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## Labour Economics

journal homepage: [www.elsevier.com/locate/labeco](http://www.elsevier.com/locate/labeco)Beneath the surface: The decline in gender injury gap<sup>☆</sup>Tiziano Razzolini<sup>a,\*</sup>, Roberto Leombruni<sup>b</sup>, Giovanni Mastrobuoni<sup>c</sup>, Mario Pagliero<sup>d</sup><sup>a</sup> University of Siena, IZA, LABOR, Italy<sup>b</sup> University of Turin and LABOR, Italy<sup>c</sup> University of Essex, Collegio Carlo Alberto, NETSPAR and IZA, UK<sup>d</sup> University of Turin, Collegio Carlo Alberto, Italy

## HIGHLIGHTS

- We show a reduction in gender wage and injury gaps in Italy from 1994 to 2002.
- Results are driven by changes experienced by low-skilled female workers.
- Our analysis suggests that the effects are due to compensating wage differential.

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## ABSTRACT

Gender differences in the labor market are typically measured by the wage gap. In this paper, we investigate how extending the analysis to an additional job amenity, namely workplace safety, may shed new light on the evolution of gender differences. Our results show that focusing on one unique measure of the gender gap may provide a biased view of the actual progress of women in the labor market. In our data, a significant reduction in the wage gap has been accompanied by a relative increase in injury risk for some groups of workers, e.g. low-skilled female workers. The decreased gender wage gap for these workers does not necessarily imply an overall improvement in their labor market outcomes.

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## 1. Introduction

The gender gap measures systematic differences in outcomes that men and women experience in the labor market. Most developed countries are witnessing a secular trend that is reducing such differences. Such progress is typically evaluated based on wages only (see among others [Blau, 1998](#); [Blau and Kahn, 1997](#); [O'Neill and Polachek, 1993](#); [Del Bono and Vuri, 2011](#)). While wages are among the most important

job amenities, they are certainly not the only one. Job security, hours of work, safety, and career opportunities are just some of the factors that workers tend to care about.

However, whereas wages are quite readily observed and quantified, most other job amenities are not easily captured by labor force surveys or administrative data and remain largely unobserved to the researcher (see for an overview [Altonji and Blank, 1999](#); [Goldin, 1994](#)). In this paper, we investigate how extending the analysis to an additional job amenity, namely workplace safety, may shed new light on the evolution of gender differences. Workplace safety is one of the most important, yet understudied, job amenities. In 2009, over 2.8 million accidents involving more than three days lost occurred in the EU (Eurostat, 2012). During the same year, as a consequence of workplace accidents, 3.8 thousand workers died in the EU and about 4.5 thousand in the U.S. (Bureau of Labor Statistics, 2012).

From a policy perspective, focusing on one unique measure of the gender gap may provide a biased view of the actual progress of

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women in the labor market. In the cross section, higher wages are typically associated with better working conditions (and our data are not an exception), as more skilled and better paid workers trade-off part of their earnings for other amenities, such as workplace safety (see Hamermesh, 1999). Hence, it is expected that the increasing skills and participation of the female labor force will eventually lead to higher wages, improved job amenities, and lower gender differences through income effects. Still, an increase in salaries for a group of female workers, e.g. low-skilled female workers, may in part be the result of some workers shifting to more risky tasks, previously reserved to men. This reallocation of workers to tasks may reduce the observed wage gap for low-skilled workers (and also influence that of the average worker) through compensating wage differentials, without sizeable improvements in job satisfaction.

The main contribution of this paper is to jointly analyze, as in the seminal paper by Hamermesh (1999), wages and workplace safety. The main innovation with respect to Hamermesh (1999) is that, having access to individual- instead than industry-level data on workplace injuries, we can extend the analysis to the gender differences. Moreover, we can investigate how changes in workers' and job characteristics, and unobserved skills and human capital influence gender differences in pay and safety and their joint evolution.

