Ontario workers with permanent impairments resulting from work-related injuries to investigate the complex relationships among post-injury work outcomes: wages, accommodations, returning to the same or different employer, and duration of work absence. We argue the different aspects of post-injury work experience may be jointly determined, making post-injury job characteristics endogenous in a duration model. To explore the endogeneity issues we instrument post-injury job variables from first-stage equations and compare results from this "informed" model to a "naive" model that treats the variables as exogenous. We find that returning to one's pre-injury employer is associated with more favorable post-injury work outcomes, including higher wages, greater likelihood of job accommodations, and shorter durations of work absence relative to workers who change employers. We also find substantial differences between the naive and informed models, with accommodations having the predicted negative effect on duration only after we control for endogeneity [PUBLICATION ABSTRACT].

FULL TEXT

1. Introduction

Workers' compensation claims data have provided a rich resource for studies of post-injury returns to work and durations of work absence. Most existing studies use information current to the time of injury to construct explanatory variables for the models. One would like to include information from the post-injury job as well, but data on the nature of post-injury employment, including wages, employers, and job accommodations, are not typically available. Even when the data are available, taking advantage of the data in empirical analyses is less than straightforward because of the natural data truncation, such that post-injury job information is observable only for those who return to work. More generally, a worker's post-injury work experience is probably best viewed as a bundle of attributes, including wages, job accommodations, and durations of work absence, theoretically determined through a search process that incorporates incentives and preferences of both the injured worker and potential employers.

In this study we use a unique data set for injured workers from Ontario to provide more comprehensive evidence regarding the relationships among key post-injury work outcomes, including durations of work absence, job accommodations, post-injury wages, and whether or not the worker is able to return to the pre-injury employer. We view these post-injury job characteristics as jointly determined, and our models explore the extent of empirical difficulties this presents, beginning with descriptive analyses to explore associations among the post-injury work outcomes and moving to a more structural duration model with controls for endogeneity. In so doing, we show robust patterns of the post-injury work outcomes, yet uncover some of the pitfalls associated with estimating the relationships separately.

One key finding is the significant difference in post-injury work experiences of workers who return to the same or different employers. Others have noted an advantage for workers who return to their pre-injury employers (Galizzi and

Boden 2003), but the extent of differences between "stayers" and "changers" has not been explored before. Workers who return to the same employer are not only more likely to receive accommodations, but those accommodations have different effects on post-injury wages and durations of work absence for stayers and changers. Workers who return to the pre-injury employer earn higher post-injury wages, all else equal, as others have shown, but we also find that associations between pre- and post-injury wages and between disability benefits and durations of work absence are significantly different for stayers and changers.

Our results demonstrate the importance of controlling for endogenous job accommodations in duration models. Treating accommodations as exogenous often yields the counterintuitive result that accommodations lengthen spells of work absence. In models that control for endogeneity, the variables are more likely to have a negative effect, as expected if job accommodations mitigate the effects of functional impairments resulting from work-related injuries. While we do not claim to have solved definitively the econometric problem of endogeneity in a work absence duration model, the results reveal important relationships that are obscured in more naive models.

2. Background

According to standard search theory, durations of work absence are determined by an injured worker's reservation wage and the distribution of wage offers she receives. The typical empirical approach is to use the pre-injury wage as a proxy for the post-injury wage offer, and workers' compensation temporary disability benefits as a proxy for the reservation wage (e.g., Butler and Worrall 1985; Johnson and Ondrich 1990). This practice has the advantage of using predetermined variables defined for all injured workers, whether or not they have returned to work, but it also has several shortcomings. First, pre-injury wages do not reflect the impact of the injury on worker productivity and, therefore, are likely to be a poor proxy of post-injury wage offers for workers with more severe injuries. Second, the strong correlation between workers' compensation temporary disability benefits and pre-injury wages makes it difficult to separate the effects of the two (Meyer, Viscusi, and Durbin 1995). Perhaps more significantly, the practice of estimating duration models with data from the time of injury ignores other key factors that may influence both the reservation wage and the distribution of post-injury wage offers, such as whether an injured worker is offered job accommodations or whether he is able to return to his time-of-injury employer.

Three recent studies incorporate post-injury job information into a model of work absence and in so doing demonstrate some of the empirical difficulties of using these data to estimate causal relationships. Hyatt (1996) uses data from the Ontario Survey of Workers with Permanent Impairments to estimate the effects of permanent partial disability benefits on probabilities of return to work, incorporating information on post-injury wages in the model. He imputes post-injury wages for workers who have not returned to work from a selection-corrected wage equation. Results indicate the generosity of permanent partial disability benefits is negatively associated with the probability of return to work, while higher post-injury wages increase the likelihood of a return.

