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Firm Investment, Labor Supply, and the Design of Social Insurance: Evidence from Accommodations for Workplace Disability

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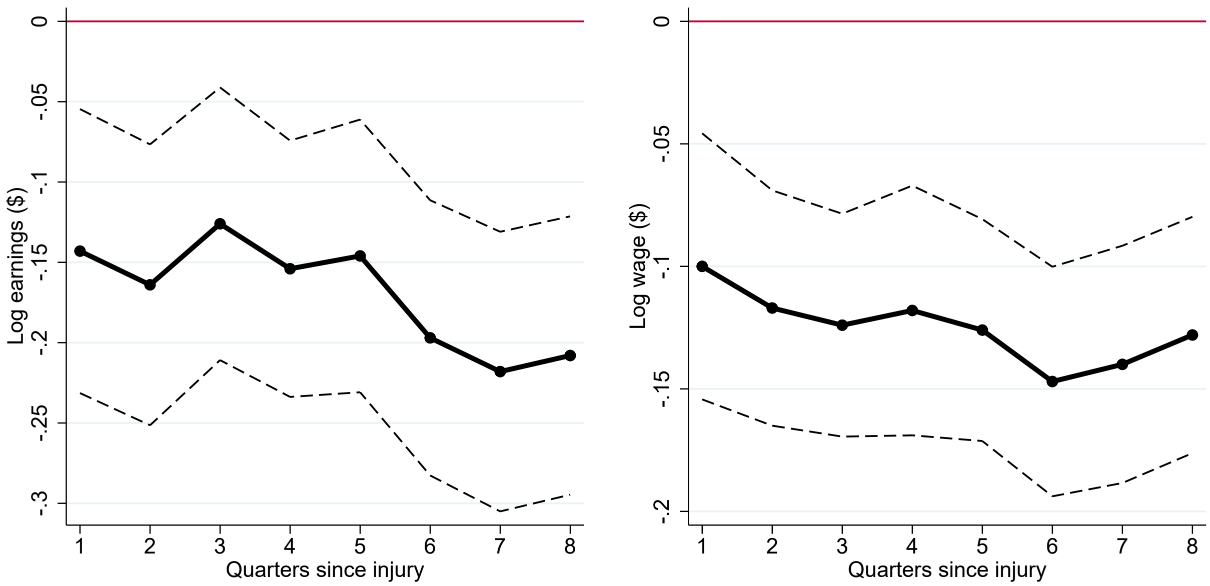
Figure 4: Effect of EAIP policy change on earnings and wage



(a) Log earnings, cond. (b) Log wage, cond.

Notes: Data provided by Oregon Department of Business and Consumer Services. Sample includes disabling claims in Oregon, 2005-2015. Dependent variable in (a) is quarterly log earnings in the quarter of interest, conditional on working in that quarter and in (b) is quarterly log wage (earnings/hours) in the quarter of interest, conditional on working in that quarter. Solid dots denote the estimated coefficients on the interaction of treatment and post-period from regression equation (2) separately for each quarter since injury, and dashed lines report 95% confidence intervals. All regressions include the broad set of worker, firm, and injury controls.

In sum, our empirical analysis finds that a change in the EAIP wage subsidy to employers from 50 percent to 45 percent induced a substantial decrease in EAIP take-up among workers' compensation claims. Moreover, this decrease in EAIP take-up was also associated with a decrease in overall employment starting three quarters after injury and persisting at least two years and an immediate decrease in earnings even conditional on employment that persisted at least two years. On the other hand, conditional on working, we found no differential outflow to new employers. We next turn to a model of workplace accommodation and labor market outcomes in order to understand the mechanisms behind these changes and conduct counterfactual policy experiments.

5 Dynamic Bargaining Model

To better understand the welfare impacts of EAIP and examine optimal policy, we develop and estimate a model of workplace injury and workers compensation that incorporates both employer decisions to accommodate and employee decisions to work.[22] The model has three key ingredients that capture the role of firm accommodation decisions in workers' compensation policy and labor market outcomes. First, the model incorporates the immediate costs and benefits of accommodation that accrue to the firm and worker: firms pay the direct cost of accommodation and may recoup some of that cost through increased worker productivity, and accommodated workers are able to work (with higher earnings than time loss benefits) but incur a disutility of working while still injured. Second, the model incorporates longer run benefits of accommodation to account for our empirical finding that accommodation increases labor force attachment even after the worker has recovered from their injury. We operationalize this as a two stage model where the first period captures injury and accommodation decisions and the second period captures longer run labor market outcomes. Finally, the model incorporates labor market frictions and worker turnover to capture the risk to the firm that workers can leave the firm at any moment and thus the firm cannot necessarily recoup the cost of accommodation as future surplus. We next describe the model environment, the worker and firm value functions, and bargaining solution, and then return to a discussion of the model's key properties and assumptions.

5.1 The Environment

We consider a two period dynamic bargaining problem from time 0 to time T between a worker x and firm y that form a match $\mathbf{z} = (x, y)$ to produce output. Workers are heterogeneous in x to capture differences in skill and occupation, and firms are heterogeneous in y to capture differences in productivity and the type of workers' compensation contract they face.

Workers face risk of a workplace injury with probability p_j, where $j = 1, ..., N$ captures the severity of injury (i.e., more severe injuries are denoted by higher j), and $p_0 = 1 - \sum_{j=1}^{N} p_j$

[22] We restrict our attention to decisions taking the probability of injury as given, and abstract from decisions related to investment in workplace safety.

is the probability of no injury. The duration of injury is denoted by $d_j \in [0, T]$ where we assume that $d_j < d_{j'}$ for $j < j'$. Injured workers either receive time loss benefits b from workers' compensation if they remain out of work for the duration of their injury, or return to work early if accommodated, where accommodation decisions ($a \in \{0, 1\}$) capture both transitionary work as well as physical workplace modifications.[23] Once recovered, workers spend their remaining time ($T - d_j$) working or unemployed.

We model four direct effects of working with accommodations. First, workers with accommodated injuries incur a disutility of work $\phi_{x,j}$ during the duration of injury (where the disutility of work for uninjured workers is normalized to zero).[24] Second, net output of workers with accommodated injuries ($f_{1,z,j,\xi}$) can differ from uninjured workers ($f_{1,z}$), due to both a difference in productivity as well as the financial cost of accommodation, which we model as a match-specific accommodation cost ξ with distribution $\mathit{\Gamma}_j$. Third, working with accommodation affects the probability of exogenously leaving the labor force after injury $q_{z,j,a}$. Finally, injury and accommodation can affect post-injury net output $f_{2,z,j,a}$ and wages $w_{2,z,j,a}$.

The timing of the model is as follows. First, workers and firms bargain ex-ante over the first period wage $w_{1,z}$ and accommodation decisions $a_{z,j}(\xi)$ for each possible injury j and accommodation cost ξ, prior to the injury realization j and accommodation cost ξ. Note that wages in the first period do not depend on injury j; this constraint is imposed to match the empirical context in which firms cannot legally pay lower wages to workers who experience disability and return to the same job. All workers who are accommodated and work receive wages $w_{1,z}$, and injured workers who do not work receive a time loss benefit b_z from the workers' compensation program.[25]

After the duration of the injury (or straightaway for uninjured workers), each worker recovers and enters the second period of the model. The worker exits the labor market with probability $q_{z,j,a}$, and conditional on remaining in the labor market they either stay at the same firm or move to another firm with probability λ_z. Notably, injury and accommodation affects the probability of exiting the labor force, but not the probability of moving to a new firm, to match the empirical results in Section 4. If the worker remains with the same firm, the match produces output $f_{2,z,j,a}$ and the worker and firm bargain over the second period wage $w_{2,z,j,a}$, which depends on the match z, injury j, and the whether they were accommodated a (again, to match the empirical findings in Section 4 that accommodation affects wages conditional on working).

[23]Transitionary work includes reduced workloads to help injured workers slowly transition back to full time work as well as modified or different tasks to retrain injured workers.

[24]Implicitly we assume that injured workers without accommodations have infinite disutility of work, so in that sense accommodation mitigates the disutility of work while injured.

[25]Injured workers also incur medical expenditures, which we abstract from in the model but account for in the expenditure function.