We document that there is a significant gender gap both in wages and in work-related injury risk. Wages for men are on average 20% higher than for women, and men experience more than three times as many work-related injuries as women. Both gender gaps diminished over time. Between 1994 and 2002 an increase in the average female wage and a decline in the average male wage decreased the wage gap by 21%. During the same period, the probability of injury decreased substantially for men (−21%) and remained approximately the same for women. As a result, the gender gap in the probability of injury decreased by 27%. Over time it appears that compensating wage differentials, which move the two gender gaps into the same direction, dominate the income effects, which would move the two gender gaps into opposite directions.

Our data allows to further investigate this finding. We can measure changes in wages and workplace risk at different points of the wage distribution. In the first quartile of the wage distribution, an increase in female wage is associated with higher workplace risk. This suggests that some reallocation across tasks is taking place for low-skilled jobs. In the fourth quartile, an increase in female wage is associated with lower workplace risk. Hence, income effects seem to prevail for high-skilled female workers. As a result, at the end of the sample period injuries became clearly concentrated among low-paid female workers, whereas for male workers, this pattern was already present in 1994 and remained fairly stable over time. Can we then interpret the observed reduction in the wage gap as an indication of an overall improvement in job amenities enjoyed by female workers? This interpretation seems to be consistent with the outcomes for high-skilled female workers, not for low-skilled ones. The decline in the wage gap for low-skilled workers overstates the true change in job amenities experienced by them.

We cannot estimate how much of the increase in wage for low-skilled female workers is a pure compensating wage differential. This would require knowing the monetary equivalent of the disutility from absence from work due to workplace injury, which depends on factors that are difficult to measure, like the gravity of the injury and the related pain. Still, one can imagine different scenarios.

The wage increase experienced by these workers would be equivalent (in expectation) to the increased injury risk if the monetary value of the disutility of one week of absence was about equal to the wage. If it was higher, the wage increase net of the disutility of injury would be negative. These computations suggest that accounting for more than one job amenity may have a significant impact on our evaluation of changes in workers' well-being.

To explain the observed distributional changes, we adopt the DiNardo et al. (1996) (hereafter DFL) decomposition. This allows us to

generate counterfactuals and to disentangle the changes in wages and injury distributions due to changes in unobservables from changes induced by variations in observable characteristics (or compositional changes, such as the switching of jobs across sectors and occupation). We conjecture that the observed changes in the (joint) distribution of wages and injuries could be explained by the transitioning of women from traditionally “female” tasks, usually concentrated in the middle of the wage distribution (Blau and Kahn, 2000), toward “male” tasks at both the lowest and highest ends of the earnings distribution.

The paper is organized as follows. The next section describes the data and provides some descriptive statistics. Section 3 presents the methodological framework. Section 4 reports the empirical results, and Section 5 concludes.

## 2. The data and descriptive evidence

### 2.1. The data

Data availability has been a long-standing issue in the literature on job amenities, and injury risk in particular, mainly because of the lack of individual level information on injuries. We overcome this issue by using administrative data on a 1:90 random sample of Italian workers, the Work Histories Italian Panel (WHIP), linked with administrative records from the Italian Workers' Compensation Authority (INAIL), covering the years 1994–2002 (Bena et al., 2012). Overall, the data set includes about 120,000 individual records for each of the 9 years in the sample. This data set provides information on worker and job characteristics (age, sex, place of birth, type of occupation, sector, size of firm, number of weeks worked in a year, part-time job, earnings), the number of work-related injuries and their exact description, and the days of work lost due to such accidents. Moreover, the diagnosis and prognosis of the accidents are reported and certified by physicians. Hence, our data set provides an exceptionally rich source of information which we use to analyze the joint distribution of (deflated) weekly earnings and workplace injuries.

Despite this wealth of information there are three limitations in our data. First, a precise estimation of injury risk is only available for employees in the non-agricultural private sector, as employees in other sectors are either not covered (public sector, agriculture and fishing), or the available information is inadequate to measure the exposure to injury risk (hours of work and days of work for self-employed workers are imprecisely measured).