Galizzi and Boden (2003) examine how returning to the time-of-injury employer affects post-injury work experiences. They construct a database that includes post-injury job information by merging Wisconsin workers' compensation claims files with earnings histories from the state unemployment compensation system. The authors treat post-injury wages and returns to the time-of-injury employer as endogenous, computing predicted values of the post-injury wage and probability of changing employers that are then incorporated in the duration models. The main finding is that durations of work absence are significantly shorter for injured workers who return to the same employer. Without controls for endogeneity, however, returning to the time-of-injury employer is associated with longer spells of work absence.

Most recently Campolieti (2005) uses the Ontario data to examine the effects of job accommodations on durations of post-injury employment. He estimates hazard models that control for worker characteristics, expected permanent disability benefits, and job accommodations on the first post-injury job, restricting the sample to injured workers who have returned to work. The results suggest that accommodations have a smaller effect on post-injury work outcomes than previous studies would suggest, and that type of accommodation matters (flexible schedules and modified equipment are the only types of accommodation associated with significantly longer durations of post-injury employment).

Previous studies demonstrate the challenging data and modeling issues involved in incorporating post-injury job information into a duration model and strongly suggest that the different post-injury employment outcomes are interrelated. Other studies, although not focused specifically on durations of work absence, also hint at the complex relationships between job accommodations, post-injury wages, and whether the worker returns to his time-of-injury employer (Gunderson and Hyatt 1996; Campolieti 2004). To date, however, no study has investigated the post-injury work experience collectively, including durations of work absence, job accommodations, post-injury wages, and returning to the

same or different employers, in models that begin to address the difficult econometric issues this presents. In this article we report a number of key findings from a more comprehensive model of post-injury work experience than has been estimated before. In so doing, we hope to encourage others to refine the duration model further, looking at the entire bundle of attributes of post-injury work experience, rather than studying individual variables in isolation.

3. Data and Descriptive Statistics

Ontario Survey Data

We use data from the Ontario Survey of Workers with Permanent Impairments, conducted by the Workers' Compensation Board of Ontario (WCB) in 1989-1990. The survey population includes all workers who were examined for permanent partial disability assessment by WCB physicians between June 1989 and June 1990.¹ This data set is used by four of the five previous studies that examine post-injury job information (Gundersen and Hyatt 1996; Hyatt 1996; Campolieti 2004, 2005).

The Ontario workers' compensation system, like its counterparts in the United States, is designed to provide financial assistance to workers who are injured on the job and are temporarily or permanently unable to work. Workers' compensation disability benefits are paid by the WCB (now renamed the Workplace Safety and Insurance Board) and funded through employer assessments based on total payrolls and risk experience.²

Injured workers who are absent from work longer than four days receive temporary total disability (TD) benefits while they recover from their injury. The weekly benefit rate is a fixed percentage of the worker's average pre-injury wage, subject to statutory minimum and maximum benefit rates. TD benefits are paid until a worker is reemployed or until it is determined that the worker has a permanent residual disability, and he or she receives a permanent partial disability (PPD) award.³

Most studies of post-injury work absence focus on workers who receive temporary disability benefits only because these represent the majority of indemnity claims. The larger portion of costs, however, is incurred from compensation to workers with permanent impairments. Webster and Snook (1994), for example, analyze costs of cumulative trauma upper extremity claims filed with a large national workers' compensation insurer in 1989 and find that the most costly 25% of claims account for 89% of indemnity costs.

In this study we focus on post-injury job outcomes of the potentially high-cost claims from workers with permanent impairments resulting from a workplace injury. Workers with minor work-related injuries, not resulting in permanent impairments, are not represented in the data. We exclude workers who have not returned to work by the survey date because they do not have the critical post-injury job information.⁴ These exclusions leave an analysis sample of 4116 observations.

