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Wages and return to work

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Abstract

This is the first analysis of determinants of the return to work of injured workers in an institutional setting where workers earnings are fully compensated during the disability spell. Employers carry the costs associated to the time off work; hence they could face an incentive to put pressure on workers to shorten their leave. We use a matched employer-employees panel data merged with Italian workers compensation records. We find that even when we control for measures of commitment and job security, workers with high wages and high relative wages (who are more costly for the employer) return to work sooner.

Keywords: Return to Work; Injury; Workers' Compensation; Relative wages; Commitment; Hazard models.

JEL-Code: J22, J28

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1. Introduction

Several western countries have witnessed a decline in the total number of reported occupational injuries over the last twenty years. This trend has characterized also the Italian labor market. In 2008 Italy reported a national incidence rate of 2.9 % corresponding to a total number of 790,278 notified injuries, 67% of which were recognized and compensated for temporary or permanent disabilities (Eurogip, 2010). The debate about the outcomes of occupational injuries has not diminished, however. This is partly because, more generally, "disability compensation is the only universal program for which entitlement criteria are open to interpretation and for which, therefore, access can be severely restricted. Disability compensation provides one of the principal mechanisms through which society can regulate social spending" (Yelin, 1989, p.116) Indeed, across Australia, European countries, and North America jurisdictions, the last two decades have been characterized by the spreading of aggressive early return programs with the effect of reducing the payment of workers' compensation benefits (Lippel, 2012).

Occupational injuries that result in time off work lead to substantial costs that are distributed among different stakeholders depending on labor market institutions and regulations. Countries vary greatly in the mechanisms that they choose to compensate injured workers (OECD, 2003). Time off work leads workers and households to incur costs because of reduced compensation, obsolescence of skills, or reduced employability; employers incur costs in terms of lost productivity, adjustment costs, and increases in insurance premiums (Soklaridis, et al. 2012); insurers, health care providers, or taxpayers carry the costs associated with both the administration of the workers' compensation cases and the benefits payments. In addition, the length of the spell off work predicts how successful the return to work will be in terms of future health, work ability, employability, and, possibly, of new injuries (Galizzi and Boden, 2003, Galizzi 2013).

The existing economic analysis on this topic has made use mainly of Northern American data and has focused on the workers' compensation benefits replacement rate as the key economic determinant of the speed to return to work. This suggests that the literature has mainly focused on supply side explanations of the dynamics of return to work (Yelin, 1989): on the moral hazard behavior induced possibly by disability benefits, or on the health constraints that may affect workers' ability to return to work. Very limited research has been conducted to assess how the demand of labor and, more generally, the interaction between individual workers' decisions and employers' behavior affect return to work patterns. There is acknowledgment that this is a very critical area of research across disciplines (Pransky et al. 2005).

This study aims at casting some light on this discussion by exploring a new Italian data set that combines a national sample of matched employer-employees data with records from the Italian national workers' compensation agency, the *Istituto Nazionale per l'Assicurazione contro gli Infortuni sul Lavoro* (INAIL). These merged data permit to study the determinants of return to work by analyzing the spell between the time of the injury and the time of actual return to paid employment that in Italy corresponds to the time when workers' compensation benefits are terminated. Furthermore, they permit to study an institutional setting that differs dramatically from the one previously analyzed in U.S. studies. In fact, a combination of national laws and of union sector rules makes the workers' compensation replacement rate for most Italian injured workers equal to 100%. Such full wage replacement is financed by firms both through the experience ratings premium that they pay to the INAIL, and thorough direct reimbursement to the workers. Furthermore, labor laws impose that jobs will be guaranteed at the time when the worker is declared ready to return to work.

Such data and rules permit to explore new research questions: first, we can explore a setting where workers are not incentivized to return to work because of their need to go back to full earnings, a setting where post injury moral hazard behavior should be greatly amplified and result in very long spells of work. Second, the lack of variation and full replacement rate among injured employees permits us to focus on other reasons that may explain potential different return to work likelihoods between high and low wage - or more and less committed - workers. We study a setting where employers carry large part of the immediate marginal monetary costs associated to the time off work caused by a new injury. In this context, employers could face a stronger incentive to put pressure on workers to return to work, or to underreport injuries. These potential threats may differ - or been perceived differently- by employees depending on their degree of job security. Finally, with this study we want to contribute also to the filling of a research gap. Since 2005 Europe has published more papers on the topic of return to work than the U.S. This increase has been mainly lead by research in northern European countries and in the medical field, however (Rollin and Gehanno, 2012). Most of the existing economic analysis on this subject is still focusing on the North American labor market. With this paper, we aim at bringing new economic and southern European evidence on the topic.

2. Literature review

The study of the factors affecting the return to work of injured workers has been the focus of several articles in the field of industrial medicine and occupational rehabilitation, although the economic literature has offered also important insights (for extensive reviews see Galizzi and Boden 1996, Krause et al. 2001, and Franche et al. 2005). While one of the first important economic studies on the effect of illnesses and injuries on labor market outcomes referred to British workers (Fenn, 1981), most of the economic literature on return to work has made use of North American workers' compensation data. It developed in the early 90s partly as a response to the need to understand the escalating costs of the U.S. workers' compensation systems.

Despite the interdisciplinary nature of this literature, several results appear to be quite consistent. As far as personal characteristics are concerned, older age, lower education, lower tenure, lower wage, intermittent labor market experience, and problematic pre injury medical history have been found to be negatively associated with the likelihood of returning to work or the length of spells off work. Women have also been found to take longer time to return to work although the results are mixed when the analysis distinguishes between shorter and longer disability spells (Galizzi and Boden, 2003). The evidence is also mixed about the role played by union membership given the different functions that unions can play in providing employees with information, in protecting the job of injured workers, or in facilitating accommodations on the job. The factors that play a major role in determining the time off work are clearly associated with the event of the injury itself, however: the severity of the injury, the nature of the impairment, the injured body part, as well as the replacement rate measured as the ratio between weekly temporary disability benefits and the gross weekly pre-injury wage (Fenn, 1981, Fenn and Vlachonikolis, 1986, Johnson and Ondrich, 1990, Butler, Johnson, and Baldwin, 1995, Meyer, Viscusi, and Durbin, 1995, Cheadle et al., 1996, Oleinick et al., 1996, Butler, Baldwin, and Johnson, 2001, Galizzi and Boden, 2003). As in the case of public and private disability insurances (Gruber, 2010, Autor, Duggan and Gruber, 2013), the positive relationship between workers' compensation benefits level and claim frequency or claim duration has been interpreted as evidence of workers' moral hazard behavior (Butler and Worrall, 1991, Dionne and St-Michel, 1991). Recently few studies estimating the likelihood of filing of workers' compensation claim have found new results that contradict such theory, however (Guo and Burton 2010, Bronchetti and McInerney 2011). They suggest that the labor supply disincentive effects of workers' compensation benefits may have been overestimated. They indicate that more focus should be put instead on studying the effect of the increasing restrictions for compensability that several workers face (Spieler and Burton 2012), or on the effect of different degrees of job security (Block and Prins 2001).

Indeed, the most interesting results discussed in the most recent literature refer to the great importance that job characteristics and the organizational culture play in influencing the return to work of injured workers. Some previous economic studies had already found that the likelihood of such return was greatly affected by the workers' ability to return to the pre injury employer (Galizzi and Boden, 1996, 2003), by the degree of physical job demands (Fenn, 1981, Johnson and Ondrich, 1990), and by firm specific disability management policies, such as the possibility of returning at reduced hours or to modified employment (Butler, Johnson, and Baldwin (1995).

The lessons and policy implications of these studies are somehow limited, however, by the fact that countries vary in terms of rules protecting jobs, or accommodating and compensating injured workers (Block and Prins, 2001). Therefore, the study by Anema et al. (2009) is quite important because it represents one of the very few cross country comparison of return to work patterns. It confirms the importance of compensation policy variables, but it finds also that work interventions and job characteristics are the *main* determinants of differences in return to work patterns across countries. Such variables carry even more explanatory power than patients' characteristics, health, and medical interventions. These results suggest the need to further develop studies that account for richer measures of employers' characteristics and organizational culture, an area of research that is "still in its infancy" (Krause et al. 2001, p. 472). Indeed, employer's characteristics go beyond the measures of firm's size, unionization, or industrial sector that are often used in economy analysis. In the context of the return to work of injured workers what seems to matter is organizational behavior: people oriented culture (involvement in decision making, supporting and cooperative working relationships with coworkers and supervisors, workers' trust toward - and attachment to - the company, sense of satisfaction, involvement on the job), and a safety oriented culture (case management policies and practices, ergonomics practices) (Amick III et al., 2000, Franche et al, 2004, Young, 2010).