5.2 Worker and firm value functions

Workers derive utility from consumption (either wages or time loss benefits) over the two periods and possible disutility from work when injured. Specifically, the worker's value function $V_z(w_{1,z}, \mathbf{a}_z)$ from match z given an employment contract defined by wage $w_{1,z}$ and a vector of state-contingent accommodation decisions $\mathbf{a}_z$ is given by:

$$V_z(w_{1,z}, \mathbf{a}_z) = p_0 V_{z,0} + \sum_{j=1}^{N} p_j \mathbb{E}_\xi \left[a_{z,j}(\xi) V_{z,j} + (1 - a_{z,j}(\xi)) \widetilde{V_{z,j}} \right] \tag{3}$$

where the first term in Equation (3) is the worker's value if uninjured, given by:

$$V_{z,0} = T\left(q_{z,0} u(c_u) + (1 - q_{z,0}) \left[(1 - \lambda_z) u(w_{1,z}) + \lambda_z u(w_{1,z,O})\right]\right) \tag{4}$$

where $d_0 = 0$ so they spend all of their time T in the second period.[26] With probability $q_{z,0}$, the worker becomes unemployed and receives an unemployment benefit c_u. If they remain employed, with probability $(1 - \lambda_z)$, they stay in the same firm and receive a wage of $w_{1,z}$, and with probability λ_z they exogenously move to another firm and receive an outside wage of $w_{1,z,O}$.

The terms within the summation of Equation (3) are the worker's values under injuries of different severity j for working $(V_{z,j})$ and not working $(\widetilde{V_{z,j}})$ during injury, given by:

$$V_{z,j} = d_j \left[u(w_{1,z}) - \phi_{x,j}\right] + (T - d_j)\left((1 - q_{z,j,1})\left((1 - \lambda_z) u(w_{2,z,j,1}) + \lambda_z u(w_{2,z,j,1,O})\right) + q_{z,j,1} u(c_u)\right) \tag{5}$$

$$\widetilde{V_{z,j}} = d_j u(b_z) + (T - d_j)\left((1 - q_{z,j,0})\left((1 - \lambda_z) u(w_{2,z,j,0}) + \lambda_z u(w_{2,z,j,0,O})\right) + q_{z,j,0} u(c_u)\right) \tag{6}$$

These values capture the weighted sum of the value during the injury period (first term) and the value in the post-injury period (second term). During the injury period, workers who work receive wage $w_{1,z}$ and incur a disutility of work $\phi_{x,j}$, while workers who decide not to work receive a time loss benefit b_z. After the injury period, with probability $q_{z,j,a}$ the worker remains in the labor market, which depends on the accommodation choice a to capture our empirical finding that accommodation leads to higher long-run employment. Conditional on remaining employed, the worker stays with the current job with probability $(1 - \lambda_z)$ and receives a wage of $w_{2,j,z,a}$ and moves to a new employer with probability λ_z with wage $w_{2,z,j,a,O}$.

Firms care about profits gained from the match over the two periods, which are equal to output net of wages and accommodation costs in each period. Specifically, a firm's value function J from match z with wage $w_{1,z}$ and accommodation decisions $\mathbf{a}_{z,j}(\xi)$ is given by:

$$J_z(w_{1,z}, \mathbf{a}_z) = p_0 J_{z,0} + \sum_{j=1}^{N} p_j \mathbb{E}_\xi \left[a_{z,j}(\xi) J_{z,j,\xi} + (1 - a_{z,j}(\xi)) \widetilde{J_{z,j}} \right] - P_{tot,z} \tag{7}$$

[26] Note, however, that their wage is $w_{1,z}$, which is the same wage that injured workers receive while accommodated.

where the first term is firm profit if the worker is uninjured, given by:

$$J_{z,0} = T\left(1 - q_{z,0}\right)\left(1 - \lambda_z\right)\left(f_{1,z} - w_{1,z}\right) \tag{8}$$

and the terms within the summation are profits under injuries of different severity j when the individual chooses to work while injured ($J_{z,j,\xi}$) or not work while injured ($\widetilde{J_{z,j}}$), given by:

$$J_{z,j,\xi} = d_j\left[f_{1,\underset{\smile}{z,j,\xi}} - (1-\delta)\,w_{1,z}\right] + \left(T - d_j\right)\left(1 - q_{z,j,1}\right)\left(1 - \lambda_z\right)\left(f_{2,z,j,1} - w_{2,z,j,1}\right)$$
$$\widetilde{J_{z,j}} = \left(T - d_j\right)\left(1 - q_{z,j,0}\right)\left(1 - \lambda_z\right)\left(f_{2,z,j,0} - w_{2,z,j,0}\right)$$

where $f_{1,z,j,\xi}$ is output of the worker *net* of accommodation costs, which are paid during the injury period. In addition, δ denotes the wage subsidy provided by workers' compensation through the EAIP program if the firm accommodates the worker.

The final term in Equation (7) is the total premium paid for workers' compensation coverage, $P_{tot,z}$, defined as:

$$P_{tot,z} = \tau_y \sum_{j=1}^{N} p_j d_j \mathbb{E}_\xi\left[\left(1 - a_{z,j}\left(\xi\right)\right) b_z\right] + \left(1 - \tau_y\right) P_{z,b} + P_s \tag{9}$$

where τ_y is the firm-specific degree of experience rating for time loss claim costs, $P_{z,b}$ is the average time loss claim costs for non-self-insured firms, and P_s is the flat premium paid for wage subsidies. In estimation we distinguish between premium regimes for self-insured firms, for which the premium is fully experience-rated ($\tau_y = 1$), and non-self-insured firms, for which the premium is only partially experience-rated ($\tau_y < 1$).

5.3 Worker-firm bargaining problem and solution

Wages and accommodation choices are determined by Nash bargaining between the worker and firm in two stages: in the first stage, the first period wage and menu of accommodation decisions (by injury and accommodation cost realizations) are determined ex-ante (i.e., prior to the injury), and in the second stage post-injury wages are determined at the beginning of the post-injury period. The outside option to the firm is zero and the worker's (exogenous) outside options are defined by $U_{2,x,j,a} = \left(1 - \lambda_{2,x,j,u}\right) u(c_u) + \lambda_{2,x,j,u} u(w_{2,x,j,a,O}))$ in the post-injury period and ex-ante value $U_{1,x} = T\left(\lambda_{1,x,u} u(c_u) + \left(1 - \lambda_{1,x,u}\right) u(w_{1,x,O})\right)$, both a weighted average of the value of unemployment and the value of finding a job with outside wage $w_{2,x,j,a,O}$ or $w_{1,x,O}$, respectively. Accommodation decisions are made contingent on injury severity j and the accommodation-specific cost ξ, i.e., $a_{z,j}\left(\xi\right)$. While wages in the injury period cannot differ by injury (by law), we allow post-injury wages to depend on all worker characteristics to capture effects such as promotions or hours changes.

We can solve this problem by backward induction. First, the post-injury wage for each injury severity j and accommodation decision a is determined by Nash bargaining at the beginning of the second period:

$$\max_{w_{2,z,j,a}} \left(u(w_{2,z,j,a}) - U_{2,x,j,a})\right)^\beta \left(f_{2,z,j,a} - w_{2,z,j,a}\right)^{1-\beta} \;\; \forall\; j, z, a \tag{10}$$

The first order conditions then define implicit solutions for post-injury wages for all z, j, a:

$$\beta u'(w_{2,z,j,a})\left(f_{2,z,j,a} - w_{2,z,j,a}\right) - (1-\beta)\left(u(w_{2,z,j,a}) - U_{2,x,j,a}\right) = 0 \tag{11}$$

Second, the accommodation choices and initial wage are determined by Nash bargaining at the beginning of the first period (prior to the realization of injury):

$$\max_{w_{1,z},\mathbf{a}_z} \left(V_z(w_{1,z}, \mathbf{a}) - U_{1,x}\right)^{\beta} J_z(w_{1,z}, \mathbf{a})^{1-\beta} \tag{12}$$

To solve for accommodation choices, we posit that there are thresholds $\xi^*_{z,j}$ such that $a_j = 1$ for all $\xi_{z,j} < \xi^*_{z,j}$ and $a_j = 0$ otherwise. We solve for these thresholds and initial wage by solving first order conditions with respect to the initial wage and thresholds; see Appendix A for details.

5.4 Discussion

5.4.1 Mechanisms Behind Accommodation Decisions

Three key considerations determine the accommodation decision in our model: a static consideration, a dynamic consideration, and a fiscal externality consideration. First, there is a static trade-off during the injury period for both firms and workers. Firms pay the direct cost of accommodation ξ; whether accommodation is profitable thus depends on this direct cost, the productivity of the worker, and the wage cost. The static benefit of accommodation to workers is higher wage compensation relative to time loss benefits, but at the cost of disutility from working while injured. Therefore, the relative static costs and benefits during the injury period can influence accommodation decisions.

Second, accommodation entails dynamic gains in the form of higher probability of employment and higher productivity in the second period for accommodated workers relative to unaccommodated workers (i.e., $q_{z,j,1} > q_{z,j,0}$ and $w_{2,z,j,1} > w_{2,z,j,0}$). An important feature of the employment channel is that these gains accrue to the worker regardless of whether they switch employers, and thus this channel has direct parallels to training decisions as in Becker (1962), Becker (1964), and Acemoglu and Pischke (1999). In a similar spirit to Acemoglu and Pischke (1999), if there is no static gain to accommodation and the labor market is frictionless, then firms have no incentive to accommodate because they cannot recoup the cost of accommodation. On the other hand, in a frictional labor market such as the bilateral monopoly we model, firms may have an incentive to accommodate injured workers even in the absence of static gains to accommodation because they can extract some of the surplus from accommodation. However, they may still under-accommodate workers (relative to the social optimum) due to the possibility that the worker may move to a new employer in the post-injury period. Therefore, the economic environment in which dynamic gains take place is also an important factor in accommodation decisions.