Second, information on workplace injuries is currently available only for the 9-year period between 1994 and 2002. However, although relatively short, this period witnessed important economic and social changes and provides significant variability in wages, injury probabilities, and injury index.<sup>1</sup> Another reason why 9 years might not be such a short period when studying workplace injuries is that most injuries happen at the beginning of a job spell (see Tables 1 and A.2 in the Appendix) and the Italian workforce changed significantly during the 1994–2002 period.<sup>2</sup> Female labor force participation increased significantly, and new cohorts of workers entered the labor market. These changes were so pronounced that 42% of women and 35% of men working as employees in 2002 were still out of employment in 1994.

<sup>1</sup> In 1992, a severe recession forced the Italian government to devalue the lira (the currency lost almost 40% of its value with respect to the German Mark) and to abandon the European Exchange Rate Mechanism. The old political parties disappeared in the midst of widespread corruption charges against their leaders, and a government of technocrats was formed. New parties and new leaders entered the new political scene, called “2nd Republic,” in 1996. Despite these changes, economic growth saw an unprecedented low, with average yearly growth rates close to 1.5%.

<sup>2</sup> These two years precede and follow a period of recession. Statistics on overtime hours and injuries are consistent with these years being characterized by a similar intensity of economic activity.

**Table 1**  
Descriptive statistics on worker and job characteristics.

	Men		Women		Men–women	
	1994	2002	1994	2002	1994	2002
Avg. age	36.54	36.75	33.16	34.94	3.39***[0.07]	1.82***[0.06]
Avg. months of tenure	62.36	68.63	55.46	60.92	6.90***[0.30]	7.71***[0.42]
% apprentice	4.64%	5.58%	4.58%	6.79%	0.06 [0.10]	–1.21***[0.10]
% blue-collar	67.03%	67.62%	49.07%	46.10%	17.96***[0.31]	21.52***[0.28]
% white-collar	26.74%	25.47%	46.17%	46.84%	–19.43***[3.02]	–21.37***[2.68]
% manager	1.60%	1.33%	0.18%	0.26%	1.14***[0.07]	1.07***[0.06]
% part-time	2.10%	5.08%	17.88%	27.74%	–15.78***[0.16]	–22.66***[0.19]
% jobs in the North	57.12%	56.41%	65.86%	63.43%	–8.74***[0.32]	–7.02***[0.29]
% jobs in the Center	19.01%	19.14%	19.82%	20.33%	–0.81 [0.26]	–1.19***[0.23]
% jobs in the South	23.87%	24.45%	14.32%	16.24%	9.55***[0.26]	8.21***[0.24]
% firm size 0–9	26.62%	28.24%	33.46%	31.54%	–6.84***[0.30]	–3.30***[0.27]
% firm size 10–19	12.88%	13.48%	14.60%	13.19%	–1.72***[0.22]	0.29 [0.20]
% firm size 20–199	28.42%	29.81%	28.43%	27.41%	–0.00 [0.29]	2.40***[0.26]
% firm size 200–999	13.14%	12.93%	10.72%	12.48%	2.42***[0.22]	0.45** [0.19]
% firm size ≥ 1000	17.91%	15.23%	11.77%	15.16%	6.14***[2.39]	0.06 [0.21]
n. obs	72,891	84,408	34,267	45,005		

Note: Standard errors in square brackets.

- \*\*\* 1% significant.
- \*\* 5% significant.
- \* 10% significant.