Quantitative research in this area is complicated by the difficulty of obtaining measures that capture such variables. The availability of richer employer-employees data can prove to be very useful in this context. This paper is as step in this direction.

3. The Institutional Setting

In Italy, the length of the healing period following an occupational injury is decided by a doctor specialized in occupational medicine. In principle, this decision is based on medical grounds only, although in some instances it is possible to extend or reduce the leave. This can happen if the worker applies for an extension, or a shortening of the period off work, and the doctor agrees[i].

According to Italian law, injured workers' jobs are preserved till the employees return to work, i.e. all injured workers return to their previous firm, provided that they were originally hired with a permanent contract[ii]. Temporary contract workers, however, have to leave the firm if the contract expires before the end of the leave period. In this case they have to look for a new employer at the end of the healing period.

Italian employers have to pay the insurance premium to the public insurance system (administered by INAIL, the Italian National Workers' Compensation Agency and one of our data providers). The amount of the premium depends on the intrinsic risk linked to the tasks performed within the firm, and on an additional bonus/malus scheme that increases firms' premium as new work incidents are recorded. In the case of temporary disability, the public insurance system covers 60% of the wages up to 90 days of leave, 75% afterward, subject to a maximum and a minimum (Eurogip, 2005). The residual is covered by the firm. In fact, all collective agreements on job contracts entail a top up of INAIL's disability benefit to 100% of the wage, with just few exceptions that are not relevant for our study[iii] (Leombruni and Costamagna, 2013). This means that, in practice, Italian injured workers' are guaranteed benefits corresponding to a 100% wage replacement rate, although the time off work may still lead to the loss of overtime payments[iv].

Finally, employers have to carry the adjustment costs that they incur when injured workers return to work but have to be offered accommodations because of their long lasting temporary or permanent work disabilities. In fact, upon return to work, if the worker still suffers of a functional limitation resulting in a work disability (as stated by a medical certificate) the firm needs to explore the possibility of accommodating the worker by moving him/her to a new occupation; even if this implies a demotion, the firm cannot lower the salary. If there are no viable tasks, workers can be dismissed following a judicial sentence.

Despite some similarities, these features make the Italian systems remarkably different from the one in the Northern America (studied by most of the economic literature): the U.S. workers' compensation system differs by state and is designed usually to provide return to work incentives, as temporary disability benefits usually replace only 2/3 of the worker's pre injury salary. In addition, in some states employers are given monetary incentives to rehire injured workers (Seabury et al., 2011). In Italy the injury does not produce immediate economic losses for the employees and large part of the immediate financial burden of the injury falls on the employers. Therefore, in this institutional setting it becomes particularly relevant to study whether the length of spells off work is determined only on medical grounds, or whether it is related also to different determining factors, such as pressure by the firm for an early return, workers' attachment to - and status within - the firm, or discrimination toward more vulnerable categories of employees. To explore the role of these potential factors we need data that permit to observe both employees' and firms' behaviors over time.

4. Data

We use a unique dataset that combines at the individual level work histories from WHIP (Work Histories Italian Panel)[v] and work-related injuries from INAIL, the Italian national workers' compensation agency. The data span the period 1994-2005. This is the first Italian database merging on an individual basis a sample of work histories and of occupational injuries (Bena et al. 2012).

To the best of our knowledge only very few studies have exploited similar matched employer-employees and workers' compensation administrative data to study the determinants of the spell off work (Reville et al 2001, McLaren el al. 2010). These authors have focused on cases in specific states in the U.S. or reported by self-insured employers, while our data is for all types of injuries covered by INAIL across the whole country. The INAIL dataset records all injury events resulting into a leave longer than three days; shorter healing periods do not involve INAIL but are responsibilities of the firm, according to collective contract agreements[vi]. The data record a description of the injury event itself (when, how, where) and of its consequences (nature of injury, length of temporary disability payment, or degree of permanent disability - if any).

WHIP's reference population includes all Italian workers and pensioners, as well as social security provisions (several kinds of unemployment and invalidity benefits); it excludes only public sector employees hired on an open ended contract and high skill professions (e.g. lawyers) who are compensated with different insurance funds. The dependent employment section of WHIP is a matched employer-employees database that includes start and closing dates of each employment spell, as well as worker characteristics (age, sex, place of birth), job characteristics (temporary vs. permanent contract, full vs. part time, occupation, location), labour market outcomes (the number of days and weeks worked in a year and annual earnings) and firm characteristics (size, opening and closing date, sector, location, monthly new hires and separations). The information of all individuals' earnings within each firm permits to calculate also a measure of relative wages as the ratio between each worker's wage and the average of workers' wages within the same firm and with the same job title (blue or white collar).

The INAIL dataset and the WHIP dependent employment section have been matched for a 1:15 random sample (about 1.5 million workers each year) covering the period 1994-2005, generating a unique source of information for the analysis of occupational injuries (Bena et al. 2012).

For the purpose of this work we select only employees who have had a work incident in the observation period (about 260,000 individuals). We further select only those who were *blue collar* workers hired with a *permanent contract* at the moment of the injury. The first choice is motivated by the heterogeneity of occupations, types of injury and physical demands of manual and non-manual occupations. The second choice is due to the specific regulation regarding temporary contract workers, for whom the working contract can expire before the end of the recovery period stated by the doctor. This excludes from the analysis a share of new hires, mainly after 2001 when temporary contracts were fully liberalized[vii] (Berton et al. 2011). Furthermore, in our analysis we study the hazard of returning to work after the incident, hence we drop from our final dataset 1198 individuals who died because of the injury. Finally, we focus only on the first incident a worker experiences in our observation period[viii], as repeated injuries and careers that may follow a first occupational injury are different issues from the one we address here. We discuss this in our conclusions.

We end up with a sample of 180,420 workers/spells off work, which we describe in section 6. We measure the spell off work as the length of disability payments. In fact, Italian injured workers' jobs are protected so that workers are guaranteed to return to paid employment as soon as their temporary disability leave expires.

5. Empirical framework

The Research Hypotheses

Given the Italian institutional background, we are studying a labour market where injured workers do not face monetary incentives to return to work because they are customarily compensated with a 100% benefits replacement rate. In this context, our hypotheses are that workers' hazard to return to work will be affected by the following factors:

a. Employers' incentive to accelerate the return to work of the most "costly" workers.

Early returns to work bring substantial monetary benefits to the firm. A spell off work generates costs for the firm that are proportional to the worker's wage. This is the case first because the firm's share of the monetary compensation to the worker is proportional to the wage[ix]; second because, if wages are a measure of productivity, the absence of a high-wage worker causes a higher production loss and higher adjustment costs. Therefore we would expect firms to put more pressure on high wage injured workers to induce them to shorten their spells off work.

b. *Workers' feelings of job commitment that prevail on their belief of having the right to heal properly.*

Workers may have been paid efficiency wages before the injury, i.e. higher wages aiming at eliciting stronger job commitment as predicted by the social exchange theory, gift exchange models (Eisenberg et al. 1986, 1999, Allen et al., 2003, Rebitzer and Taylor, 2011), and as shown by the presenteeism and absenteeism literature (Löve et al. 2010, Head et al., 2007). More committed workers are more likely to return to work sooner (Holmgren et al. 2013) despite the fact that workers who return to work before full recovery can jeopardize their long run health, work ability, employability, and may increase the risk of new occupational incidents (Galizzi and Boden, 2002).

This means that higher wages may proxy both higher firms' costs and stronger employees' commitment. To disentangle these two potential effects of *high individual wages* on the timing of the return to work we exploit additional information contained in our longitudinal employers-employees data set. From this data we can gain some knowledge both about individuals' and firms' employment histories, and about workers' relative status within their firm. Human capital theory postulates that firms that invest in specific human capital can increase loyalty and commitment of their workers. They gain in terms of lower turnover rates. Then if we can observe a measure of *workers' turnover* at the firm level, we can use it to proxy the level of commitment generated by human resource management at the firm level. Also a faster *individual wage growth within the firm* can be linked both to higher productivity and to higher job commitment; i.e. it can signal either a firm's performance feedback policy that triggers higher attachment (Bakker et al. 2008), or the individual worker's higher commitment that is rewarded with a speedier career by the firm.

c. Workers' status within the firm that can increases their decision latitude and ability to accommodate/manage their own job after return

High individual wages could also capture workers who have higher status within the firm. Such status could be the result of greater education, skills, seniority, or supervisory duties. These are workers who may identify more with their jobs and who may want to return to work sooner. Or they may be the ones who have more decision latitude within the firm and better ability to accommodate and manage their return to work. In our data we have information about *tenure;* furthermore the nature of the employer-employees matched data permit us to calculate a measure of *relative wages* that we can use as a proxy for worker's status within his/her firm (the ratio of individual blue collar wage and average blue collars' wage within the firm).

d. Workers' fear that a long time off work will lead to retaliation in terms of future job loss, or poor future career prospects.