Finally, the financing of workers' compensation benefits can also impact accommodation decisions through the impact of accommodation decisions on workers' compensation premiums, P_z. Accommodation can lower workers' compensation claim costs by decreasing the extent to which time loss benefits are paid. For self-insured (or fully experience-rated) firms, these savings accrue directly to the firm, while partially experience-rated firms do not accrue the full savings of their actions. Firms that are not fully experience-rated thus have an incentive to under-accommodate as a result of this fiscal externality (similar to the static moral hazard channel in the context of Bailey-Chetty). This suggests that the efficiency of accommodation decisions may differ depending on the insurance contract that a firm faces.

5.4.2 Modeling Assumptions

We make a few important assumptions to make the analysis tractable. First, we assume that both the probability of injury and the duration of injury are exogenous. While we could in principle relax these assumptions by modeling effort as a function of future payoffs to avoiding or shortening injuries, we believe that these extensions are unlikely to change our main insights. In addition, Appendix Figure 3 shows that the number of claims did not respond to the wage subsidy policy change, and evidence from other contexts shows that the number of claims also does not respond to changes in the generosity of time loss benefits (Cabral and Dillender, 2020). Thus, moral hazard on the margin of claiming is unlikely to be first-order in our policy environment. In addition, the duration of the majority of accommodated claims are a couple months long, so it is unlikely that moral hazard would have a large impact on the duration margin either.

Second, we assume that there is no heterogeneity in the duration of injury conditional on the realization of specific injury shock j. One can instead formulate that λ_j is the expected duration of injury from an ex-ante perspective, and we can consider that the realized claim duration in the data is drawn from the distribution of random injury outcomes. Such an extension does not change the essential feature of the model.[27]

6 Estimation

We estimate the model primarily using Oregon administrative workers' compensation claims data linked to longitudinal quarterly earnings records. Our sample is the same as in Section 3: closed disabling claims that originated between 2005-2015. We supplement this with publicly available data on overall rates of injury in Oregon during our sample period. We first estimate several parameters outside the model, and then structurally estimate the remaining parameters within the model using a combination of first-order conditions and indirect inference. For this version of the paper, our estimation assumes a binary injury state and four types of worker-firm pairs: two types of workers (high wage and low wage, where we define high and low wage as above and below the median wage in the quarter prior to injury) and two types of firms (self-insured and not self-insured).

[27] Alternatively, one can formulate the model in the infinite-horizon continuous time with the hazard rate λ_j. Such an extension involves more complications without providing much newer insights.

6.1 Parameters Estimated Outside the Model

We estimate several parameters outside the model, summarized in Table 4. We set $p_j = 0.01$ to match the fact that 1% of workers file a disabling claim in Oregon annually.[28] We set the duration of injury to equal the mean claim duration for injury type j in our claims data, which is 60 days. We set the probability of unemployment in the post-injury period ($q_{z,0}$ and $q_{z,j,a}$), the job-to-job transition rate (λ_0 and $\lambda_{j,z}$), and the job-finding rate from unemployment ($\lambda_{u,z}$) using employment outcomes from the quarterly earnings records.[29] We also set the ex-ante and post-injury outside wages ($w_{1,x,O}$ and $w_{2,x,j,a,O}$) to the mean earnings in a new job in the quarterly earnings data, and set the unemployment benefit (c_u) to 40% of the outside wage. We set the worker bargaining power parameter to $\beta = 0.5$, which is in the range of estimates in the labor search literature, and set the utility function to log utility.[30]

Finally, we set the workers' compensation parameters to reflect Oregon's program during our sample period. Specifically, we set the replacement rate for the time loss benefit to 63% of wages and the wage subsidy rate to 50%.

6.2 Structural Estimation: Identification and Estimation Procedure

For parameters structurally estimated within the model, our estimation proceeds in two steps. In the first step, we estimate the post-injury output parameters $f_{2,z,j,a}$ by solving the Nash bargaining solution in Equation (11), using the parameters in Table 4 and setting second period wages equal to the average earnings one year after injury. In the second step, we estimate the remaining parameters by indirect inference, including parameters related to productivity during the injury period and the disutility of working while injured. We impose a functional form assumption on the net output for injured workers that $f_{1,z,j,\xi} = f_{1,z,j} + \xi$ where $f_{1,z,j}$ is the mean injury-match specific net output and ξ is random variable that follows a log-normal distribution with mean zero and standard deviation $\sigma_{\xi,y}$. Thus, the remaining parameters include $f_{1,z,0}, f_{1,z,j}, \sigma_{\xi,y}$, and $\phi_{x,j}$.

We use moments related to earnings and accommodation rates to help identify these parameters. A key identification challenge is that net output, the standard deviation of accommodation cost shocks, and worker disutility during the injury period all affect accommodation decisions. To separately identify net output from the disutility of work, we leverage the quasi-experimental estimates from Section 4 as well as accommodation rates by worker-firm type. First, a higher disutility of work should generate lower accommodation rates, so we use average accommodation rates by worker type to identify the disutility of work by worker type (low and high skill). Second, higher dispersion of firm accommodation costs should generate lower responsiveness of accommodation to a change in the wage subsidy, so we use the regression coefficient of the effect of the wage subsidy change on accommodation to

[28] In future iterations with heterogeneous injury severity we will calibrate p_j by multiplying 1% with the proportion claims of injury type j in our claims data.

[29] We calibrate the job-finding rate from unemployment using job transitions prior to injury.

[30] For example, Flinn (2006) estimates that worker's bargaining power is about 0.4.

Table 4: Parameters estimated outside the model

Parameter	Description	Value
p_j	Probability of injury	1%
d_j	Duration of injury	60 days
$q_{z,j,0}$	Unemployment probability, post-injury, unacc.	0.30, 0.23, 0.12, 0.06
$q_{z,j,1}$	Unemployment probability, post-injury, acc.	0.15, 0.11, 0.05, 0.03
$q_{z,0}$	Unemployment probability, uninjured	0.10, 0.08, 0.01, 0.01
$\lambda_{j,z}$	Job-to-job transition rates, post-injury	0.22, 0.14, 0.07, 0.03
λ_0	Job-to-job transition rates, uninjured	0.06, 0.08, 0.14, 0.17
$\lambda_{u,z}$	Job-finding rate of unemployed	0.36, 0.35, 0.72, 0.66
$w_{1,x,O}$	Outside wage, first period	mean earning in a new job
$w_{2,x,j,a,O}$	Outside wage, second period	mean earning in a new job
c_u	Consumption during unemployment	40% replacement rate
β	Worker bargaining power	0.5
$u(c)$	Utility function	$\log(c)$
b	Time loss cash benefit (replacement rate)	0.63
δ	Wage subsidy rate	0.5
$P_{b,z}$	Average claim cost	Public WC data
$P_{s,z}$	Premium to fund wage subsidies	Public WC data

Note: Rows with four values denote types of worker-firm matches: (1) Low skilled worker at a not-self-insured firm, (2) low skilled worker at a self-insured firm, (3) high skilled worker at a not-self-insured firm, and (4) high skilled worker at a self-insured firm.

identify the standard deviation of the cost shock by firm type.[31] Third, conditional on these parameters, the difference in accommodation rates by firm type within each worker type identifies the average net output for injured workers, given our functional form assumption of $f_{1,z,j} = \alpha 1_{\text{High}} + \beta 1_{\text{SI}}$. Finally, we identify net output for uninjured workers and recovered workers using their respective wages.[32]

6.3 Estimation Results

Table 5: Parameters estimated within the model

Param.	Description	Estimate			
		Low, NSI	Low, SI	High, NSI	High, SI
$f_{1,z,0}$	Net output, not injured	6.46	7.26	15.16	18.61
$f_{1,z,j}$	Net output (mean), injured ($= \alpha 1_{\text{High}} + \beta 1_{\text{SI}}$)	0	-0.29	-1.09	-1.38
$f_{2,z,j,1}$	Net output, recovered and acc.	7.39	7.52	12.56	15.42
$f_{2,z,j,0}$	Net output, recovered and not acc.	6.89	7.02	12.56	15.42
ϕ_x	Disutility of work	1.77	1.77	0.60	0.60
$\sigma_{\xi,y}$	SD of accommodation cost shock	5.16	11.15	5.16	11.15

Note: Output is quarterly and is expressed in units of $1,000. Columns denote types of worker-firm matches: (1) Low skilled worker at a not-self-insured firm, (2) low skilled worker at a self-insured firm, (3) high skilled worker at a not-self-insured firm, and (4) high skilled worker at a self-insured firm. Disutility of work parameters are estimated by worker type only, net output for recovered high skilled workers are not distinguished by accommodation, the standard deviation of the accommodation cost shock is estimated by firm type only, and net output for injured workers is parameterized as $\alpha 1_{\text{High}} + \beta 1_{\text{SI}}$.