Descriptive Statistics

Table 1 gives definitions of variables used in our analyses and reports summary statistics for the samples of workers who returned to the same (3535 stayers) or different (581 changers) employers.⁵ Post-injury job information includes the post-injury wage, types of job accommodations received, and whether or not the worker returned to the pre-injury employer.⁶ Demographic and human capital characteristics include age, education, gender, and marital status. Nature of injury is a vector of seven injury categories constructed from information on injury type and part of body injured reported in workers' compensation claims files.⁷ Labor market characteristics include union membership, size of the time-of-injury firm, year of injury, a binary variable identifying workers in the high-unemployment northeast region of Ontario, and controls for six occupation/industry categories.⁸ Expected workers' compensation temporary disability benefits are calculated using the benefit formulae in effect on the date of injury, taking account of statutory maximum and minimum benefits. Although workers with permanent impairments have all received a permanent disability settlement, we focus on temporary benefits in our analyses because TD benefits are conditional on work absence, while the permanent settlement is not.

Table 1 Variable Definitions and Summary Statistics for Stayers and Changers (Table omitted. See article image.)

The vast majority (86%) of workers in our sample return to their time-of-injury employers and have better post-injury work outcomes, on average, than workers who change employers. Mean duration of work absence is 29 weeks (202 days) for stayers, compared to 74 weeks (518 days) for changers. Stayers have a higher pre-injury hourly wage (\$14.33 vs. \$12.44) and earn 99% of that wage on return to work, compared to 86% for changers.

Workers who return to the pre-injury employer are more likely to receive job accommodations (48% vs. 39%) and tend to receive different types of accommodations than those who change employers. The results suggest that stayers are more likely to receive accommodations that enable a return to the same job (38% vs. 21% receive light work accommodations), while changers are more likely to be accommodated for a different job (3% vs. 11% receive special training).

We also observe some differences in the demographic and pre-injury job characteristics of eventual stayers and changers but not in the distributions of injury types. On average, stayers are older (40 vs. 35), are more likely to belong to a union (67% vs. 33%), are more likely to have been employed in medium- or large-size firms (45% vs. 15%), and are less likely to be employed in construction work (11% vs. 20%). The injury distributions of both groups reflect the importance of repetitive trauma injuries in workers' compensation: Nearly 60% of workers have permanent impairments resulting from back or non-back sprains or strains, or cumulative trauma injuries.

To visualize the complexity of relationships between post-injury employment outcomes, Figures 1-3 present histograms showing the two-way associations between post-injury wages, job accommodations, and duration of work absence, comparing stayers and changers. Workers who stay with the pre-injury employer consistently have higher wages, both pre- and post-injury, than those who change employers (Figure 1), with the exception of the unusual case ($n = 27$) of workers who return to a different employer within three months. Among workers who return to the same employer, post-injury wages are fairly insensitive to duration of work absence; whereas, wages drift downward as work absences lengthen for workers who eventually change employers.

Figure 1

Mean Pre- and Post-Injury Wages by Duration of Work Absence and Stay/Change

(Figure omitted. See article image.)

Figure 2a

Accommodations Provided to Stayers by Duration of Work Absence

Figure 2b. Accommodations Provided to Changers by Duration of Work Absence

(Figure omitted. See article image.)

Figure 3

Mean Pre- and Post-Injury Wages by Accommodations and Stay/Change

(Figure omitted. See article image.)

Patterns of accommodations over time are depicted in Figures 2a (stayers) and 2b (changers). Among stayers the likelihood of receiving most types of accommodations increases over time; although, there is a decline in the likelihood of the most common accommodation, light work, after a two-year absence. The upward trend likely reflects, at least in part, the greater need for accommodations among more severely injured workers, who take longer to "recover" from their injuries. Time trends in accommodations are less clear among changers, but two patterns are notable: Changers are more likely to receive special training than stayers, and this difference increases with duration, but changers are also less likely to receive light work accommodations, regardless of duration. Taken together, the accommodations results are consistent with the hypothesis that changing employers involves an intrinsic change in job responsibilities and loss of job-specific human capital that is less likely to occur among injured workers who return to the same employer.

Figure 3 charts mean pre- and post-injury wages for stayers and changers, comparing those who do or do not receive job accommodations. Workers who receive accommodations "pay for" those accommodations in terms of lower wages, but the wage penalty is greater for those who change employers. Among stayers the mean post-injury wage is 0.2% lower than the mean pre-injury wage when there are no accommodations but is 1.8% lower if the worker receives accommodations. Among changers the wage loss is 13% without accommodations but 17% for those who receive accommodations. In other words, the combination of moving to a different employer and receiving accommodations is associated with economic losses of nearly 20% of pre-injury wages.