Because injuries produce significant adjustment costs, injured workers are often concerned about facing stigma and retaliation by their co-workers and by their employers if they take a long disability leave (Galizzi et al. 2010). Such fear may lead workers to speed their return to work. Or, put it differently, firms can vary in their ability to influence their employees' decisions, and some employees may fear retaliation in term of higher likelihood of future layoffs, or compromised future career opportunities. In this context, a higher job security provided by the Employment Protection Legislation (EPL) is crucial to reassure workers about their future within the firm. Because employment protection is less stringent in *small firms*, we may expect workers to feel more pressure to return to work quickly in smaller firm. At the same time the small firm/limited EPL effect on return to work should be tested against a different explanation: that workers return slower to smaller firms because these establishments may have a harder time accommodating disabled employees (Krause et al., 2001). Furthermore, firms' investment in workers' specific human capital can shield injured workers against any "stigma", and protect their career prospects despite the work incident. We would then expect *longer tenure* workers to feel "safer" and to take longer time to return to work.

Finally, some specific categories of workers may be more vulnerable to pressure to return to work before full recovery because they have weaker bargaining power. We know that *immigrants* are on average more exposed to the risk of displacement (i.e. discrimination); or they can feel this to be the case as their position in the labour market is usually weaker (Venturini and Villosio, 2008; Pastore and Villosio, 2012). The same argument can apply to Italian *female* employees, who often face substantial degrees of discrimination, comparable to the one suffered by male foreigners workers (Venturini, Villosio, 2000; Olivetti and Petrongolo, 2008; Wetzels, 2008).

Controlling for all these factors –individual wage, firms' workers turnover, individual wage growth, firm's relative wages, size and selected workers' characteristics - we try to single out the effect of firms' higher costs (as measured by wage levels) as the main reason for the firm to put pressure on workers for a speedier return to work versus other explanations based on workers' commitment, status, fear of retaliation, and general preferences.

The empirical model

The main variable of interest for our analysis is the time off work and we study it with the help of survivals models (Lancaster, 1990, Wooldridge, 2002). Our main concern is to mitigate the effect of unobserved heterogeneity on our estimated coefficients, as one never really observes all the factors that may affect the process under scrutiny. Unobserved heterogeneity may lead to an estimate of negative duration dependence simply because workers with higher hazards of returning to work will return sooner, leaving behind those workers who face greater difficulties in returning to employment (Galizzi and Boden, 2003). Furthermore, it may lead to a downward bias on the (absolute value of the) estimated parameters (Jenkins, 2005) so that we may end up estimating only a lower bound of the true and larger effect of the regressors on the hazard rate.

We could estimate our model including explicitly unobserved heterogeneity. This would assume that unobserved heterogeneity is uncorrelated to observables. In fact, to model a general correlation between unobserved heterogeneity and the covariates requires data with repeated spells (i.e. repeated events) for each individual (Horowitz and Lee, 2004). However, selecting only individuals experiencing more than one injury would select a highly non-random sample that would compromise of the generalization of any estimated result.

In the context of survival analysis, Jenkins (2005) states that the effects of unobserved heterogeneity can be mitigated by the use of a flexible specification of the baseline hazard in a proportional hazard setting[x], as the shape of the baseline hazard would absorb the effect of unobserved heterogeneity so reducing its distortive impact on the estimated parameters β (equation 1). The most flexible option is to use a set of dummies on each time-interval. To take full advantage of this property, in our estimations we use a discrete time setting, even though the return to work process is a continuous time process. We model a complementary log-log function because such function is the discrete time counterpart of an underlying continuous time proportional hazard model (see Jenkins, 1995 for the proof). Its hazard rate reads as follows:

$$h_j(X_{ij}) = 1 - \exp\left[-\exp\left(X_{ij}^{'}\beta + \log\int_{t_{j-1}}^{t_j}\lambda_0(\tau)d\tau\right)\right] \qquad [1]$$

where X_{ij} is our vector of regressors for individual injured worker i (personal, firm, injury, and pecuniary characteristics of injury), j is the time spell in the discrete setting (weeks) while τ is time in its continuous flow within the spell, β is the vector of parameters to be estimated and $\lambda_0(\tau)$ is the baseline hazard function. The β coefficients are the same ones as those characterizing the continuous time hazard rate $h(t) = \lambda_0(t)\ exp(X_{ij}^{'}\beta)$ and can be easily interpreted (Jenkins, 2005).

As a further robustness, we also allow for the existence of time invariant unobserved individual heterogeneity uncorrelated to the *X*; we call it *v* and we include it assuming a normal distribution $N(0, \sigma_v^2)$. Now the hazard rate reads as follows:

$$h_j(X_{ij}) = 1 - \exp\left[-\exp\left(X_{ij}^{'}\beta + \nu_i + \log\int_{t_{j-1}}^{t_j}\lambda_0(\tau)d\tau\right)\right] \qquad [2]$$

Finally, we define an indicator d_{it} that is equal to one if individual i returns to work in the interval $[t_{j-1}, t_j)$ and is equal to zero otherwise. In each interval, censored observations contribute to the likelihood function only information about the value of the survival function at the end of the interval. We write the log likelihood function as:

$$\text{Log } L = \sum_{i=1}^{n}\sum_{j=1}^{t_i}\{d_{ij}\log\ h_j(X_{ij}) + (1-d_{ij})\log[1-h_j(X_{ij})]\} \qquad [3]$$

The chosen regressors

Across our specifications, the main data generating process for $X\beta$ is specified as follows. We control for the type of incident: nature of injury, body part injured, and the degree of disability. We control for age, as we expect that any injury takes longer to recover from as age increases. We control also for individuals' past sick leaves[xi]. We expect those individuals who have experienced more of these episodes to have worse health and hence a reduced natural ability to recover. This last control can be interpreted also as capturing a higher propensity to absenteeism. In both cases we expect it to slow down the return to work.

To test the hypothesis that employers may put some pressure on “more expensive/productive” workers, we focus on the cost of each injured worker that we measure in terms of the (log of) individual gross real daily wage.

Because a high wage could also capture workers with higher job commitment who want to return to work sooner, we try to control for this effect by including two covariates aiming at capturing workers' commitment. First, a measure of workers’ turnover at the firm level[xii], as firms that aim at increasing loyalty and commitment of their workers invest in specific human capital and experience a lower turnover rate of employees. Second, a dummy variable that captures whether the average annual real wage growth experienced by the worker since the time of his/her hiring at the firm is "high", i.e. above the 75th percentile in the wage growth distribution across all firms[xiii].

We use a dummy signalling whether the individual blue collar worker’s wage is above the average wage of blue collars in his/her own firm to capture the worker’s relative status. This could indicate a worker’s greater control on his/her job and a greater actual -or perceived- sense of being important and essential for the firm’s functioning.

Finally to test the effect of perceived job security as a factor determining workers return to work patterns, we estimate whether workers return earlier as firm size decreases (the EPL hypothesis would require them to return earlier the smaller the firm): whether workers with longer tenure take longer to return to work: and whether more vulnerable workers (migrants and women) return earlier with respect to natives and men.

We control also for additional firm characteristics to capture the effect of firms' heterogeneity and competiveness: growing/shrinking firms, firm’s age, and industrial sector. Finally, we control for geographical area and calendar year, to capture both the effect of regional practices and cultures, and the effect of the business cycle on labour market tightness. As a final robustness check we split the sample by gender, nationality, firm size, and injury characteristics.

6. Descriptive analysis of occupational injuries

Our descriptive statistics refer to .the previously described sample. They correspond to 180,420 individuals employed in 105,573 firms. Such sample is made of injured workers who were predominantly male (85%), native (83.5%), and full time employees (94%), with an average age of 37 years and an average tenure of 4.6 years at the time of injury. They were employed in firms with an average size of 1611 employees, but a median size of 36 employees, and operating mainly in the construction (17%), metallic and machinery manufacturing (24%), textile and food manufacturing (18%) and trade (11%) sectors. The majority of these firms were located in the northern regions of the country (63%) (Table I in Appendix).

The length of time off work

Our variable of interest is the length of the spell off work due to an on-the-job injury; our analysis excludes very short spells, as the INAIL dataset records injury events resulting into a leave longer than three days only. Table 1 displays the distribution of such variable. Almost all injured workers were back at work within two months; the average time off work across all cases was 27 days half of employees returns to work within two weeks, a much shorter time frame compared to what is usually found in other studies that have used U.S. workers' compensation data (Reville et al. 2001, Galizzi and Boden 2003, McLaren et al. 2010). This is a quite interesting result given that we would have expected more pronounced evidence of post injury moral hazard behaviours given the 100% replacement rate enjoyed by injured Italian workers. The distribution of days off work is quite stable over the years that we are studying although the distance between the 50th and the 90th percentiles has increased over the most recent years, possibly as an effect of a reform that was introduced in the country in 2000[xiv]. Off work spells longer than 90 days are quite rare, being less than 5% of the total.