**Table 2**  
Weekly wages and the wage gap.

	Men			Women			Men–women		
	1994	2002	2002'	1994	2002	2002'	1994	2002	2002'
Mean log deflated	5.771	5.753	5.800	5.570	5.595	5.593	.201	.158	.207
Weekly earnings	[.002]	[.002]	[.002]	[.002]	[.002]	[.002]	[.003]	[.003]	[.003]
5th percentile	5.053	5.059	5.150	4.883	4.911	4.941	.170	.148	.209
	[.006]	[.006]	[.005]	[.007]	[.007]	[.008]	[.009]	[.009]	[.008]
10th percentile	5.280	5.278	5.336	5.150	5.173	5.195	.130	.105	.141
	[.003]	[.003]	[.002]	[.006]	[.004]	[.006]	[.006]	[.004]	[.005]
25th percentile	5.507	5.487	5.529	5.394	5.400	5.409	.113	.087	.120
	[.001]	[.001]	[.001]	[.002]	[.002]	[.002]	[.002]	[.002]	[.002]
50th percentile	5.727	5.690	5.736	5.564	5.578	5.580	.163	.112	.156
	[.002]	[.001]	[.002]	[.002]	[.001]	[.002]	[.002]	[.002]	[.002]
75th percentile	6.016	5.983	6.025	5.768	5.790	5.780	.248	.193	.245
	[.002]	[.003]	[.002]	[.002]	[.003]	[.003]	[.003]	[.003]	[.003]
90th percentile	6.336	6.349	6.380	6.039	6.093	6.058	.297	.256	.322
	[.003]	[.004]	[.004]	[.005]	[.006]	[.006]	[.006]	[.006]	[.007]
95th percentile	6.572	6.609	6.640	6.215	6.306	6.267	.357	.303	.373
	[.005]	[.005]	[.007]	[.007]	[.006]	[.007]	[.008]	[.007]	[.009]
Gini index	0.281	0.287	0.283	0.216	0.249	0.233			
	[.002]	[.002]	[.002]	[.002]	[.005]	[.004]			
Theil index	0.174	0.182	0.175	0.098	0.188	0.158			
	[.004]	[.005]	[.004]	[.004]	[.020]	[.015]			

Note: The columns denoted by 2002' report counterfactual values for 2002, assuming the same distribution of observable characteristics as in 1994. Bootstrapped standard errors in square brackets (200 replications).

Third, like many administrative records that are used to compute social security benefits, our data set has no information on education, as education does not enter the benefit formula directly. Fortunately, the data does include information on whether the worker is a blue or a white collar, or whether he has managerial tasks, which tends to be highly correlated with education.<sup>3</sup>

Tables 1 and A.2 in the Appendix describe the evolution of our main controls between 1994 and 2002. There are several differences in labor force participation across sectors. The most evident are the 3 percentage point increase for males and the almost 6 percentage point increase for females in the financial intermediation sector.<sup>4</sup>

Changes in the textile industry generate the largest convergence between male and female workers across sectors. In fact, this industry almost exclusively employs women and has been constantly declining since the 1990s.<sup>5</sup> Table 1 shows that there were no major changes in the proportion of white and blue collar employees or in the geographical location of jobs. Both men and women experienced a substantial increase in part-time jobs. The participation rate of male workers in large firms declined over time, whereas the female participation rate increased. The last two columns show that the gender differences in age have been declining, mainly due to the increase in the age of retirement for women.<sup>6</sup>

<sup>3</sup> The rank correlation index between educational attainment and professional position, as computed in the Labor Force Survey within dependent workers, was 60.3 for males and 56.0 for females in 1994; 59.6 and 57.6 respectively, in 2002.

<sup>4</sup> Given that temporary help agencies (agencies that rent out workers on a non-permanent basis to firms) are recorded as financial intermediaries, part or even most of this increase might be attributed to these agencies. These workers seem to come from traditional sectors like vehicle manufacturing for men (–1 percentage point) and the textile industry for women (–6 percentage points).