Tables 5 and 6 report the structurally estimated parameters and model fit, respectively, for each worker-firm type, where column (1) is low-skilled workers in non-self-insured firms, column (2) is low-skilled workers in self-insured firms, column (3) is high skilled workers in non-self-insured firms, and column (4) is high skilled workers in self-insured firms. The model is able to reproduce the main features of wage and accommodation patterns in the data, and there are a few note-worthy features of the estimates. First, net output during injury is significantly lower than net output for uninjured workers. This may be a result of lower productivity of accommodated workers and/or high accommodation costs. Second, the distribution of accommodation cost shocks is very dispersed, suggesting firms vary substantially in how costly it is to accommodate injured workers. This distribution is more disperse for self-insured firms, which helps explain the lower responsiveness of accommodation to

[31] A more disperse distribution means that there is less mass in the range of accommodation cost shocks affected by the wage subsidy change.

[32] Note that we cannot use wages to identify net output of injured workers because they are constrained to be equal to wages of uninjured workers.

a change in the wage subsidy (as captured through the targeted regression coefficient).[33] Finally, low-skilled workers generate lower net output and have a higher disutility of work during injury than high-skilled workers, suggesting that on average it is less costly (to both firms and workers) to accommodate high-skilled workers. One possible reason is that it is more difficult for firms to provide alternative work arrangement for the low-skilled workers, making it very difficult for the low-skilled to adjust a new work environment during the injury.[34]

Table 6: Within-Sample Fit of Targeted Moments

	Type			
Moment	Low, NSI	Low, SI	High, NSI	High, SI
Accommodation (EAIP use, %)				
Data	19.88	36.28	27.67	46.62
Model	18.78	35.31	27.38	50.45
Wages, non-injured				
Data	4.48	4.61	11.13	12.91
Model	4.24	4.53	11.48	13.29
Wages, recovered and accommodated				
Data	4.54	4.58	9.96	11.74
Model	4.54	4.58	9.96	11.74
Wages, recovered and not accommodated				
Data	4.35	4.58	9.96	11.74
Model	4.35	4.58	9.96	11.74
	NSI		SI	
Regression coefficient of policy effect on EAIP				
Data	-0.04		0.00	
Model	-0.04		-0.02	

Note: Wages are quarterly and are expressed in units of $1,000. The regression coefficient of the policy effect on EAIP comes from Equation (1). Columns denote types of worker-firm matches: (1) Low skilled worker at a not-self-insured firm, (2) low skilled worker at a self-insured firm, (3) high skilled worker at a not-self-insured firm, and (4) high skilled worker at a self-insured firm.

[33] A more disperse distribution means that there is less mass in the range of accommodation cost shocks affected by the wage subsidy change.

[34] Although it is beyond the scope of this paper, one interesting possibility is that firms may design the alternative arrangement to make it more costly for the low skilled to retain the current job. See Aizawa et al. (2020) for exploring such a mechanism in the labor market of disabled workers.

6.4 Mechanisms

We next use the estimated model to conduct comparative statics that shed light on key mechanisms that may affect the decision to accommodate. We focus on (i) the role of worker turnover, (ii) the role of experience rating, and (iii) the role of the utility cost of work while injured.

Table 7 reports the findings. The second row reports the effect of reducing the job-to-job transition rate to one quarter of its estimated value: $\tilde{\lambda}_z = 0.25\lambda_z$. As discussed in Section 5.4, worker turnover could generate under-provision of accommodation if firms cannot capture the surplus from future productivity gains brought about by accommodation, but it does not necessarily lead to under-provision if, for example, the static gains to accommodation are high enough. The simulations show, however, that lower turnover leads to higher accommodation rates for all worker-firm types. This suggests that accommodation is inefficiently low in labor markets with turnover. The simulations also show significant differences by type in the magnitude of the effect of turnover on accommodation. While some of this reflects differences in benchmark worker turnover rates, one important pattern is that the accommodation rate in non-self-insured firms is much more sensitive to the rate of worker turnover than the accommodation rate in self-insured firms, conditional on the worker's skill level. This difference mainly arises because self-insured firms have a greater incentive to accommodate injured workers to reduce their workers' compensation costs, even if the injured workers leave the firms later. In contrast, this incentive is weaker for non-self-insured firms because they are only partially experience rated. Thus, the dynamic inefficiency highlighted in this counterfactual is more stark for non-self-insured firms.

Table 7: Comparative Statics of Accommodation Decisions

	Accommodation Rate, by Type			
Model	Low, NSI	Low, SI	High, NSI	High, SI
Benchmark	18.78	35.31	27.38	50.45
$\tilde{\lambda}_z = 0.25\lambda_z$	37.25	46.27	31.89	50.96
All firms are self-insured	49.65	35.31	59.62	50.45
$\tilde{\phi}_{low} = \phi_{high}$	63.40	55.74	27.38	50.45

Note: Table shows accommodation rates from our benchmark model and from modifying the exogenous worker turnover rate λ_z to 25% of its estimated value. Columns denote types of worker-firm matches: (1) Low skilled worker at a not-self-insured firm, (2) low skilled worker at a self-insured firm, (3) high skilled worker at a not-self-insured firm, and (4) high skilled worker at a self-insured firm. The estimated values for each type (in order of how they appear in the columns) are reported in Table 4.

The third row reports the effect of experience rating on accommodation by forcing non-self-insured firms–which are only partially experience rated–to be self-insured (i.e., perfectly experience rated). As also discussed in Section 5.4, full experience rating makes firms more financially accountable for the costs they generate for the workers' compensation system, which encourages them to provide efficient levels of accommodation. The simulation results confirm this fiscal externality: fully experience-rating all firms (i.e., through self-insurance) increases accommodation rates substantially.

The final row reports the effect of the utility cost of work while injured by decreasing the disutility of work for low- skilled workers to be equal to the disutility of work for high-skilled workers (i.e., from 1.77 to 0.60). If workers have a very high disutility of work, then it may not be optimal to accommodate workers, even with low turnover, perfect experience rating, and generous wage subsidies. The results show a substantial increase in accommodation among low-skilled workers.

In sum, we find that all three factors – worker turnover, experience rating, and the disutility of work – play an important role in explaining accommodation rates. We next turn to counterfactual policy experiments to explore the role of workers' compensation policy in influencing accommodation.

7 Counterfactual Workers' Compensation Policies

Using the estimated model, we conduct counterfactual experiments to quantitatively explore the optimal design of accommodation subsidies within the workers' compensation program. For each experiment, we impose budget neutrality for the workers' compensation system. Because claim costs are likely to differ in response to these experiments, budget neutrality requires solving for the equilibrium premia for workers' compensation. We first discuss the equilibrium of the insurance market, and then present counterfactual wage subsidies.

7.1 Equilibrium of the Workers' Compensation Insurance Market

In each of the counterfactual experiments, we impose budget neutrality for the workers' compensation system. Since changes in accommodation rates change the fraction of claims that use time loss benefits, the counterfactual experiments are likely to generate changes in claim costs. In order to maintain budget neutrality, insurance premiums must also change, and thus we need to solve the insurance market equilibrium. As summarized in Equation (9), the premium for a non-self-insured firm is a weighted average of claim costs generated by the firm's worker and market-level claim costs t_{wb}. Both of these components might change in response to a change in the firm's and market's incentives to accommodate.