Table 1 here

In our sample only 1.34% of workers left their employer before the end of the healing period; 4.12% separated upon return (during the same month). This is not surprising given that our sample is limited to permanent contract workers whose jobs at return are protected by law. It is interesting to notice that foreigners faced quite higher shares, 2.6% and 5.8% respectively, hinting to a possible case of discrimination or retaliation.

Injury severity

The time off work, together with the degree of permanent disability, is often used as a proxy of injury severity (Bena et al., 2012). In our study time off work represents the outcome variable; therefore we use only the information on the degree of permanent disability to assess the consequences of the incidents. We set two thresholds: a degree of permanent disability above 20% is said to generate a "severe permanent damage", while one between 1% and 19% generates a "mild permanent damage". A degree of 0% indicates a temporary disability. The 20% threshold is chosen to be above the legal thresholds granting specific compensations, which varied over time[xv]. This choice is to avoid the bias due to the habit to overstate the degree of disability for workers just below the threshold, which can cause spurious heaps in the distribution of disability degrees.

In our sample 89.7% of workers experienced only temporary and no permanent disability, 9.4% a mild damage and 0.9% a serious one. As expected, there is a clear correlation between the degree of permanent disability and the length of time off work (Figure 1).

Figure 1 here

It is important to note that a lack of permanent disability does not necessarily imply lack of injury severity. In fact, temporary disabilities that require long healing time can also be quite severe. Therefore to reach a better understanding of the nature of injuries, we focus on the distribution of the occupational incidents by type of injury and body part (Table II in the appendix). About one third of recorded injuries were wounds or bruises in the upper extremities, and 11 % were back injuries. In general, back injuries are among the most controversial work related injuries given the difficulty workers may encounter in proving that they are work related. Table II also displays the share of injuries generating a serious permanent damage, being them anatomic losses or, more seldom, fractures.

Wages

One of the key variables in our analysis is the worker's individual wage. In our data we can compare the individual wage of injured workers to the average wage their firm pays to workers with similar qualification (blue-collar workers). We find that injured workers earned as much as 16% less than the average wage of blue collars in their own firm, and the share of injured workers earning more than the firm average was about one fifth (18%). To investigate this issue further we split the sample by workers' tenure, age and firm size quartiles (Table 2). The main insight we gain from this analysis is that the negative wage gap between injured and non-injured workers is not due to sample selection (by tenure, age or firm size), but it is present in all the subsamples we consider[xvi]. Similarly, a significant share of high wage workers was present in all the subsamples we considered. To the best of our knowledge, despite the interest in the topic of compensating wage differentials, there are not many analogous descriptive statistics measured at the firm level in the economic literature. We will exploit this piece of information in our empirical model.

Table 2 here

Firm size

Finally, given our interest in understanding the potential role played by employment protection legislation, we analyse the relationship between days off work and firm size. We split our analysis also by age quartiles to reduce composition effects; in fact, age proxies the individuals' natural speed of recovery, and the average age of the workforce is lower in smaller firms (Contini, 2002). It emerges (Table 3) that for any given age group, workers in larger firms exhibit shorter spells off work, on average, but this is clearly linked to the larger share of serious incidents reported by small firms compared to larger ones.

Table 3 here

To cast more light on the higher rate of serious injuries in small firms emerging in Table 3, we estimate the probability of suffering a severe permanent disability instead of a non-severe one (i.e. mild or no permanent damage). We estimate a probit model where the likelihood of suffering a permanent impairment above the 20% disability threshold is a function of firm size, conditional on the nature of injury, body part injured and worker's age. Table 4 shows that the conditional probability of experiencing a serious injury decreases as firm size increases. This multivariate analysis excludes that the higher rate of serious injuries in small firms is due to simple composition effects.

Table 4 here

The higher incidence of severe incidents in smaller firms is consistent with the international literature. When focussing on fatal events (that are excluded from our sample), literature reports fatality rates which are up to 10 times higher in small firms with respect to medium to large size ones (Lents and Wentzl, 2007; Mendeloff et al., 2006; Walters, 2001; Stevens, 1999). Literature documents also a higher share of severe injuries in small firms: e.g. in USA (Olenick *et al.*, 1995), Britain (Nichols *et al*., 1990), Italy (Fabiano et al., 2004). It is also recognized that a higher exposure to ergonomic, physical and chemical hazards exists in smaller firms (Sorensen et al., 2007). Furthermore, prevention is more difficult because of fewer safety and health resources (Lents and Wentzl, 2007), and also safety regulations developed primarily for larger firms may be less effective (Breslin *et al*., 2010).

While various explanations for this may be investigated, underreporting of injuries from small establishments is considered to be a substantial possibility (Olenick *et al*., 1995). Indeed, smaller firms enjoy a higher ability to under-report less severe or less "objective" injuries (while injuries with severe permanent damage are more difficult to underreport and hence they show up more in statistics like Table 3). In fact, external monitoring is looser in small firms, and the additional insurance costs generated by a work injury can be more relevant for a small business.

The point is relevant because it entails a potential bias in our estimations –in particular on the estimated effect of firm size on return to work. To tackle the issue, we will estimate our hazard model also by type of injury. Injuries that require immediate medical assistance (e.g. fractures, anatomic losses) are very difficult not to report and they might provide different estimates of our model. In fact, the next section will discuss that the effect of firm size on the hazard of returning to work emerges only when we focus on injuries that cannot be hidden**.**

7. Estimation Results

As discussed in section 5, our regression analysis aims at highlighting the role played by individual wage – a potential measure of firm's costs or workers' commitment - and of other firms' and workers' characteristics on the hazard of returning to work after a first occupational injury.

We estimate a discrete time proportional hazard model with fully flexible baseline hazard and normally distributed random effects, i.e. time invariant unobserved individual heterogeneity uncorrelated to the X with a normal distribution $N\left(0,\sigma_v^2\right)$. The estimated coefficients of the variables of interest are reported in Table 5 as *exp(β)*, i.e. hazard ratios; when *exp(β)>1* the return to work is faster, when *exp(β)*<1 it is slower. The table highlights in bold the estimated coefficients that are significant at 90% confidence level.

Table 5 presents results referred to the whole sample (model A) as well as to several subsamples, i.e. by gender, nationality, firm size and kind of injury. Results are strongly robust across all these estimations, and are discussed jointly[xvii].

Table 5 here

The estimated conditional time profile of the hazard (reported in appendix A) shows that the likelihood of returning to work picks at three weeks and then declines (Figure 2). Because the replacement rate provided by the public insurance system jumps from 60% to 75% of wages after 90 days of leave (12.8 weeks), we include separate intervals until 15 weeks to highlight an eventual sudden change in the return to work likelihood around that threshold. However, the estimated time profile shows no significant changes around the 13 weeks threshold.

Figure 2 here

As far as injury characteristics are concerned (reported in appendix A), we find that the medical determinants (nature of injury and injured body part) influence the length of the spell off work as expected. As anticipated by Figure 1, injuries resulting in permanent disabilities lengthen dramatically the return to work compared to temporary disabilities. The more severe permanent disabilities also produce much longer spells off work. Regardless of the degree of permanent disability, the hazard is the lowest in the case of fractures and anatomic losses and the highest when injuries are caused by “foreign bodies”. Even when we control for tenure, we find that older workers and workers with a history of health problems (captured by the frequency of past sick leaves) delay return to work significantly.

Conditional on the above medical determinants of the speed of return to work, we now turn to the non-health related dimensions of the issue at stake. One of our hypotheses stated that in an institutional environment where the marginal monetary cost of occupational injuries falls mainly on firms, employers might be inclined to pressure - or to accommodate more promptly - the most costly/productive workers so that they will return to work sooner. Indeed, our estimations show that a higher individual wage speeds the return to work.