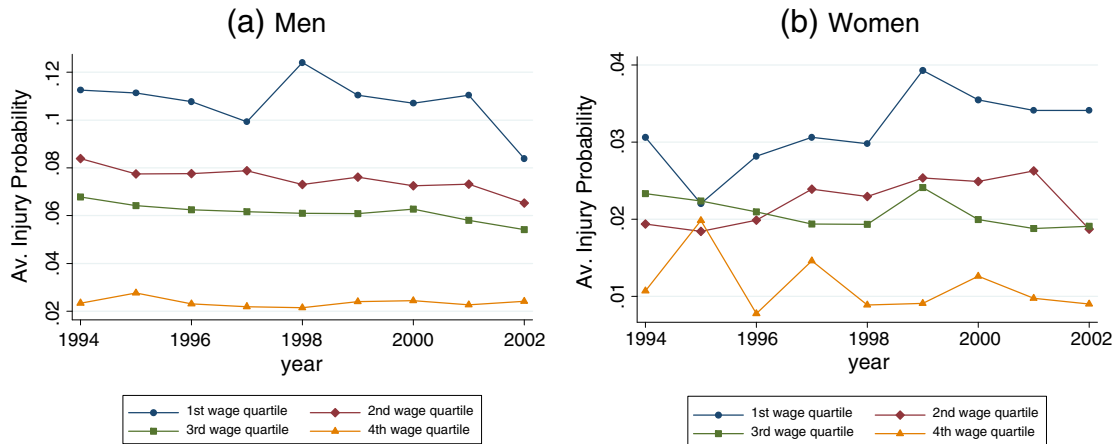
<sup>5</sup> An analysis of participation rates in the manufacturing sectors reveals that increased foreign competition explains part of the decline. Results are available upon request.

<sup>6</sup> Although retiring much later than in the past, women are increasingly employed in part-time jobs, so their tenure in office is decreasing in comparison to men.

**Table 3**  
The probability of injury and the injury gap.

	Men			Women			Men–women		
	1994	2002	2002'	1994	2002	2002'	1994	2002	2002'
Injury probability	.072 [.002]	.057 [.001]	.054 [.001]	.021 [.001]	.020 [.002]	.018 [.002]	.051 [.002]	.037 [.002]	.036 [.002]
Injury index	1.678 [.048]	1.503 [.047]	1.439 [.050]	.467 [.039]	.447 [.033]	.389 [.031]	1.210 [.064]	1.056 [.059]	1.050 [.059]

Note: The table reports the mean probability of injury and the mean number of days lost due to injury within a year. The columns denoted by 2002' report counterfactual values for 2002, assuming the same distribution of observable characteristics as in 1994. Bootstrapped standard errors in square brackets (200 replications).



**Fig. 1.** The average injury probability by wage quartile. The series represent the evolution of the average injury probability within each wage quartile for male and female workers.

2.2. Descriptive evidence

Table 2 describes the distribution of our first main variable of interest, the log weekly wages, in 1994 and 2002 (the 2002 “prime” year represents a counterfactual year that we will discuss later). Wages include all kinds of contingent pay and overtime payments and are deflated to constant 1995 values. They are computed as the log of full-time equivalent weekly earnings, which are obtained by dividing annual earnings by full-time equivalent employment in the year.<sup>7</sup> Overall, wages have been stagnant in the middle and increasing at the tails of the wage distribution, thus displaying a polarization for both male and female workers. The changes at the top and bottom of female wage distribution are more pronounced than the corresponding variations for males. Women in the top percentiles of the distribution underwent the largest increase in wages, although women in all quantiles faced some improvements. This was not the case for men. Adjusting for inflation, men between the 10th and the 75th percentile received lower wages in 2002 than 9 years earlier. The Gini index and the Theil index show that the relatively more stagnant evolution of wages in the middle of the wage distribution has led to increasing inequality.

Regarding our second main variable of interest, workplace injuries, we define the weekly probability of injury as the likelihood that a worker is injured at least once during the year divided by the number of full-time equivalent paid weeks during that year.<sup>8</sup>

In the Appendix we show that the results hold when using a measure that we call injury index, which is equal to the number of

days lost in a year due to an injury divided by the number of paid weeks during the same year. This index depends not only on the occurrence of an injury but also on its severity. To facilitate interpretation of the results, we report the probability of injury and the injury index on a yearly basis, i.e., the probability of injury in a year and the number of days lost per year.

Table 3 shows the average injury probability and average injury index over time for male and female workers. The probability of injury for male workers dropped from 7.2% in 1994 to 5.7% in 2002, a 21% reduction in risk. Female workers witnessed a less than 5% reduction, from 2.1 to 2.0%. A similar picture emerges from the injury index.