We solve for the equilibrium premium for each type ($P_{b,z}$) that satisfies the break even condition in the insurance market, i.e.,

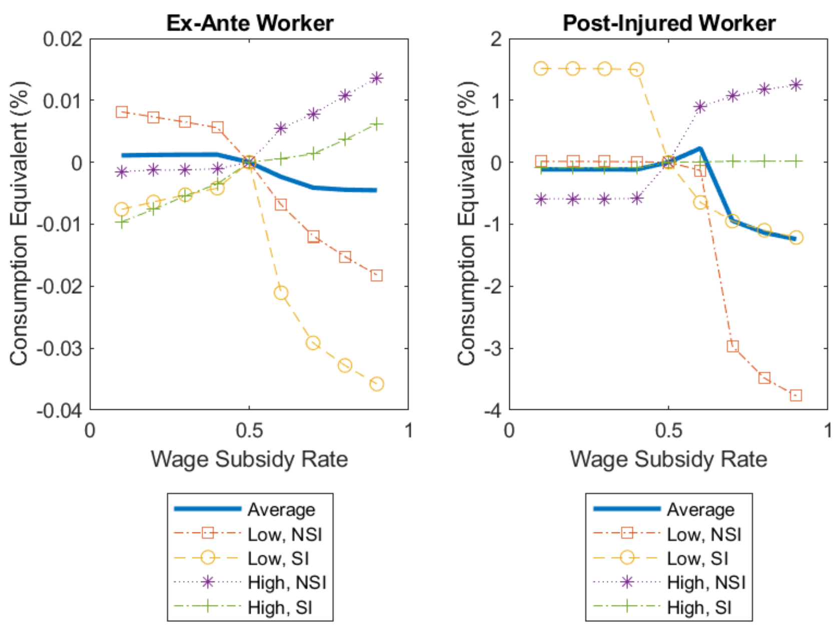
$$\int (1-\tau_y)\, P_{b,z} dF_z(z|NSI) = \int (1-\tau_y) \sum_{j=1}^{N} p_j d_j \mathbb{E}_{\xi}\left[\left(1-a_{j,z}\left(\xi\right)\right) b_z\right] dF_z(z|NSI) \qquad (13)$$

where NSI is an indicator for non-self-insured firms. We then characterize the optimal combination of wage subsidies and worker compensation benefit, resolving this equilibrium for each candidate policy.[35]

7.2 Optimal Wage Subsidies

In our experiment, we consider budget-neutral changes to the wage subsidy rate δ, holding time loss benefits b constant.[36] This counterfactual is motivated by the possibility that firms under-accommodate injured workers, and thus the results will show the quantitative extent of under-accommodation, the welfare loss of such under-accommodation, and the effectiveness of wage subsidies as a tool to encourage efficient accommodation.

Figure 5: Worker Welfare Effects of Alternate Wage Subsidies



Note: Figures report ex-ante (left figure) and ex-post of injury (right figure) worker welfare for alternative wage subsidy rates relative to the benchmark model of $\delta = 0.5$. Low and High denote worker skill type and NSI and SI denote not-self-insured and self-insured firm type.

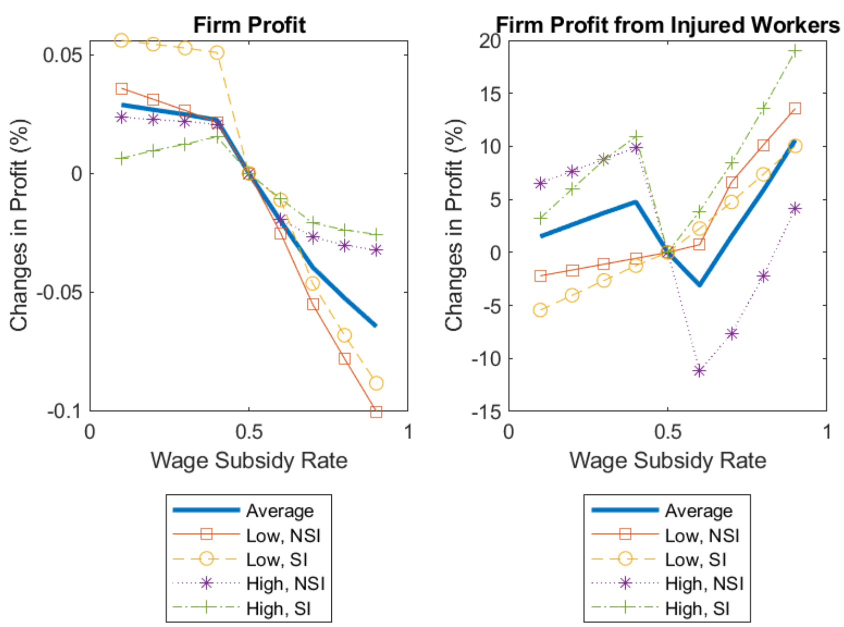
[35] Note that we assume that z is fixed for workers and firms, so they cannot change their insurance status in response to policy changes. We believe this is a reasonable assumption because there is very little variation in insurance status over time, perhaps in part because it is highly correlated with firm characteristics like firm size.

[36] Like time loss benefits, we have to solve for the equilibrium $P_{s,z}$, but unlike time loss benefits, wage subsidies are financed via a flat tax to employers so we simply solve for the change in $P_{s,z}$ for all firms to satisfy budget neutrality.

Figure 5 shows the impact of the wage subsidy on worker welfare ex-ante (left graph) and ex-post of injury (right graph) relative to the benchmark wage subsidy of 0.5. We measure welfare as the percent change in consumption in all states and periods of the counterfactual environment to be indifferent between the counterfactual wage subsidy and the benchmark wage subsidy. The thick blue lines report average welfare and the four thin lines report welfare by type z. Average ex-ante welfare is maximized at a 40% wage subsidy, though the magnitudes do not change substantially across wage subsidy rates. In contrast, there is significant heterogeneity across types, where high skilled workers and workers in non-self-insured firms prefer higher subsidies while low skilled workers and workers in self-insured firms prefer lower subsidies. There is very little change in ex-ante welfare and profit when the wage subsidy increases or decreases, likely because there is only a 1% chance of injury. However, conditional on being injured, worker welfare is maximized at a wage subsidy of 60% with a 0.2% welfare gain.

Figure 6 shows an analogous figure for firm profits under various wage subsidies. In general, higher wage subsidy rates *decrease* firm profits. The optimal wage subsidy thus weighs the opposing effects on workers and firms.

Figure 6: Firm Profit Effects of Alternate Wage Subsidies



Note: Figures report ex-ante (left figure) and ex-post of injury (right figure) firm profits for alternative wage subsidy rates relative to the benchmark model of $\delta = 0.5$. Low and High denote worker skill type and NSI and SI denote not-self-insured and self-insured firm type.

One implication from these findings is that optimal wage subsidies vary with worker characteristics. Because disutility of work during injury differs so much by skill, it may be more desirable to set a low wage subsidy for low-skilled individuals and a higher subsidy for high-skilled individuals. Similarly, to correct fiscal externalities, it may be desirable to have higher subsidies for workers in non-self-insured firms.

8 Conclusion

In this paper, we examine the role of employer accommodations in return-to-work outcomes for workers who experience temporary disability shocks in the context of workers' compensation programs. We first leverage quasi-experimental variation and detailed administrative data on disabling claims from workplace injuries linked to quarterly earnings records in the state of Oregon to estimate the effect of firm investment incentives on accommodation and employment outcomes for injured workers. We show that accommodation is responsive to the wage subsidy incentives through the workers' compensation program, and that accommodation has positive effects on long-term labor market outcomes, including employment and earnings. We then develop and estimate a dynamic bargaining model between workers and firms. We use the model to first highlight that labor market frictions and worker turnover lead to firm under-accommodation and inefficient labor market outcomes after workplace injury, and then use the estimated model to quantitatively explore the optimal design of firm accommodation subsidies. Our finding suggests that a wage subsidy of 40% maximizes overall worker welfare, with higher welfare gains for workers with low disutility of work during injury in labor markets with inefficiently low accommodation rates.

This paper is an important first step to understanding the role of employers in returning to work after a disability and in the design of social insurance programs to protect individuals after disability and work-related injury. Although our data and empirical application are specific to the workers' compensation context, we believe our analysis opens the door to further work on employer accommodation incentives in disability programs more broadly. An important insight from our analysis is that employer financial incentives are a key factor in encouraging accommodation; if employers do not have the proper incentives (e.g., workers' compensation is imperfectly experience rated, in our context), accommodation rates may suffer. A second broad insight is that while accommodation may be optimal for some workers, it can be too costly for other workers whose disabilities do not allow for safe or cost-effective accommodation. Future research is needed to explore these insights within other disability contexts.

References

Acemoglu, D. and J. D. Angrist (2001). Consequences of employment protection? the case of the Americans with Disability Act. *Journal of Political Economy 109*(5), 915–957.

Acemoglu, D. and J.-S. Pischke (1999). The structure of wages and investment in general training. *Journal of political economy 107*(3), 539–572.

Aizawa, N. and H. Fang (2020). Equilibrium labor market search and health insurance reform. *Journal of Political Economy 128*(11), 4258–4336.

Aizawa, N., S. Kim, and S. Rhee (2020). Labor market screening and social insurance program design for the disabled. Technical report, National Bureau of Economic Research.

Autor, D. H. and M. G. Duggan (2010). Supporting work: A proposal for modernizing the u.s. disability insurance system. *Center for American Progress and the Hamilton Project*.

Balke, N. and T. Lamadon (2020). Productivity shocks, long-term contracts and earnings dynamics. Technical report, National Bureau of Economic Research.

Becker, G. S. (1962). Investment in human capital: A theoretical analysis. *Journal of political economy 70*(5, Part 2), 9–49.

Becker, G. S. (1964). *Human Capital*. The University of Chicago Press.

Black, S. E., J. T. Denning, and J. Rothstein (2020). Winners and losers? the effect of gaining and losing access to selective colleges on education and labor market outcomes. Technical report, National Bureau of Economic Research.