As we discussed before however, higher wages could also indicate efficiency wages and, therefore, stronger workers’ commitment toward their employers. Therefore, the simple effect of wages on the hazard does not permit to test the high wage/cost hypothesis against the high commitment hypothesis. For this reason our model specification tries to control for workers’ commitment through other variables: the history of the injured worker’s wage growth within the firms and the history of the firm’s effort to retain its employees. We assume that workers will be more attached to employers who have rewarded them more over time through raises, and employers who have a history of investing in human capital and valuing long term employment relations with their workers (so decreasing workers' turnover in excess to job creation and destruction). Indeed, we find that a higher wage growth experienced by the worker within the current firm is linked to a significantly speedier return to work. Also the higher the excess worker turnover in the firm the slower is the return to work. Therefore, to the extent that our model specification and variables capture workers' commitment, our results show that more attached workers will speed their return to work after an occupational injury. The dummy signaling whether the wage of the injured worker is higher than the average wage of other blue collars in the same firm has also a large and significant effect. This suggest that workers with higher status within the firm speed their return to work possibly because more urgently needed or because more able to advocate for their own accommodation. But most importantly, our results show that, controlling for commitment and relative status, high wage workers have still shorter spells off work, suggesting potential pressure to return to work put by firms on their more costly employees.

Firms can also vary in their ability to influence their employees' decisions. Even in an institutional setting that require the firm to guarantee a job to injured workers at their return to work, employees may fear retaliation in term of higher likelihood of future layoffs, or compromised future career opportunities. This is more likely to happen in firms where EPL is less enforceable and there is lower job security, as in small firms (Garibaldi et al., 2004). However, at first (models A-I in Table 5) the estimated effect of firm size on return to work produces mixed results. In fact the interpretation of this coefficient - and therefore of the role played by potential perceived job insecurity- is complicated by the pattern of underreporting of occupational injuries in smaller firms that we detected earlier in Table 4. Hence, we split the sample by types of injury (models J to Q in Table 5). Some injuries are likely to require immediate medical treatment ("fractures", "anatomic losses", "and foreign bodies"). Hence firms' under-reporting of these injuries is less likely and we should be able to observe most, if not all, of them regardless of firms' dimensions. Indeed, the results for these last estimated models become clearer (models J to Q in Table 5). The effect of firm size on the length of time off work that we estimate by selecting these more objective injuries confirms the job security explanation: workers take longer time to return to larger firms after fractures, foreign body treatment and anatomic losses (although in this last case the tiny sample size provides quite imprecise estimates). Notice that the selection on these injuries is likely to identify workers who are more likely to need accommodation at their return to work. These accommodations are much easier to implement and therefore likely in larger firms. The fact that nonetheless we estimate a speedier return to small firms supports even more strongly our "job security" hypothesis.

Workers may also differ in their vulnerability and, therefore, in their perception that a long time off work will jeopardize their employment prospects. Longer tenure workers who have received more investment in firm specific human capital are likely to feel more secure on their jobs. In fact, we find that tenure - conditional on wage, wage growth, relative wage, firm's growth and age - slows down the return to work significantly. Vice versa our results show that, given the same type of injury and work history, women return to work sooner. The estimated hazard shows also that foreign-born workers return to work significantly earlier than natives. These results are consistent with the lower job security/discrimination/retaliation hypothesis, although we cannot dismiss alternative explanations. For example, immigrants could be characterized not only by less employment protection but also by a "healthy worker effect" that might explain a shorter healing period: those who migrate could be healthier than those who do not. Although we try to control for workers' general health through our variable capturing past illnesses, it is difficult to dismiss completely this alternative hypothesis. In fact immigrants could also be more hesitant to disclose illnesses and ask for sick leave. It is also plausible that immigrants have less access to good medical care with respect to natives; this would worsen actually their general health and their ability to heal. With our data it is not possible to identify the prevailing effect, or whether they compensate each other. However, none of the above arguments (healthy worker or reduced access to healthcare) apply to women, who nonetheless return to work significantly earlier.

Finally, our analysis includes also several variables aiming at capturing other dimension of the work environment. Studies on firm performances indicate that firms usually become more efficient at addressing new problems, including safety problems, over time (Seabury et al. 2014). Accordingly, in our study older firms are able to speed up the return to work of injured workers, conditional on all the mentioned controls. Compared to shrinking and stable firms, injured workers also return faster to work at expanding firms. This could indicate some pressure that workers may experience to return to work faster when they are - or feel - much needed. Finally, we find a significant difference in the hazard of returning to work depending on whether workers were employed by firms operating in the north-eastern, central or southern regions of the country with respect to north-western regions. Workers in the north-east take less to return to work. This may suggest regional differences in medical, employment, or cultural norms.

9. Conclusions

Early return to work after an injury is desirable because long spells off work imply productivity losses and adjustment costs for the firm. Workers' skills also risk becoming obsolete. Potential resentment on the part of co-workers and employers can jeopardize future employment and career perspectives. At the same time, when workers return to work before full healing, they increase their probability of long run health problems and, therefore, of repeated absences or injuries.

This study represents one of the first analyses exploring the factors affecting the return to work of injured workers in an institutional setting – the Italian labour market- where workers do not face an immediate incentive to return to work to limit their earnings losses. A combination of labour market regulations and unions practices guarantees Italian injured employees both job security and workers' compensation benefits corresponding to a 100% replacement.

We exploit a matched employer-employees data set, merged with administrative workers' compensation data, to assess whether information about workers' and firms' employment histories can provide us with additional insights about incentives that speed returns to work.

Our descriptive analysis shows some important results. First, we find that the high level of workers' compensation benefits income replacement does not exacerbate moral hazard behaviour. In fact our data show that, if anything, Italian injured workers' spells of work, are shorter than the ones observed in northern American countries where replacement rates are lower. We find also that injured workers earn as much as 25% less than the average wage in their own firm, and that the share of injured workers earning more than the firm average is as small as 18%.

Our multivariate analysis suggests that even in an environment where workers do not face immediate monetary incentive to return to work early, their earnings and earnings history play a large role in determining the length of the spells off work. On one side, workers who are likely to have developed stronger attachment to their firm –because of better compensations over time and because employed in firms with better histories of stable employing – tend to return to work sooner. The same is true for workers with higher relative status within the firm. Workers who may feel more vulnerable - such as immigrant or female workers - or less protected by employment protection legislation – such as employees in smaller firms – also tend to return to work sooner. On the other side, even when we control for our measures of commitment, status, and job security we find that high wage workers return to work sooner. Because we study an institutional environment where the marginal cost of workers' compensation benefits falls largely on firms, we interpret this result as an indication that in this setting firms put pressure on those workers whose time off ends being more costly to the employer, i.e. high wage workers.

Our study shares some of the limitations common to analyses that have explored the determinants of spells off work after a first occupational injury (Dasinger et al. 1999). Our measure of time off work focuses on time until the first return to work as recorded by the disability payments administrative records. Given the Italian institutional setting this measure should capture correctly the time of return to paid employment. However, studies based on North American data have shown that a first return to work is often not synonymous of "successful return to work" (Butler et al. 1995). In fact a first spell of work is often followed by additional episodes of occupational injuries and temporary disabilities (Galizzi 2013, Krause et al. 1999), of unstable employment (Butler et al. 1995, Galizzi and Boden 2003), or of compromised work reintegration and advancement (Young et al. 2005, Wasiak et al. 2007). There is no reason to believe that these issues should not characterize European labour markets as well. Therefore our future research will focus on the problem of recurrent injuries, unemployment spells, and careers that may follow an occupational injury.

Our analysis is also original because it is the first study to analysis return to work in an institutional setting where most injured workers are guaranteed a 100% workers' compensation replacement rate. Our data does not permit to control for the potential loss of overtime compensation, however. This could represent another impotent channel pressuring high wage workers to return to work sooner.

Our current study is also focused on Italian injured employees who were employed with permanent contracts. The Italian legislation introduced changes that facilitate the hiring of employees on temporary contracts after 2001. Such workers are not protected in terms of a guaranteed job at the end of their spell of disability and may face very different incentives to return to work. Their role within the firm may be different as well. Therefore, our future analysis will also explore potential differences in occupational injuries outcomes between workers employed with permanent or temporary contracts.

Finally, our research has made use and stressed the role played by measures of firm's turnover, firm's relative wages, individual wage growth, firm size and workers' gender and nationality. We have done so to capture the role played by firms' costs, workers' statuses, job commitment and job security. Such approach was guided by the increasing awareness that return to work patterns cannot be properly understood without knowledge of the work environment, and of the perceived quality of workplace relations (Krause et al. 2001, Allen et al. 2003, Pransky et al. 2005, Young 2010). Despite our effort to estimate a model that accounts also for unobserved heterogeneity, we are aware that administrative data are not designed to capture all these work environment factors, however. Therefore, our study also suggests the need to develop further research on this topic by combining administrative data with survey and qualitative data.

To conclude, our results suggest the importance of employees' commitment, status, and job security considerations. Even when our proxies for these factors are controlled for, the findings show that high wage workers return to work sooner. This suggests that employers may put more pressure - or may be more willing to accommodate - the most costly employees to reduce the financial burden associated with their obligation to replace workers' lost earnings and productivity. This finding highlights a different dynamic from the one that has been previously shown in studies concerning the North American labour market, where the focus is often on workers' moral hazard behaviours or earning losses. Our study represents therefore not only an important contribution to understand the understudied economic factors affecting the outcomes of occupational injuries in the European context; it also highlights that return to work policies have to be designed to reflect, address and coordinate all the different stakeholders' interests (Franche et al. 2005, Young et al. 2005): workers, employers, and public agencies whose concerns are largely affected by institutions and regulations.