But the overall reduction hides some important heterogeneity. Fig. 1 and Table 4 show that among men the largest reductions are for the lowest paid quarter of the wage distribution, where injuries are more prevalent. The exact opposite is true for female workers. The lowest paid quartile is the only group of workers that is facing increasing rates of injury (from 3.1 to 3.4).

As a result, between 1994 and 2002, wage gaps and injury gaps, shown in the last columns of Tables 2 and 3, dropped by 21% and 27%, respectively. In the next section, we will introduce a semi-parametric strategy for testing whether such evolution can be explained by changing characteristics of the workforce.

3. Methodological framework

Given the well-known heterogeneity in risk across sectors, the pattern in injury risk and wages may simply be a result of changes in the participation rates across sectors.<sup>9</sup> More generally, changes over time in the distribution of injuries and wages and their joint distribution can be ascribed to changes in several observable characteristics of the workers (age, tenure, part-time work, industrial sector, occupation, region of work, region of birth), or unobservable factors, such as the price of skills, the workers’ attitudes toward risk and the assignment

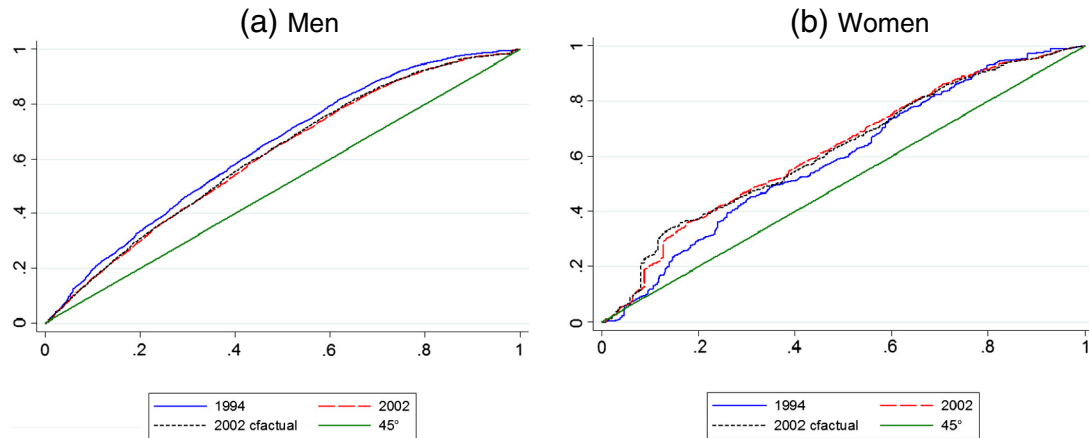
<sup>9</sup> Table A.2 describes the composition of the sample by industry.



**Table 4**  
The probability of injury and the injury gap by wage quartile.

Wage quartile	Men			Women			Men–women		
	1994	2002	2002'	1994	2002	2002'	1994	2002	2002'
1st quartile	.113 [.005]	.084 [.004]	.080 [.003]	.031 [.004]	.034 [.007]	.031 [.007]	.082 [.007]	.050 [.008]	.050 [.008]
2nd quartile	.085 [.003]	.066 [.002]	.063 [.002]	.019 [.002]	.019 [.002]	.017 [.002]	.065 [.004]	.047 [.003]	.046 [.003]
3rd quartile	.068 [.003]	.054 [.002]	.051 [.002]	.024 [.003]	.019 [.002]	.017 [.002]	.044 [.004]	.035 [.003]	.034 [.003]
4th quartile	.022 [.002]	.024 [.003]	.023 [.003]	.011 [.002]	.009 [.001]	.009 [.001]	.012 [.003]	.015 [.003]	.014 [.003]

Note: The injury probability is the estimated probability of injury within a year. The columns denoted by 2002' report counterfactual values for 2002, assuming the same distribution of observable characteristics as in 1994. Bootstrapped standard errors in square brackets (200 replications).