Bronchetti, E. T. (2012). Workers' compensation and consumption smoothing. *Journal of Public Economics 96*(5-6), 495–508.

Bronchetti, E. T. and M. P. McInerney (2015). What determines employer accommodation of injured workers? the influence of workers' compensation costs, state policies, and case characteristics. *ILR Review 68*(3), 558–583.

Bureau of Labor Statistics (2020). Local area unemployment statistics.

Burkhauser, R. V., J. Butler, and Y. W. Kim (1995). The importance of employer accommodation on the job duration of workers with disabilities: A hazard model approach. *Labour Economics 2*(2), 109–130.

Burkhauser, R. V. and M. Daly (2011). *The declining work and welfare of people with disabilities: What went wrong and a strategy for change*. AEI Press.

Butler, R. J., W. G. Johnson, and M. L. Baldwin (1994). Managing work disability: Why first return to work is not a measure of success. *Indus. & Lab. Rel. Rev. 48*, 452.

Cabral, M. and M. Dillender (2020). The impact of benefit generosity on workers' compensation claims: Evidence and implications. Technical report, National Bureau of Economic Research.

Currie, J. and B. Madrian (1999). Health, health insurance and the labor market. *Handbook of labor economics 3*, 3309–3416.

De Groot, N. and P. Koning (2016). Assessing the effects of disability insurance experience rating. the case of the netherlands. *Labour Economics 41*, 304–317.

Elvery, J., C. L. Reynolds, and S. M. Rohlin (2021). Employer wage subsidy caps and part-time work.

Fang, H. and A. Gavazza (2011). Dynamic inefficiencies in an employment-based health insurance system: Theory and evidence. *American Economic Review 101*(7), 3047–77.

Federal Reserve Bank of St. Louis (2020). Fred economic data: Unemployment rate.

Flinn, C. J. (2006). Minimum wage effects on labor market outcomes under search, matching, and endogenous contact rates. *Econometrica 74*(4), 1013–1062.

French, E. and J. Song (2014, May). The effect of disability insurance receipt on labor supply. *American Economic Journal: Economic Policy 6*(2), 291–337.

Gelber, A., T. J. Moore, and A. Strand (2017). The effect of disability insurance payments on beneficiaries' earnings. *American Economic Journal: Economic Policy 9*(3), 229–61.

Giupponi, G. and C. Landais (2018). Subsidizing labor hoarding in recessions: The employment & welfare effects of short time work.

Hansen, B., T. Nguyen, and G. R. Waddell (2017). Benefit generosity and injury duration: Quasi-experimental evidence from regression kinks.

Hawkins, A. and S. Simola (2020). Paying for disability insurance?: Firm cost sharing and its employment consequences. *Opublicerat manuskript https://www. dropbox. com/s/ksgkjkumdtz6ux0/ahss_disability_paper. pdf*.

Hill, M., N. Maestas, and K. J. Mullen (2016, August). Employer accommodation and labor supply of disabled workers. *Labour Economics 41*, 291–303.

Kostøl, A. R. and M. Mogstad (2014, February). How financial incentives induce disability insurance recipients to return to work. *American Economic Review 104*(2), 624–55.

Krueger, A. B. (1990). Workers' compensation insurance and the duration of workplace injuries. Technical report, National Bureau of Economic Research.

Layton, T. J., H. Liebert, N. Maestas, D. Prinz, and B. Vabson (2019). Predicting disability enrollment using machine learning.

Maestas, N., K. J. Mullen, and S. Rennane (2019). Unmet need for workplace accommodation. *Journal of Policy Analysis and Management 38*(4), 1004–1027.

Maestas, N., K. J. Mullen, and A. Strand (2013). Does disability insurance receipt discourage work? using examiner assignment to estimate causal effects of SSDI receipt. *American Economic Review 103*(5), 1797–1829.

Mas, A. and A. Pallais (2020). Alternative work arrangements. *Annual Review of Economics 12*, 631–658.

Meyer, B. D., W. K. Viscusi, and D. L. Durbin (1995). Workers' compensation and injury duration: evidence from a natural experiment. *The American economic review*, 322–340.

Mullen, K. J. and S. Rennane (2017). The effect of unconditional cash transfers on the return to work of permanently disabled workers. Technical report, National Bureau of Economic Research.

Murphy, G., J. Patel, E. Weiss, and L. I. Boden (2020). Workers' compensation: Benefits, costs, and coverage (2018 data). *National Academy of Social Insurance*.

Neuhauser, F. and S. Raphael (2004). The effect of an increase in worker's compensation benefits on the duration and frequency of benefit receipt. *Review of Economics and Statistics 86*(1), 288–302.

Office of the Chief Actuary (2020). The 2020 oasdi trustees report. Technical report, Social Security Administration, Baltimore MD.

O'Leary, P., G. A. Livermore, and D. C. Stapleton (2011). Employment of individuals in the social security disability programs. *Soc. Sec. Bull. 71*, 1.

Oregon Department of Consumer and Business Services (2020). Employer at injury program (eaip).

Prinz, D. and B. Ravesteijn (2020). Employer responsibility in disability insurance: Evidence from the netherlands.

Rennane, S. (2018). Buying time: The insurance value and distortionary effects of workers' compensation. *RAND Working Paper WR-1220*.

Reville, R. T. and R. F. Schoeni (2004). The fraction of disability caused at work. *SOCIAL SECURITY BULLETIN-WASHINGTON- 65*(4), 31.

SAIF (2020). Employer at injury program: Fast facts.

Thomas, J. and T. Worrall (1988). Self-enforcing wage contracts. *The Review of Economic Studies 55*(4), 541–554.

Appendix

A Worker-Firm Bargaining Solution Details

In this appendix we provide more details on the solution to the first stage bargaining problem in which accommodation decisions and the initial wage are determined:

$$\max_{w_{1,z},\mathbf{a}_z} \left(V_z(w_{1,z},\mathbf{a}) - U_{1,x}\right)^{\beta} J_z(w_{1,z},\mathbf{a})^{1-\beta} \tag{14}$$

To solve for accommodation choices, we posit that there are thresholds $\xi^*_{z,j}$ such that $a_j = 1$ for all $\xi_{z,j} < \xi^*_{z,j}$ and $a_j = 0$ otherwise. Given this threshold rule, we can re-express worker and firm value functions as

$$\overline{V}_z(w_{1,z},\boldsymbol{\xi}^*_{\mathbf{z}}) = V_z(w_{1,z},\mathbf{a}_z) = p_0 V_{z,0} + \sum_{j=1}^{N} p_j \left[\varGamma\left(\xi^*_{z,j}\right) V_{z,j} + \left(1-\varGamma\left(\xi^*_{z,j}\right)\right)\widetilde{V_{z,j}}\right] \tag{15}$$

and

$$\overline{J}_z(w_{1,z},\boldsymbol{\xi}^*_{\mathbf{z}}) = J_z(w_{1,z},\mathbf{a}_z) = p_0 J_{z,0} + \sum_{j=1}^{N} p_j \left[\varGamma\left(\xi^*_{z,j}\right)\ \bar{J}_{z,j}\ \left(\xi^*_{z,j}\right) + \left(1-\varGamma\left(\xi^*_{z,j}\right)\right)\widetilde{J_{z,j}}\right] - P_{tot,z} \tag{16}$$

where the value $\bar{J}_{z,j}$ is the conditional expectation of firm's profit of accommodating the injured,

$$\bar{J}_{z,j}\left(\xi^*_{z,j}\right) = d_j\left[\mathbb{E}_{\xi}\left[f_{1,z,j,\xi}|\xi<\xi^*_{z,j}\right] - (1-\delta)\,w_{1,z}\right] + (T-d_j)\,(1-q_{z,j,1})\,(1-\lambda_z)\,(f_{2,z,j,a}-w_{2,z,j,a}) \tag{17}$$

With this representation, the bargaining solution in the first stage is determined by:

$$\max_{w_{1,z},\boldsymbol{\xi}^*_{\mathbf{z}}} \left(\overline{V}_z(w_{1,z},\boldsymbol{\xi}^*_{\boldsymbol{z}}) - U_{1,x}\right)^{\beta} \overline{J}_z(w_{1,z},\boldsymbol{\xi}^*_{\boldsymbol{z}})^{1-\beta} \tag{18}$$

The first order condition with respect to the first period wage is:

$$\beta \overline{J}_z(w_{1,z},\boldsymbol{\xi}^*_{\boldsymbol{z}})\frac{d\overline{V}_z}{dw_1} + (1-\beta)\left(\overline{V}_z(w_{1,z},\boldsymbol{\xi}^*_{\boldsymbol{z}}) - U_{1,x}\right)\frac{d\overline{J}_z}{dw_1} = 0. \tag{19}$$

where

$$\frac{d\overline{V}}{dw_1} = p_0 T u'(w_1) + \sum_{j=1}^{N} p_j d_j \varGamma\left(\xi^*_{z,j}\right) u'(w_1) \tag{20}$$

and

$$\frac{d\overline{J}_z}{dw_1} = -p_0 T - \sum_{j=1}^{N} p_j d_j \varGamma\left(\xi^*_{z,j}\right)(1-\delta) \tag{21}$$