4. Models

The descriptive analyses reveal that receiving job accommodations and returning to one's pre-injury employer are not random events but are correlated with one another, with the post-injury wage, and with the decision of when to re-

turn to work. The post-injury work outcomes are also correlated with worker and job characteristics; however, and this may confound the observed associations. For example, if more productive (for example, more educated) workers are more likely to earn high wages (pre- and post-injury), to return to the same employer, and to receive job accommodations, the descriptive statistics may make these outcomes appear more strongly related than they truly are. Our first step, therefore, is to estimate a set of descriptive models in which we analyze the relationships among post-injury work outcomes controlling for worker and job characteristics.

Next, we deal with the possible endogeneity of post-injury variables in a duration model. Ideally, duration would be estimated jointly with other post-injury work outcomes, but that complex model is beyond the reach of our data.⁹ Instead, we use an instrumental variables approach to control for endogeneity, where the probability of receiving accommodations, staying with the pre-injury employer, and the predicted post-injury wage are instruments estimated in first-stage models. For comparison, we also estimate a naive duration model in which all other post-injury work outcomes are assumed exogenous.

We are unable to estimate the duration models stratified by stay because our sample of changers is so small.¹⁰ Instead, each duration model includes a set of interaction terms between "stay" and other post-injury outcomes. In this way we obtain a more complete picture of the magnitude and significance of differences between the two groups. This approach is less demanding of the data and makes the differences between stayers and changers more transparent.

More specifically, the descriptive duration model has the form (Formula omitted. See article image.) where $\ln D$ is the natural log of work absence duration in days. The key post-injury outcomes are the wage w , accommodations A , and whether the worker returns to the pre-injury employer $stay$. Interaction terms allow the effects of wages and accommodations to differ between stayers and changers. Disability benefits B , while determined pre-injury, are a key policy variable, and so we allow the effects of benefits to vary by $stay$ as well. The remaining independent variables are worker demographics, injury type, and characteristics of the pre-injury job, denoted by the vector Z . We estimate six specifications of the model: one with a binary variable for any accommodation, the others including binary variables for each of five types of accommodations, one at a time.

We next estimate a duration model with the post-injury job information treated as endogenous using an instrumental variables approach. In the above equation, this means that all variables except benefits and the vector Z require instruments. $stay$, accommodations, and their interaction are discrete variables, so we use estimated probabilities as instruments. Specifically we estimate the marginal probabilities of staying with the pre-injury employer ($\Pr(stay = 1)$), receiving an accommodation ($\Pr(A = 1)$), and the joint probability ($\Pr(stay = 1 \text{ and } A = 1)$) with a bivariate probit. Independent variables in the model, denoted by the vector X , include all exogenous variables in the descriptive equation (benefits and the vector Z), plus a set of identifying variables discussed below.

The post-injury wage is a continuous variable, so its instrument is the predicted value from a first-stage equation estimated via ordinary least squares. The remaining endogenous variables, interactions between benefits and $stay$ ($B \tilde{A} - stay$) and wage and $stay$ ($w \tilde{A} - stay$), are nonlinear functions of endogenous variables. Following the approach suggested by Wooldridge (2002, pp. 235-236), we estimate $B \tilde{A} - stay$ as a function of X and $B \tilde{A} - X$, and $w \tilde{A} - stay$ as a function of the full set of interactions and squares among the exogenous variables, $X \tilde{A} - X$.¹¹

Identification is always an issue in structural models, and ours is no exception, especially with the large number of endogenous variables. Nonetheless, to explore the possible role of endogeneity we must select identifying variables. We choose the pre-injury wage, the year of injury, a set of industry/occupation dummies, and a dummy variable identifying workers from the high-unemployment northeast region of Ontario. These variables capture labor market conditions and as such should affect firms' willingness to offer accommodations and wages, as well as the ability to return to the pre-injury firm. While certainly not without criticism, we believe these identifying variables are the best we can do with the data available, and we are reassured by their ability to easily pass all of the typical tests of instrument validity (see note 11). We are also reassured by the overall robustness of our results to differing (smaller) sets of instruments and different model specifications (for example, only allowing the accommodation coefficients to vary with $stay$, or fully stratifying the sample and correcting for self-selection).

We estimate this multistage duration model for each type of accommodation separately, and for receiving any type of accommodation. All models are estimated conditional on the decision to return to work, excluding workers who have not returned to work by the interview date. Our results should be interpreted with this restriction, as well as with any possible shortcomings of our identifiers, in mind.