**Fig. 2.** Concentration curves of injury probability for men and women in 1994 and 2002. The concentration curves describe the proportion of injuries that are attributable to the cumulative percentage of the sample ranked by wage. The curve denoted by 2002 "cfactual" represents the counterfactual concentration curve for 2002, assuming the same distribution of observable characteristics as in 1994. The values of concentration index, i.e. the area between the concentration curve and the 45° line are reported in Table 5.

of hazardous tasks and wages among workers with the same characteristics and within a specific occupation. Hence, the observed changes in the gender gaps can also be decomposed into these two components. To do so, we estimate the counterfactual densities (indicated by a prime ') of wages and injuries that would have been observed at the end of the sample period (2002) had the observed characteristics been distributed as they were at the beginning of the period (1994).

The difference in the statistics based on the counterfactual and the observed density in 1994 represents the impact of changes in unobservable factors, but also changes in workers' attitudes toward risk and changes in the assignment of tasks within a specific type of occupation. The difference between the observed density in 2002 and the counterfactual one (denoted by 2002') indicates the impact of changes in observable characteristics. This reveals how changes in wages and injuries are driven by variations in labor force participation and by the sorting decisions of workers into different types of activities. We adopt the reweighting approach of DiNardo et al. (1996) to compute the counterfactual density and to create counterfactual population measures of a single outcome variable (i.e. wages or injury indexes, separately) or counterfactual measures based on the joint distribution of wages and workplace injuries. When creating the counterfactual scenario with all covariates being distributed as in 1994, the reweighting procedure is a function of the propensity score and two constants (DiNardo, 2002).<sup>10</sup>

<sup>10</sup> We have also created counterfactual scenarios by redistributing only a subset of covariates as in 1994 and changing the order in the sequential decomposition as in DFL. In all these specifications the differences between the actual and counterfactual 2002 distributions were mainly driven by changes in the distribution of sectors and occupations. Since the inclusion of other covariates did not affect our results, we only report the specification in which all observations are reweighted to replicate the distribution of covariates in 1994.

Thus, the sample weights can be estimated using Bayes's rule as follows:

$$\hat{\Phi}_x(2002, 1994) = \frac{\hat{Pr}(t_x = 1994|x)\hat{Pr}_{2002}}{\hat{Pr}(t_x = 2002|x)\hat{Pr}_{1994}}, \quad (1)$$

where  $\hat{Pr}(t_x = 1994|x)$  and  $\hat{Pr}(t_x = 2002|x)$  are the probabilities for an observation to belong to 1994 or 2002, conditional on the covariates  $x$ ;  $\hat{Pr}_{1994}$  and  $\hat{Pr}_{2002}$  are the unconditional probabilities for an observation to belong to 1994 or 2002, respectively. This procedure can easily be extended to compute statistics based on the joint distribution of two outcomes of interest, namely wages and injury indexes.<sup>11</sup> We can thus compute the counterfactual joint distributions of wages and injury probabilities and the related statistics such as concentration curves (O'Donnell et al., 2008) and concentration indexes (Wagstaff et al., 1991; Kakwani et al., 1997), which are discussed at the end of the next section. The weights from Eq. (1) can be used to construct these counterfactuals, as both measures can be computed using sampling weights (O'Donnell et al., 2008).

#### 4. Evidence of gender differences

Table 2 presents the counterfactual wage percentiles for male and female workers. In summary, in 2002 a hypothetical male worker with the same characteristics as in 1994 would have earned more

<sup>11</sup> The function  $g(\cdot)$  used in the construction of the population measure (see Biewen, 2001, Eq. (1)) can be specified as a function of both wages  $w$  and injury index  $inj$  and by replacing the conditional density function  $f(y|t_y = 2002)$  with the conditional joint density function  $f(w, inj|t_y = 2002)$ .