Similarly, the first order conditions with respect to $\xi^*_{z,j}$ for each j are:

$$\beta \overline{J}_z(w_{1,z}, \boldsymbol{\xi}^*_{\boldsymbol{z}}) \frac{d\overline{V}_z}{d\xi^*_{z,j}} + (1-\beta)\left(\overline{V}_z(w_{1,z}, \boldsymbol{\xi}^*_{\boldsymbol{z}}) - U_{1,x}\right) \frac{dJ_z}{d\xi^*_{z,j}} = 0. \tag{22}$$

where

$$\frac{d\overline{V}_z}{d\xi^*_j} = p_j \gamma\left(\xi^*_{z,j}\right)\left[V_{z,j} - \widetilde{V_{z,j}}\right] \tag{23}$$

and

$$\frac{d\overline{J}_z}{d\xi^*_{z,j}} = p_j \gamma\left(\xi^*_{z,j}\right)\left(\ \bar{J}_{z,j}\ \ \left(\xi^*_{z,j}\right) - \widetilde{J_{z,j}}\right) - p_j\ \ \bar{J}'_{z,j}\ \ \left(\xi^*_{z,j}\right) \tag{24}$$

We can thus characterize $\left(w_{1,z}, \left\langle \xi^*_{z,j} \right\rangle_{j=1}^{J}\right)$ by solving these $J+1$ system of equations.

B Appendix Tables and Figures

Appendix Table 1: Difference-in-Difference Analysis on Working

	Work 1Q	Work 2Q	Work 3Q	Work 4Q	Work 5Q	Work 6Q	Work 7Q	Work 8Q
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Treat × Post	-0.011	-0.014	-0.048***	-0.043***	-0.049***	-0.044***	-0.034**	-0.044***
	(0.011)	(0.013)	(0.013)	(0.015)	(0.015)	(0.016)	(0.016)	(0.016)
Mean DV, treatment	0.912	0.852	0.821	0.797	0.769	0.747	0.734	0.722
Mean DV, control	0.861	0.771	0.732	0.707	0.675	0.648	0.631	0.616
Observations	148705	148705	148705	148705	148705	148705	148705	148705
R-squared	0.0850	0.107	0.0991	0.0876	0.0916	0.0930	0.0889	0.0843

Notes: Columns include all controls. Standard errors clustered by firm. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Appendix Table 2: Difference-in-Difference Analysis on Working at a Different Firm, Conditional on Working

	NewF 1Q	NewF 2Q	NewF 3Q	NewF 4Q	NewF 5Q	NewF 6Q	NewF 7Q	NewF 8Q
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Treat × Post	-0.012	-0.030*	-0.014	-0.010	-0.005	-0.001	0.001	0.006
	(0.011)	(0.016)	(0.016)	(0.017)	(0.018)	(0.019)	(0.019)	(0.018)
Mean DV, treatment	0.0482	0.115	0.165	0.205	0.242	0.275	0.304	0.329
Mean DV, control	0.0966	0.233	0.315	0.382	0.440	0.484	0.516	0.548
Observations	134858	125496	120782	117174	113022	109694	107744	105797
R-squared	0.0716	0.159	0.191	0.204	0.218	0.226	0.228	0.229

Notes: Columns include all controls. Standard errors clustered by firm. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Appendix Table 3: Difference-in-Difference Analysis on Earnings, Conditional on Working

	Earn 1Q	Earn 2Q	Earn 3Q	Earn 4Q	Earn 5Q	Earn 6Q	Earn 7Q	Earn 8Q
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Treat × Post	-1218***	-1345***	-1148***	-1121***	-1166***	-1410***	-1310***	-1207***
	(184)	(204)	(220)	(223)	(240)	(265)	(271)	(250)
Mean DV, treatment	7338.6	8012.6	8312.2	8510.8	8634.4	8718.4	8779.1	8883.9
Mean DV, control	4913.8	5472.2	5691.6	5838.3	5941.9	5982.6	6029.3	6023.9
Observations	134858	125496	120782	117174	113022	109694	107744	105797
R-squared	0.472	0.477	0.488	0.479	0.422	0.449	0.480	0.466

Notes: Columns include all controls. Standard errors clustered by firm. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Appendix Table 4: Difference-in-Difference Analysis on EAIP Use, Robustness

	Lasso	Lasso, 2005-2011	OLS	Logit
	(1)	(2)	(3)	(4)
Treatment × Post	-0.055***	-0.065***	-0.048***	-0.039***
	(0.013)	(0.014)	(0.011)	(0.011)
Mean EAIP, treatment	0.278	0.278	0.279	0.280
Mean EAIP, control	0.0404	0.0402	0.0357	0.0353
Observations	140889	140889	140889	140704
R-squared	0.148	0.148	0.149	0.149

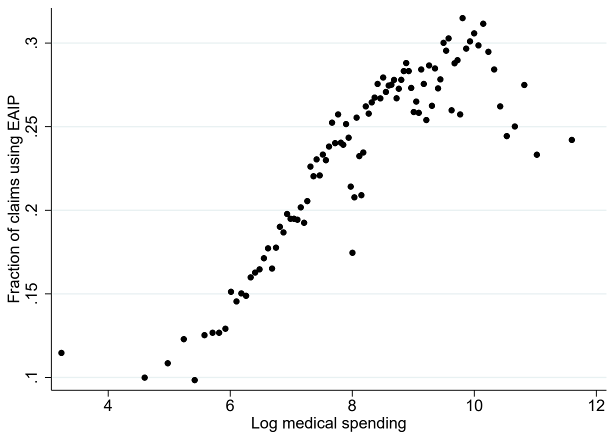
Notes: Columns include all controls. Standard errors clustered by firm. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Appendix Table 5: Difference-in-Difference Analysis on Working, Robustness

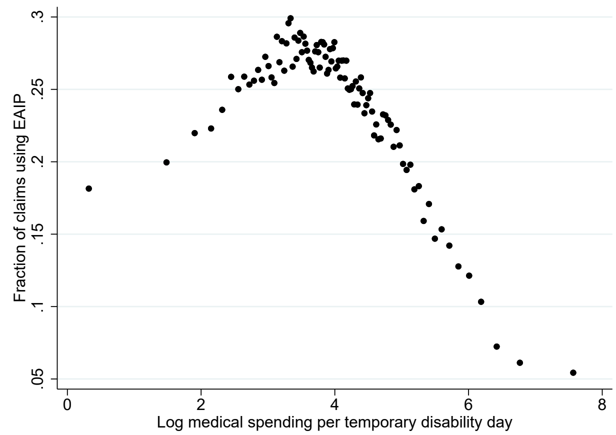
	Lasso	Lasso, 2005-2011	OLS	Logit
	(1)	(2)	(3)	(4)
Treatment × Post	-0.034**	-0.039**	-0.049***	-0.039***
	(0.016)	(0.018)	(0.013)	(0.013)
Mean working, treatment	0.799	0.799	0.799	0.798
Mean working, control	0.710	0.710	0.713	0.722
Observations	140889	140889	140889	140704
R-squared	0.0947	0.0947	0.0948	0.0945

Notes: Columns include all controls. Standard errors clustered by firm. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Appendix Figure 1: Fraction of claims using EAIP by medical spending