5. Results

Job Accommodations and Stay

Results of the bivariate probit model for job accommodations and stay are reported in Table 2 for "any accommodation." Focusing first on the results for accommodations, workers in the high-unemployment northeast region are significantly less likely to receive accommodations than workers in other regions, while workers with more recent injuries are more likely to receive accommodations than workers whose injuries occurred further in the past. Noting that the unemployment rate in Canada declined throughout the 1980s (from an all-time high of 12.9% in December 1982 to 7.9% in December 1987), the results strongly suggest that local and regional labor market conditions are a key factor in determining the probability of accommodations. Men are less likely to receive any accommodation than are women. Compared to the omitted injury category (fractures), workers with occupational illnesses or cumulative trauma injuries are less likely to receive accommodations. Some industry/occupation variables are significant as well.¹²

Table 2 Selected Coefficient Estimates from the Bivariate Probit Model of Accommodations and Stay (Table omitted. See article image.)

Turning to the bivariate results for stay, it is a combination of individual and pre-injury job characteristics that appear most important in determining outcomes. Married workers, older workers, union members, and workers from larger firms are more likely to return to their pre-injury employer, with all the advantages that entails. Compared to workers whose impairments result from fractures, workers with cumulative trauma injuries and, to a lesser extent, back injuries or occupational illnesses, are less likely to return to their pre-injury employer. Finally, receiving an accommodation and returning to one's pre-injury employer remain positively associated, even after controlling for other characteristics, as revealed by the positive and statistically significant estimate of the correlation coefficient ($\hat{\rho}$).

Post-Injury Wage

Selected results for the post-injury wage equation are reported in Table 3 for models that control for any accommodation and each individual type of accommodation. This descriptive wage model is a structural equation, differing from the first-stage reduced-form wage equation that will be used later to generate instruments for the duration model in that it includes other post-injury work outcomes (accommodations and stay) as independent variables. The estimates of the structural model test whether associations observed in the descriptive statistics remain once we control for worker and firm characteristics.

Table 3 Selected Coefficient Estimates from the Post-Injury Wage Equations (Table omitted. See article image.)

Across all specifications, the pre-injury wage is significantly and positively associated with post-injury wages, and the relationship is much stronger for those who return to the pre-injury employer than for those who change employers. The coefficient estimate for stay is negative and significant in every model, but this dampens only somewhat the powerful effect of the correlation between pre- and post-injury wages for those who return to the same employer. Workers tend to pay for job accommodations in the form of lower wages, as Gunderson and Hyatt (1996) report, but here we see the penalty is much greater for those who change employers. There is also substantial variability in the effects of different types of accommodations on post-injury wages: Workers who require special training pay a substantial wage penalty; whereas, flexible schedules and modified equipment can be accommodated with no significant effect.

To estimate the magnitude of the effects of returning to one's employer and receiving accommodations, we employ the estimator proposed by Kennedy (1981), which describes the estimated impact of a dummy variable in a log model.¹³ The calculations for stay show that returning to one's pre-injury employer leads to an estimated 25-32% higher post-injury wage among workers who do not receive accommodations. Among workers who receive accommodations, the wage effect of returning to one's pre-injury employer is typically smaller and varies from around 12-24%, depending on the type of accommodation. Modified equipment and special training are outliers: Among workers who receive modified equipment accommodations, returning to one's employer increases wages by 43%, and among workers who receive special training, returning decreases wages by about 4%.

The calculations for receiving accommodations show an even stronger effect of special training. The negative effect of special training on wages is approximately 6% for stayers and 23% for changers. Other accommodations are associated with much smaller reductions in wages, but the finding that changers are penalized more than stayers is robust. Specifically, changers suffer reductions in their wages of 4-13% if they receive accommodations, versus 0.8-2.6% for stayers. Thus, the relationships between wages, accommodations, and returning to one's pre-injury employer revealed in our descriptive analyses remain largely unchanged after controlling for worker and job characteristics.

Naive Duration Model

Empirical results from the naive duration models are summarized in Table 4 for key variables and interaction terms.¹⁴ Results are reported for six models, namely, with controls for any accommodation and for each of five distinct accommodation types. A fairly consistent story emerges: Workers who return to their pre-injury employers have significantly shorter durations of work absence than workers who change employers; although, the effect differs if they also receive accommodations. Specifically, setting the wage and benefits to the sample means and assuming no accommodations are received, the Kennedy estimator yields a predicted reduction in duration of 72-75% if a worker returns to the pre-injury employer. If accommodations are received, the effect is smaller, with estimated reductions of 40-48% except for special training (23%) and reduced hours (26%).