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TABLES

Table 1: Distribution of days off work by calendar year (10th percentile, 25th percentile, median, 75th percentile, 90th percentile)

Year	**P10**	**P25**	**Median**	**P75**	**P90**
1994	5	7	13	26	53
1995	5	7	13	26	52
1996	5	7	13	26	54
1997	5	7	12.5	26	54
1998	5	7	13	26	55
1999	5	7	13	28	59
2000	5	7	14	29	62
2001	5	7	13	29	60
2002	5	7	14	29	63
2003	5	7	14	29	64
2004	5	7	14	31	66
2005	5	7	14	32	69

Source: own calculations on WHIP-INAIL data

Table 2: Wages of Injured Workers relative to average wages within their own firm (median of the distribution), and share of injured workers earning wages above the average wage within their own firm.

	median (w_i - w_f) / w_f	share w_i>w_f
tenure quartiles		
1	-0.180	0.133
2	-0.139	0.161
3	-0.175	0.180
4	-0.180	0.242
age quartiles		
1	-0.214	0.117
2	-0.146	0.178
3	-0.138	0.205
4	-0.157	0.219
firm size quartiles		
1	-0.106	0.204
2	-0.155	0.193
3	-0.164	0.188
4	-0.267	0.140
Total	-0.164	0.179

Source: own calculations on WHIP-INAIL data

Note:
W_i=individual wage
W_f=average wage of blue collars in the firm
Tenure quartiles cuts: 303, 1022, 2835 days.
Age quartiles cuts: 28, 36, 45 years old.
Firm size quartiles cuts: 10, 36, 199 employees.

Table 3: Mean and standard error of days off work and share of severe occupational injuries by workers' age and firms' size quartiles.

	Age class	Firm size class 1	2	3	4
mean days of absence	1	25.250	22.125	21.231	19.965
s.e.		0.402	0.347	0.376	0.327
share serious injuries		**0.009**	0.005	0.004	0.003
s.e.		0.001	0.001	0.001	0.000
mean days of absence	2	28.511	25.168	24.145	22.269
s.e.		0.460	0.385	0.385	0.308
share serious injuries		**0.010**	0.005	0.004	0.003
s.e.		0.001	0.001	0.001	0.000
mean days of absence	3	32.028	28.780	26.410	25.931
s.e.		0.548	0.482	0.439	0.375
share serious injuries		**0.015**	0.010	0.007	0.006
s.e.		0.001	0.001	0.001	0.001
mean days of absence	4	40.073	34.878	31.272	28.742
s.e.		0.689	0.583	0.560	0.364
share serious injuries		**0.029**	0.021	0.016	0.011
s.e.		0.002	0.002	0.001	0.001

Source: own calculations on WHIP-INAIL data
Note:
Age quartiles cuts: 28, 36, 45 years old.
Firm size quartiles cuts: 10, 36, 199 employees.

Table 4: Probability of experiencing a serious injury

	Coef.	Robust Std. Err.
log of firm size	**-0.057**	0.005
Wound	-0.019	0.035
Bruise	**-0.127**	0.048
Dislocation	**0.872**	0.032
Fracture	**1.395**	0.058
anatomic loss	0.023	0.064
Lesion	**-0.217**	0.064
foreign body	**-0.249**	0.119
Trunk	**0.540**	0.062
Head	**0.354**	0.061
Back	**0.107**	0.057
lower extremities	-0.077	0.057
Log of worker age	**0.656**	0.042
Constant	**-4.930**	0.175

Source: own calculations on WHIP-INAIL data

Notes: bold: 90% significant

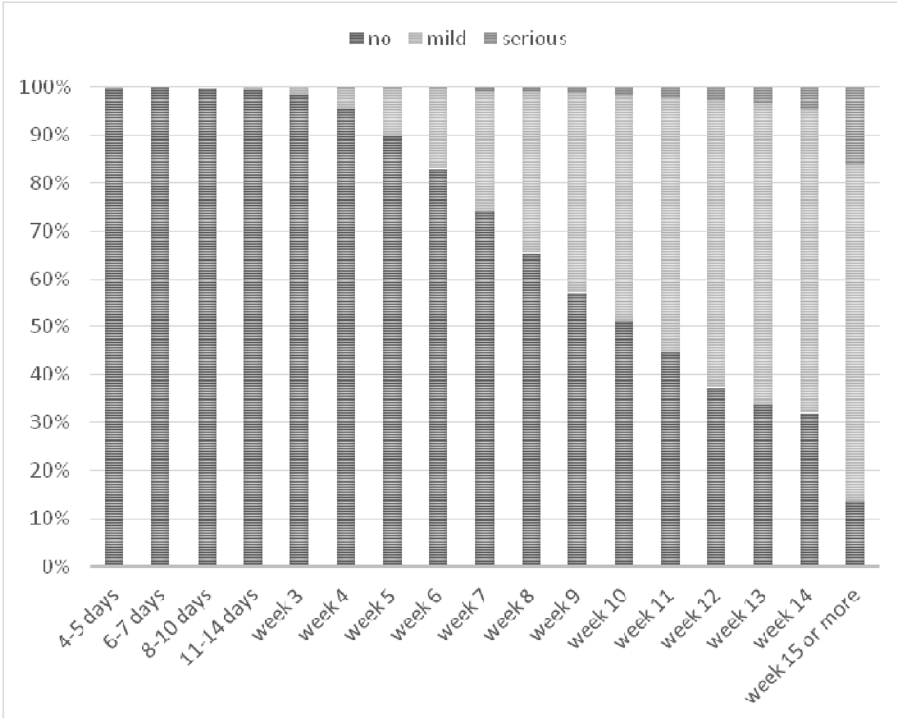
Table 5: Estimated hazard ratios of returning to work. Discrete time proportional hazard model with fully flexible baseline hazard and normally distributed random effects.

model	selection	individual obs.	log individual age	illness rate	log real weekly wage	individual w > firm mean w of blue collars (dummy)	within firm wage growth above 75 pctile (dummy)	firm excess turnover	log tenure	female (dummy)	part time (dummy)	foreigner (dummy)	log firm size	growing firms (dummy)	shrinking firms (dummy)	log firm age	north eastern regions (dummy)	central regions (dummy)	southern regions (dummy)
A	none	166,448	**0.695**	**0.771**	**2.620**	**1.046**	**1.140**	**0.955**	**0.980**	**1.085**	0.971	**1.249**	0.997	**1.053**	1.003	**1.020**	**1.221**	**1.114**	**0.921**
B	males	142,938	**0.682**	**0.806**	**2.618**	**1.053**	**1.143**	**0.955**	**0.983**		**1.079**	**1.254**	**0.995**	**1.060**	1.007	**1.016**	**1.234**	**1.104**	**0.910**
C	females	23,510	**0.754**	**0.615**	**2.637**	1.006	**1.115**	0.968	**0.965**		**0.871**	**1.154**	**1.015**	1.005	0.988	**1.033**	**1.188**	**1.177**	**1.079**
D	natives	139,117	**0.687**	**0.739**	**2.524**	**1.059**	**1.134**	**0.954**	**0.979**	**1.093**	0.972		0.998	**1.057**	1.002	**1.028**	**1.201**	**1.104**	**0.923**
E	foreign	27,331	**0.793**	**0.885**	**3.738**	0.948	**1.189**	**0.946**	**0.976**	0.953	0.959		0.990	1.016	0.986	0.975	**1.364**	**1.200**	**0.880**
F	dip_med<=15	55,699	**0.645**	**0.842**	**3.515**	0.997	**1.065**	**0.947**	**1.012**	1.050	**0.911**	**1.287**	**1.045**	0.964	**0.938**	1.003	**1.299**	**1.207**	**0.817**
G	dip_med>15	110,749	**0.710**	**0.749**	**2.423**	**1.069**	**1.168**	1.010	**0.961**	**1.091**	1.000	**1.214**	0.996	**1.072**	1.013	**1.019**	**1.189**	**1.078**	0.996
H	dip_med<=50	92,080	**0.587**	**0.769**	**3.125**	**1.045**	**1.124**	**0.940**	0.997	1.032	0.939	**1.286**	**1.033**	0.984	**0.963**	0.996	**1.312**	**1.205**	**0.839**
I	dip_med>50	74,368	**0.666**	**0.685**	**2.178**	**1.139**	**1.196**	**1.082**	**0.953**	**1.095**	0.989	**1.200**	**0.992**	**1.069**	0.999	**1.021**	**1.173**	**1.051**	**1.044**
J	WOUND	50,723	**0.619**	**0.798**	**1.934**	**1.066**	**1.096**	**0.966**	**0.978**	**1.188**	0.972	**1.107**	**1.013**	1.015	0.997	1.009	**1.202**	**1.080**	**0.921**
K	BRUISE	51,475	**0.605**	**0.798**	**1.792**	**1.119**	**1.143**	**0.955**	0.992	**1.046**	**0.917**	**1.191**	0.999	**1.029**	0.988	**1.015**	**1.155**	1.027	**0.948**
L	DISLOCATION	27,936	**0.771**	**0.716**	**2.046**	**1.128**	**1.196**	**0.948**	**0.971**	**0.891**	1.027	**1.429**	0.992	**1.098**	1.007	1.020	**1.164**	**1.219**	0.961
M	FRACTURE	20,055	**0.721**	0.918	**2.471**	1.067	**1.107**	**0.921**	1.002	1.049	**0.860**	1.046	**0.987**	0.970	0.962	1.003	**1.304**	**1.123**	**0.825**
N	ANATOMIC LOSS	1,322	0.981	**0.296**	**5.441**	0.941	0.714	1.207	1.074	0.643	0.833	**0.449**	**0.852**	0.789	1.073	0.850	**1.660**	1.292	0.904
O	LESION	6,364	**0.616**	0.900	**2.047**	0.941	1.098	0.945	0.976	**1.233**	**1.215**	**1.311**	**1.025**	1.009	0.965	1.010	**1.358**	**1.217**	0.891
P	FOREIGN BODY	5,904	**0.649**	**0.614**	**1.502**	**1.196**	1.047	**0.879**	1.028	1.034	1.086	1.111	**0.978**	0.999	0.955	0.993	**1.305**	1.018	**0.719**
Q	STRAIN	2,669	**0.534**	**0.601**	**2.696**	1.036	**1.180**	0.946	**0.914**	**0.745**	0.878	**1.270**	0.973	1.056	0.923	1.001	**1.188**	1.073	**0.816**