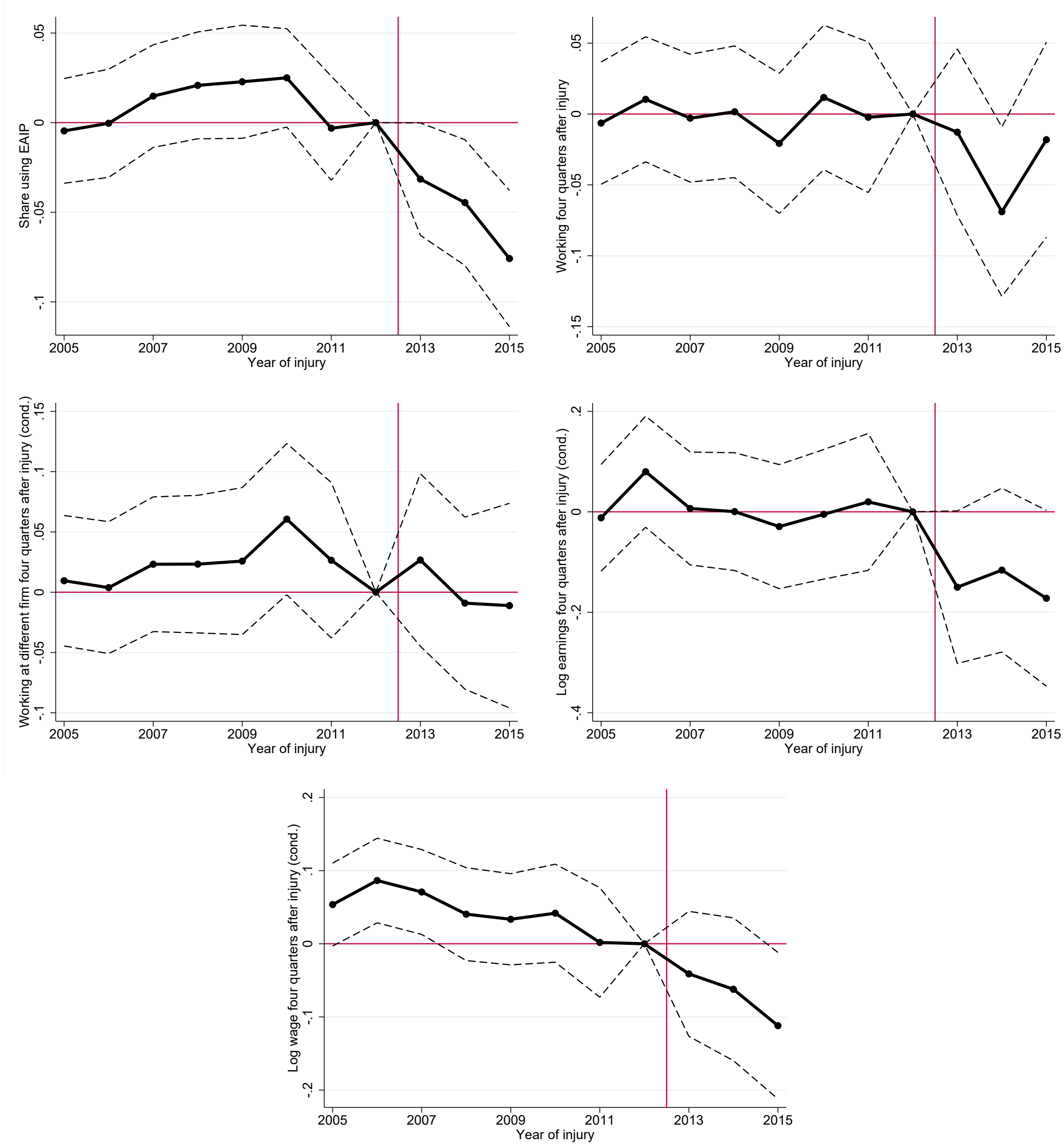


(a) Log medical spending

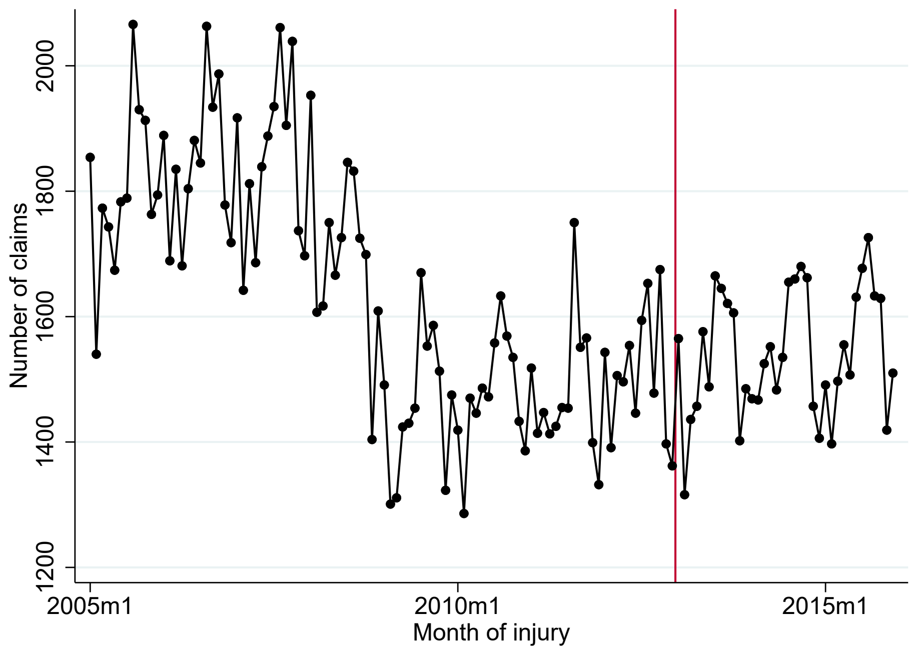


(b) Log medical spending per temp. disability day

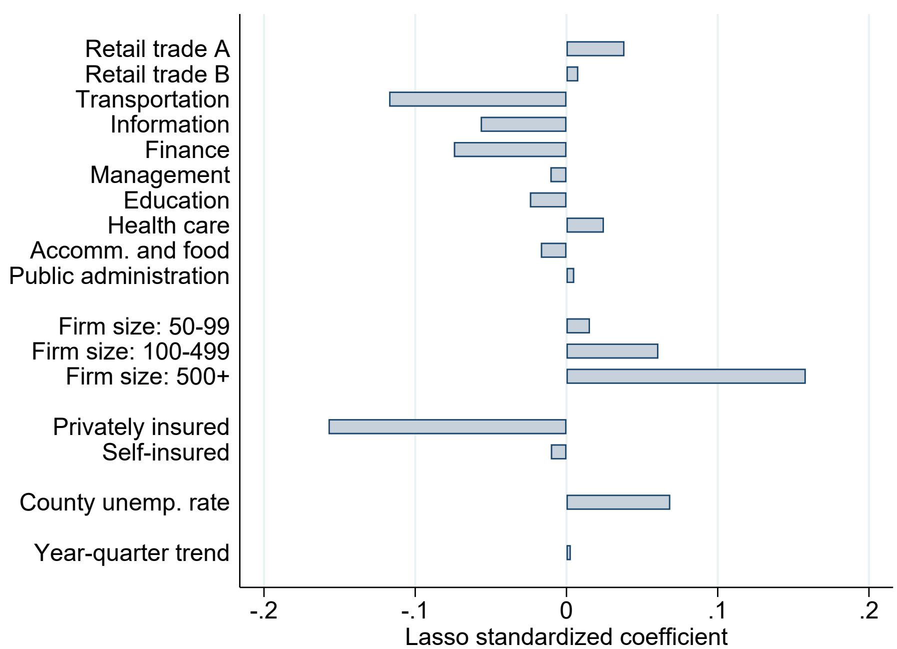
Appendix Figure 2: Regression-adjusted difference in outcomes between treatment and control, by year



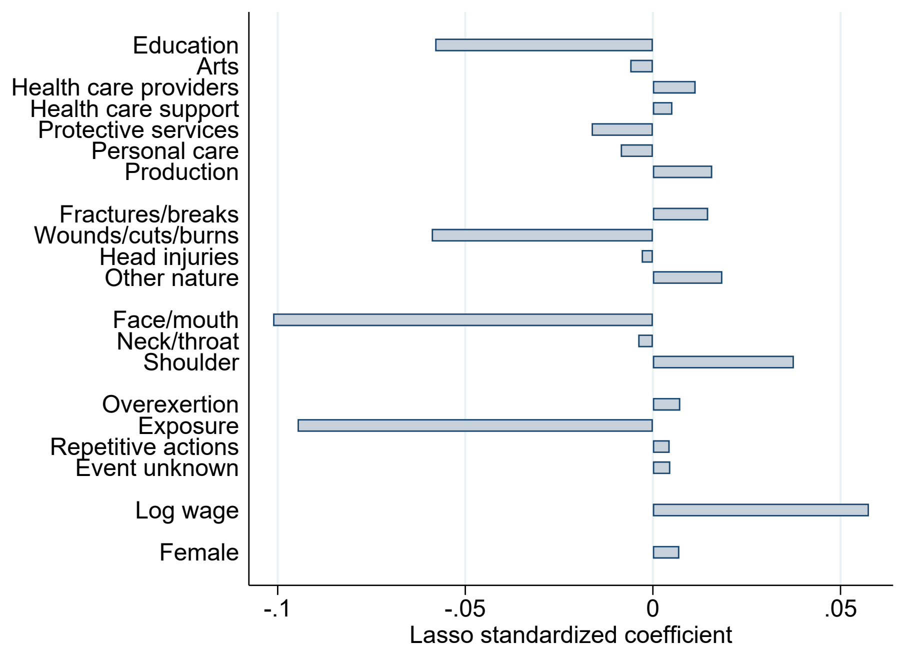
Appendix Figure 3: Number of claims, by month of injury



Appendix Figure 4: Importance of Lasso-selected firm characteristics in prediction algorithm



Appendix Figure 5: Importance of Lasso-selected worker characteristics in prediction algorithm



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