Table 4 Coefficient Estimates for Key Variables from the Naive Duration Model (Table omitted. See article image.)

Higher post-injury wages are associated with significantly shorter durations of work absence for both stayers and changers, with elasticities (in absolute value) only slightly higher for stayers. In contrast, temporary disability benefits exhibit distinctly different associations with duration for stayers and changers. Among workers who return to the pre-injury employer, higher expected temporary disability benefits are associated with significantly longer durations of work absence, as theory predicts. (The associated elasticity is 0.30-0.37; that is, a 10% increase in benefits lengthens duration by approximately 3-3.7%.) Among workers who change employers, however, the association between expected benefits and duration has a counterintuitive negative sign and is only marginally significant at best. The difference in results may reflect the much longer average durations of work absence in the group that changes employers. In the Ontario system temporary disability benefits are paid until a worker returns to work or reaches "maximum medical improvement" with some residual permanent disability. At this point the worker typically receives a lump-sum settlement with no work restrictions. Hence changers, with more lengthy work absences, are more likely to return to work after temporary benefits have ceased, so it may not be surprising that their decision to return to work is insensitive to the benefit amount. Once again we are struck with the complexity of relationships between durations of work absence, economic incentives to return to work, and the opportunity to return to the pre-injury employer.

Results for job accommodations are also distinctly different for stayers and changers. Among stayers we generally observe the counterintuitive result that receiving accommodations is associated with significantly longer durations of work absence. The result is statistically significant and of a sizable magnitude for all types of accommodations (receiving an accommodation increases duration by an estimated 21-79%). Among changers there is no significant association between accommodations and absence duration.

Duration Model with Controls for Endogeneity

The naive duration model likely confounds the effect of accommodations in facilitating returns to work with the effect of the (unobserved) injury severity gradient associated with greater probabilities of receiving accommodations. That is, workers with more severe injuries are more likely to need both accommodations and longer recovery periods before returning to work, so accommodations are correlated with unobservables in the duration model. To address this and other sources of endogeneity, we reestimate the duration model using predicted values of post-injury job characteristics from the first-stage bivariate probit (accommodations and stay) and post-injury wage models.¹⁵ Results are reported in Table 5.

Table 5 Coefficient Estimates for Key Variables from the Duration Models with Controls for Endogeneity (Table omitted. See article image.)

Controlling for endogeneity does not alter our general conclusions regarding the advantage of returning to the pre-injury employer. In all specifications of the informed model we find the coefficient estimate of stay has a negative sign, and the effects are statistically significant in the models for any accommodation, special training, and light work. For a 10% increase in the probability of stay, the duration of work absence decreases by an estimated 12-31%. The results are consistent with those reported by Galizzi and Boden (2003) using Wisconsin data.

Results for post-injury variables other than stay change dramatically when we control for endogeneity. A surprising result is that expected temporary disability benefits become insignificant in the duration model. We may be asking too much of the data with so many instruments, but the finding is robust across numerous variations of the model we have estimated.

In the informed duration model the expected post-injury wage has the significant negative effect predicted by theory only for workers who return to the pre-injury employer (with estimated elasticities ranging from -0.13 to -0.21, such that a 10% increase in post-injury wage reduces duration by approximately 1.3-2.1%). For those who change employers, the expected wage has a counterintuitive positive effect on duration that is significant in every model (with

estimated elasticities from 0.29 to 0.38). We might speculate that the expected wage represents not only an offer wage but also a worker's reservation wage, and that injured workers with higher reservation wages who cannot return to the pre-injury employer have greater difficulty securing an acceptable wage offer than those with lower reservation wages. In the first-stage wage equation the pre-injury wage is by far the most important explanatory variable, suggesting that injured workers may use the pre-injury wage as the reservation wage for their job search. As shown in Figure 3, there is a much larger gap between pre- and post-injury wages for workers who change employers, so changers with high wage expectations may search a while before receiving an acceptable offer or lowering their reservation wage. On the other hand, the counterintuitive result could reflect the greater difficulty in forecasting the post-injury wage for workers who change employers, especially those workers with higher pre-injury wages. This is confirmed by the much lower R^2 for wage equations estimated for changers versus stayers, and the disproportionately lower R^2 for changers with higher pre-injury wages.¹⁶