Source: own calculations on WHIP-INAIL data. Bold: 90% significant

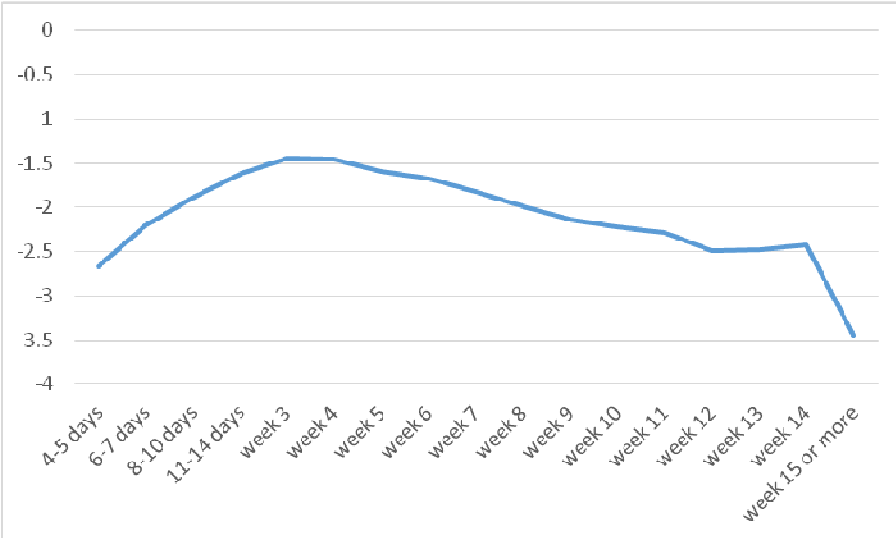
Additional controls: time spline as in Figure 2, medical determinants (part injured, type of injury, degree of permanent disability), dummies on each calendar year 1994-2005, 10 industry dummies. Stata v. 12 xtcloglog estimation command. See appendix III for details.

Figure 1: Shares of injured workers by degree of permanent disability and by time off work.



Source: own calculations on WHIP-INAIL data

Figure 2: Estimated time profile, model A. Hazard rate.



Source: own calculations on WHIP-INAIL data

APPENDIX

Table I: Descriptive statistics

	Mean	Std.Dev.
AVERAGE DURATION OF TIME OFF WORK		
days	26.9	46.1
MEDICAL DETERMINANTS		
wound	0.301	
bruise	0.311	
dislocation	0.170	
fracture	0.121	
anatomic loss	0.008	
lesion	0.039	
foreign body	0.035	
strain	0.016	
trunk	0.147	
head	0.111	
back	0.241	
lower extremities	0.463	
upper extremities	0.038	
no permanent damage	0.897	
mild permanent damage	0.094	
serious permanent damage	0.009	
MAIN CONTROLS		
Age (years)	36.951	10.464
log individual age	3.569	0.288
illness rate	0.173	0.208
real weekly wage (euro)	60.292	17.215
log real weekly wage	4.060	0.283
individual w > firm mean w of blue collars (dummy)	0.179	
within firm wage growth above 75 pctile (dummy)	0.212	
excess turnover	0.329	0.547
tenure (days)	1690.647	1702.201
log tenure	6.597	1.695
female (dummy)	0.148	
ptime (dummy)	0.057	
foreign (dummy)	0.165	
average firm size	1611.556	9067.530
Median firm size	35.666	
log firm size	3.955	2.292
growing firms (dummy)	0.416	
stable firms	0.352	
shrinking firms (dummy)	0.232	
Firm age (years)	16.327	11.406

log firm age	2.459	0.934
OTHER CONTROLS		
north west	0.332	
north east	0.295	
centre	0.179	
south	0.195	
year 1994	0.134	
1995	0.114	
1996	0.100	
1997	0.092	
1998	0.083	
1999	0.079	
2000	0.078	
2001	0.075	
2002	0.067	
2003	0.064	
2004	0.060	
2005	0.054	
agriculture	0.005	
utilities	0.009	
mining	0.081	
Metalllic and machines	0.236	
textile food	0.182	
contructions	0.175	
trade	0.112	
transportations	0.076	
banking insurance services to firms	0.067	
education health	0.057	

Source: own calculations on WHIP-INAIL data

Table II : Type of injury and part of body injured

		Part of body injured					
Type of injury		**Trunk**	**head**	**back**	**Lower ext.**	**Uper ext.**	**Total**
Wound	cell %	0.16	5.44	0.11	2.70	21.71	**30.12**
	share serious	*2.83*	*1.20*	*0.52*	*0.37*	*0.26*	***0.45***
Bruise	cell %	2.21	4.26	3.91	9.07	11.61	**31.06**
	share serious	*0.55*	*1.75*	*0.43*	*0.18*	*0.27*	***0.49***
dislocation	cell %	0.17	0.26	4.91	8.16	3.47	**16.98**
	share serious	*0.99*	*0.21*	*0.43*	*0.24*	*0.32*	***0.32***
Fracture	cell %	1.01	0.49	0.85	3.38	6.39	**12.13**
	share serious	*1.86*	*8.35*	*10.51*	*5.02*	*2.25*	***3.82***
Anatomic loss	cell %	0.00	0.00	0.00	0.02	0.77	**0.80**
	share serious	*0.00*	*0.00*	*0.00*	*40.54*	*6.96*	***7.82***
Lesion	cell %	0.16	1.41	0.04	0.58	1.67	**3.86**
	share serious	*2.70*	*0.91*	*1.59*	*0.19*	*0.27*	***0.61***
Foreign body	cell %	0.02	2.86	0.02	0.05	0.51	**3.46**
	share serious	*0.00*	*0.80*	*0.00*	*0.00*	*0.00*	***0.66***
Strain	cell %	0.07	0.02	1.22	0.09	0.21	**1.60**
	share serious	*0.00*	*0.00*	*0.36*	*0.00*	*0.27*	***0.31***
Total	**cell %**	**3.80**	**14.75**	**11.05**	**24.06**	**46.34**	**100.00**
	share serious	***1.10***	***1.47***	***1.20***	***0.93***	***0.65***	***0.92***