The results for accommodations are now much more aligned with theory. Among changers, receiving accommodations either has a large, negative, significant effect on duration of work absence (special training, light work) or no significant effect (reduced hours, flexible schedule, modified equipment). Thus, for workers who return to different employers certain types of accommodations appear to compensate, at least in part, for the work limitations associated with a permanent impairment so the worker is able to return to work. Whenever the main effect of accommodations is significant, however, its interaction with stay is significant, positive, and of sufficient magnitude to eliminate the effect of accommodations altogether. For example, a 10% increase in the probability of receiving light work (special training) accommodations decreases expected duration by 42% (91%) for workers who change employers, but increases expected duration by 5% (12%) for stayers. In other words, the significant negative effect of accommodations on duration is completely eliminated and perhaps even reversed for workers who return to their pre-injury employer. (Results for "any accommodation" follow the same pattern, with p -values just above 10% for both main effect and interaction.)

Our results suggest that job accommodations have the intended effect (facilitating returns to work and reducing spells of work absence) for workers who cannot return to their pre-injury employer. The effect can be observed, however, only when the endogeneity of job accommodations is taken into account. When job accommodations are treated as exogenous, the correlation with severity of injury (more severely injured workers have longer durations of work absence and are more likely to need accommodations) appears to generate spurious positive effects in the duration model. In both models accommodations appear far less likely to reduce duration of work absence for workers who return to their pre-injury employers.

6. Concluding Remarks

Most previous research on post-injury work absence has focused on the effects of wages and benefits using information from the pre-injury job. Once information from the post-injury job becomes available, it is apparent that the post-injury work experience is multifaceted, where the key variables are the post-injury wage offers, the possibility of returning to the pre-injury employer, and the likelihood of receiving job accommodations. Incorporating post-injury job information in a duration model becomes empirically complicated because of endogeneity and censoring issues (post-injury job offers are unobserved for workers who have not yet returned to work). While a few studies consider some aspect of the post-injury work experience, this article attempts a more comprehensive analysis of the relationships between all key variables and how they jointly affect the outcome of greatest interest, namely, the speed at which injured workers return to work.

All our analyses show the importance to injured workers of returning to the same employer. Returning to one's pre-injury employer is consistently associated with more favorable post-injury work outcomes than changing employers. On average, workers who return to the pre-injury employer receive higher wages, return to work sooner, and are more likely to receive job accommodations than changers, even after controlling for the pre-injury wage and other worker and job characteristics. Stayers also pay a smaller "wage penalty" for the accommodations they receive.

Our results also demonstrate the importance of controlling for the endogeneity of post-injury job characteristics in a duration model. The naive model, without controls for endogeneity, yields the counterintuitive, positive effects of accommodations on duration that other researchers have noted. The informed model indicates that several types of accommodations have the expected negative effect on duration of absence for workers who change employers, but no significant effect for those who stay with the same employer. Controlling for endogeneity also changes the estimated effects of the post-injury wage and expected benefits in the duration model.

The analyses also uncover several findings that require future investigation. First, our descriptive analyses suggest that the benefits of returning to one's pre-injury employer expire after two to three years. Our data are not rich enough to

explore the time effects further in a multivariate framework, but the result seems plausible in light of existing insurance policy in Canada during the period of study. During the time our data were collected, there was no legal requirement that employers accommodate their injured workers, and the economic incentives to do so diminish over time.

Second, the estimated effect of receiving job accommodations on durations of work absence appears more consistent with theory when the issue of endogeneity is addressed. This result makes sense: One would expect workers with the most severe injuries (unobservable to the analyst) to have the greatest need for accommodations and to take longer to return to work. We leave it to future research to explore different empirical approaches with possibly richer data to determine if our findings with respect to job accommodations, duration of work absence, and the different effects of accommodations for stayers and changers are robust.

Finally, the overwhelming evidence that workers who return to the pre-injury employer have distinctly different, and advantageous, post-injury work experiences relative to those who change employers has powerful implications for state policy makers. A policy that imposes legal obligations on time-of-injury employers to rehire injured workers would have obvious benefits for workers. The policy would be consistent with the original spirit of workers' compensation laws, which were established in acknowledgement of the obligations of society, employers in particular, to mitigate the economic losses of persons injured on the job.

FOOTNOTE

Earlier drafts of this research were presented at the Southern Economic Association Meetings, the University of New Hampshire Economics Seminar, the Workers' Compensation Research Group, and the W. E. Upjohn Institute for Employment Research. Our research has benefited from these presentations, and we thank the participants for their insightful comments.

See Butler, Johnson, and Baldwin (1995) for a more detailed description of the survey.

The extent of experience rating varies among industries and firms, with the assessments of larger firms more closely tied to accident experience than the assessments of smaller firms. At the time our data were collected, firms were under no legal obligation to return injured workers to their jobs, or provide job accommodations, unless such provisions were part of a union contract.

In workers' compensation parlance, this is called MMI, the point of "maximum medical improvement." PPD benefits are awarded according to a fixed schedule, based on physicians' assessments of the loss of functional capacity resulting from an injury. PPD benefits are not conditional on a worker's employment status.

In preliminary analyses we include workers who have not yet returned to work and attempt to control for self-selection via a two-stage Heckman approach. The results are similar to those reported here. Because of the additional identification such an approach requires, we emphasize models that simply exclude these workers and caution the reader to view the results as being conditional on the workers having chosen to return to work.

Seventy-six observations had no information on injury type and so were omitted from the analysis. Four more observations were omitted because of extreme values (greater than \$100 Canadian) for either the pre- or post-injury wage.

Typically in the duration model, the pre-injury wage and replacement rate (expected temporary disability benefits/pre-injury wage) are used as proxies for the unavailable post-injury wage and reservation wage, respectively. Using post-injury wages directly makes it less problematic to use the actual level of temporary disability benefits, rather than the replacement rate in the duration model. We believe the actual benefit level is a more important determinant of the post-injury reservation wage than is the replacement rate; although, the results are similar regardless of which of the measures is used.

The seven categories of work-related injuries are back sprains and strains, non-back sprains and strains, fractures, inflammations, lacerations and contusions, occupational illnesses, cumulative injuries (for example, carpal tunnel syndrome and tendonitis), and other injuries.

The data do not include information on transfer payments other than workers' compensation disability payments. Labor market variables include three occupation dummies (professional/manager, processing, and construction) and three industry dummies (service, transportation, and mining). The northeast had the highest unemployment rate of any region in Ontario throughout the period in which our data were collected.

The complex model would require simultaneous estimation of four equations, with a combination of discrete, censored, and continuous variables.

This limitation becomes especially critical in the more complicated models that control for endogeneity. As discussed shortly, the more complicated models require multiple instruments that severely strain the small sample of changers and lead to volatile results. However, the salient differences between stayers and changers persist in such models, and the results for stayers are quite similar to those reported here. The results from these exercises are available on request.

Our results are reasonably robust to using smaller subsets of instruments. Furthermore, we subject all our instrument sets to (i) tests of joint significance in the first-stage equation and (ii) overidentification tests in the second stage. Each of the instrument sets easily pass both tests.

However, in the bivariate probit models for individual types of accommodations, we find women are significantly more likely to receive flexible schedules, reduced hours, and modified equipment accommodations than are men, but men are significantly more likely to receive light work assignments. As one might expect, the injury variables also have a different effect depending on the type of accommodation. Complete results are available from the authors upon request.

The general form of the Kennedy estimator is (Formula omitted. See article image.), where $\hat{\beta}^2$ is the estimated coefficient of the dummy variable. As shown in Derrick (1984), the Kennedy estimator is superior to the commonly used estimator (Formula omitted. See article image.); the Kennedy estimator is a biased estimator, but the alternative unbiased estimator is quite complicated and yields minimal improvement over the Kennedy estimator. We therefore follow Derrick's recommendation and use the Kennedy estimator to compute all the estimated effects of accommodations and returning to one's employer on post-injury wage and absence duration. Because of the interactions with stay, the total effect of stay is a function of other variables, such as the pre-injury wage. In all calculations we evaluate these variables at the mean for the total (stayers + changers) sample. The actual estimates are available upon request.

The full set of results is available upon request.

The reader is reminded that the wage model reported in Table 3 is not the first-stage wage regression. The first-stage model is a reduced-form equation that includes exogenous variables only. Results are available from the authors. Note also that the effects of stay and accommodations are included here as predicted probabilities, such that the Kennedy estimator is no longer appropriate for calculating the predicted effects in this context. However, the total effects are still functions of several estimated coefficients, many of which are not statistically significant and so should be interpreted with caution.

The results of separate wage equations for stayers and changers are available upon request.

LOAD-DATE: August 5, 2009

LANGUAGE: ENGLISH

ACC-NO: 28586

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DOCUMENT-TYPE: Feature

PUBLICATION-TYPE: Magazine

JOURNAL-CODE: SEJ

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