Source: own calculations on WHIP-INAIL data

TABLE III: Model A

```
Random-effects complementary log-log model      Number of obs      =    853260
Group variable: idvar                           Number of groups   =    166448

Random effects u_i ~ Gaussian                   Obs per group: min =         1
                                                               avg =       5.1
                                                               max =        17

                                                Wald chi2(66)      =  98177.86
Log likelihood  = -360902.77                    Prob > chi2        =    0.0000
```

	exp(b)	Std. Err.	P>|z|
TIME PROFILE			
4-5 days	0.004	0.000	0
6-7 days	0.011	0.001	0
8-10 days	0.023	0.002	0
11-14 days	0.048	0.004	0
week 3	0.122	0.009	0
week 4	0.163	0.011	0
week 5	0.264	0.016	0
week 6	0.347	0.020	0
week 7	0.471	0.025	0
week 8	0.582	0.030	0
week 9	0.791	0.040	0
week 10	0.935	0.047	0.184
week 11	1.040	0.053	0.443
week 12	1.218	0.063	0
week 13	1.338	0.071	0
week 14	1.498	0.082	0
week 15 or more			
MEDICAL DETERMINANTS			
wound			
bruise	0.939	0.012	0
dislocation	0.522	0.010	0
fracture	0.131	0.004	0
anatomic loss	0.288	0.017	0
lesion	0.844	0.022	0
foreign body	2.590	0.083	0
strain	0.991	0.041	0.822
trunk	1.929	0.059	0
head	0.886	0.026	0
back	0.932	0.025	0.008
lower extremities	1.168	0.031	0
upper extremities			
no permanent damage			
mild permanent damage	0.030	0.002	0
serious permanent damage	0.003	0.000	0
MAIN CONTROLS			

log individual age	0.695	0.012	0
illness rate	0.771	0.019	0
log real weekly wage	2.620	0.067	0
individual w > firm mean w of blue collars (dummy)	1.140	0.014	0
within firm wage growth above 75 pctile (dummy)	1.046	0.014	0.001
excess turnover	0.955	0.009	0
log tenure	0.980	0.004	0
female (dummy)	1.085	0.018	0
ptime (dummy)	0.971	0.023	0.221
foreign (dummy)	1.249	0.018	0
log firm size	0.997	0.003	0.236
growing firms (dummy)	1.053	0.012	0
stable firms			
shrinking firms (dummy)	1.003	0.013	0.801
log firm age	1.020	0.006	0
OTHER CONTROLS			
north west			
north east	1.221	0.015	0
centre	1.114	0.016	0
south	0.921	0.013	0
year 1994			
1995	1.145	0.022	0
1996	1.139	0.023	0
1997	1.126	0.023	0
1998	1.095	0.024	0
1999	1.011	0.023	0.636
2000	1.000	0.022	0.994
2001	1.057	0.024	0.015
2002	1.063	0.025	0.01
2003	1.060	0.026	0.016
2004	1.023	0.025	0.351
2005	1.009	0.026	0.721
agriculture	0.946	0.073	0.474
utilities	0.660	0.036	0
mining	0.860	0.017	0
Metallic and machines			
textile food	0.953	0.014	0.002
contructions	0.797	0.013	0
trade	1.062	0.019	0.001
transportations	0.812	0.017	0
banking insurance services to firms	0.996	0.023	0.872
education health	1.001	0.025	0.957
ln σ_v	0.809	0.040	
σ_v	1.499	0.030	
ρ	0.577	0.010	

Likelihood-ratio test of rho=0: chibar2(01) = 7429.03 Prob >= chibar2 = 0.000
Note: Rho measures the share of total variance explained by *v*.

Source: own calculations on WHIP-INAIL data

Footnotes

[i] This practice suggests the need to study also the factors that affect the bargaining between the doctor and the patient (Franche and Krause, 2002). Unfortunately there are not available Italian data on this topic.

[ii] This was the typical Italian work contract - without termination date and with Employment Protection Legislation (EPL) provisions upon termination - during the 90s (Garibaldi et al., 2004, 2008, Berton et al., 2009). As of 2001 about 85% of the stock of employees worked with this contract. Since then, however, new hiring is mostly done with temporary contracts, i.e. contracts with a termination date. Already in 2005 temporary contracts represented more than half of all new hires. Our data covers this transformation period because it covers the 1994-2005 years.

[iii] Leombruni and Costamagna (2013) review 52 collective contracts covering over 90% of Italian employees. They find that for the first three days of leave, when the compensation is entirely paid by the employer, there are only four contracts where the replacement rate is below 100%. For the remaining period of the leave – which is the one relevant to our study since we are considering injuries with a prognosis longer than three days – all national contracts set a top-up to the benefit paid by INAIL up to the 100% of the wage. The only exception to this is the national agreement for the shoes industry, which sets a top-up at 80% of the wage for leaves below 20 days and raises the top-up to 100% afterward. In our data only 1.85% of workers are employed in the shoe-industry; being such a tiny group, including or excluding them from the estimates does not change our results.

[iv] Data on paid overtime in Italy is extremely scant and imprecise. Labour Force Survey (LFS) is the only available source but it provides this measure: "overtime hours are those that attract enhanced compensation for the worker, in the form of either an increased rate of pay or compensatory time off" (Eurofound 2003). For our study we are interested only in overtime resulting in enhanced compensation because this would represent an additional monetary loss for injured workers while off work. According to Eurofound (2003) the extent of overtime as a % of total volume of hours worked in Italy in 2001 was 4.5% in manufacturing, and 6.0% in the service sector. CNEL (*Consiglio nazionale dell'economia e il lavoro*) on its website (http://www.cnel.it/391) publishes the same statistics computed for large firms only: in 2005 overtime was 4.8% in manufacturing, 5.8% in services. Our own calculations with Italian LFS show that this figure varies a little with age, peaking at 35-44 years and averages to 5% overtime hours. But this figure is likely to be an overestimate of the potential lost compensated time because it includes also non monetary compensations like compensatory time off (quite common indeed). An average 5% overtime hours would imply an increase of the wage by about 5% (as on the one side overtime is paid more than ordinary hours, but on the other side this figure includes also non monetary compensations like compensatory time off - quite common indeed). Referring to a gross median daily wage of 60 euro, this would imply a daily gross loss of about 3 euro for each day off work for the worker and of about 90 euro (total labour cost) for the firm and INAIL (forgetting all additional and non monetary costs discussed so far). We cannot be more precise than this, and of course those individuals working longer overtime hours than the average would lose more. However, we think that the cost for the firm is so much larger that we can safely focus on it, disregarding the cost for the worker.

[v] The WHIP is a large work histories dataset built by the University of Torino with the cooperation of the Italian social security administration (INPS) and the LABORatorio R. Revelli, based on records sampled from INPS' archives. It is described at www.laboratoriorevelli.it/whip.

[vi] See footnote 3.

[vii] See footnote 2.

[viii] We observe that it is the first occupational injury in the life of the worker only for those who enter the labor market in1994 or afterward (20% of our sample).

[ix] In theory workers' compensation insurance could be considered a form of mandated benefits the cost of which firms can transfer on workers over time both in terms of lower wages and lower employment (Gruber and Kruger, 1991). The incidence of such transfer on Italian workers remains an empirical question that goes beyond the scope of this study. However, economic theory predicts that the

magnitude of this transfer will be affected by the elasticity of the labor supply. Italy is characterized by a high rate of unionization and by an industry-wide and firm-wide centralized wage bargaining system (Devicienti et al. 2008). Such institutional features are likely to hinder a quick transfer of workers' compensation insurance costs on workers. In fact, even if we assume that centralized wage bargaining accounts for the insurance premiums paid by firms, Italian employers have to assume the marginal monetary cost caused by any new injury. This is because they need to pay for the difference between the INAIL benefits and 100% of the injured worker's wage.

[x] In a proportional hazard model, the shape of the baseline hazard is assumed to be the same across all individuals, and covariates are assumed to shift the baseline hazard proportionately without affecting its shape. As the process is separable in covariates and time, this produces the very convenient property that odds ratios do not depend on the value of the covariates but are constant for every value of the covariates.

[xi] We use the number of recorded spells of absence due to illness since the first employment spell over the number of years in the labor market (both left-censored in 1985).

[xii] We use "Excess turnover" i.e. gross worker turnover minus job creation at the firm level

[xiii] Corresponding to a 3% growth rate. The results are robust to different thresholds (i.e. 60th percentile or 90th percentile).

[xiv] The reform made "the concept of right to heal prevail over the original concept of insurance against loss of earning capacity. [...] in other words the insurance organization now pays compensation chiefly for physical and psychological harm of the victim." (EUROGIP 2005, p. 27)

[xv] Prior to 2000 there was only one legal threshold, set at 9% permanent disability, above which the worker was entitled to permanent disability benefits. After 2000, the threshold to be eligible for benefits was raised to 19%, but an additional lower threshold was set at 5%, to grant eligible workers a one-time payoff compensation for the biological damage.

[xvi] It might reflect the distribution of injuries by job title within the blue collar category that is unobservable to us. However, job titles are usually correlated to age and tenure.

[xvii] In the Appendix we report diagnostic statistics and the hazard ratios of all controls included in model A. Full results for models B-Q are available upon request.