**Table 5**  
Statistics on the joint distribution of log wages and injuries.

	(a) Men			(b) Women			(c) Men–women		
	1994	2002	2002'	1994	2002	2002'	1994	2002	2002'
Concentration index (Inj. index, log wages)	-.276*** [.014]	-.221*** [.019]	-.227*** [.019]	-.184*** [.040]	-.246*** [.050]	-.242*** [.054]	-0.092** [.044]	0.25* [.051]	.015 [.060]

Note: The table reports the concentration index of the injury index and log weekly earnings. Bootstrapped standard errors in square brackets (200 replications).

\*\*\* 1% significant.

\*\* 5% significant.

\* 10% significant.

than the actual observed worker. This difference is negligible for female workers (observable characteristics explain only part of the large wage increase at the top of the female wage distribution). As a result, the approximately 30% reduction in the gender wage gap can almost be fully explained by changes in observable characteristics of the male workforce.

Do changes in observable characteristics of male workers explain also the observed reduction in the probability of injury? The short answer is no. The observed reduction in the gender injury gap is largest for the lowest paid workers, and decrease along the wage distribution (see Table 4).<sup>12</sup> Overall, women experienced and increase in wages and injury risk which can be explained using the theory of compensating differentials. In terms of gender gaps, only the reduction with respect to wages can be explained by observed changes in male characteristics.

Quartile-specific measures of injury risk neglect intra-quartile differences in injury risk. A more comprehensive measure of inequality in the distribution is provided by the concentration curve (Wagstaff et al., 1991; Kakwani et al., 1997), which describes the proportion of injuries that are attributable to the cumulative percentage of the sample ranked by wage. If wages and the probability of injury were uncorrelated, the concentration curve would correspond to the 45-degree line. If, instead, low wage earners bear more risk of injury, the concentration curve will fall above the 45-degree line.<sup>13</sup>

Fig. 2 presents the concentration curves of injury probability by wage level for men and women in panels (a) and (b) respectively. The position of the male concentration curves shows that low paid male workers bear most of the risk. In line with the quartile differences, the positions of the 1994, 2002, and counterfactual 2002 curve indicate an increased equality in injury risk that cannot be explained by observable factors.<sup>14</sup>

The opposite is true for women. Indeed, the 2002 female concentration curve resembles that of men, indicating a substantial shift in the probability of injury toward lower paid female workers. Observable characteristics cannot explain the increase in the concentration of injury risk among low wage female workers (see also Table 5). The most likely explanation is that low paid female workers are increasingly performing

traditionally “male” tasks that contain an element of risk, thus reducing the overall benefits of the shrinking gender wage gap.

## 5. Concluding remarks

Using a unique matched employer–employee data set from Italy we document a narrowing of the gender gap in wages and workplace injury risk between 1994 and 2002. While both phenomena reduce gender inequality, their effects on the relative wellbeing of male and female workers are different.

Based on DiNardo et al.'s (1996) counterfactual distributions we explore the relative importance of observable and unobservable characteristics of workers and firms in shaping gender gaps and their evolution. Changes in observable factors (age, tenure, part-time work, economic sectors, occupation, region of work, and region of birth) can only explain part of the wage convergence. Still, some convergence might also be due to a reduction in educational disparities which cannot be measured directly in our administrative data.

The evolution of the wage gap in Italy is by no means an exception. As more and more administrative data become available, our analysis could easily be replicated in many other countries with different institutions. Overall, this paper suggests that comparing the evolution of a broader set of job amenities can be more informative about gender differences in well-being than focusing merely on wages.

## Appendix A. Supplementary data

Supplementary data to this article can be found online at <http://dx.doi.org/10.1016/j.labeco.2014.04.007>.

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<sup>12</sup> Figure A.2 suggests that the same is true regarding the severity of injuries. Figure A.3 shows the differences between the male and female distributions of days lost due to workplace injuries. Finally, Figure A.4 reports the difference-in-difference between 2002 and 1994, and the male and female distributions of days lost due to injury. As can be seen from this figure, the narrowing of the injury gap is clearly driven by changes in injuries that lead to short term absences from work.

<sup>13</sup> A quantitative measure of the distribution of the injury risk  $y$  over income levels is provided by the concentration index that represents the area between the concentration curve and the 45° line. For a sample of  $n$  individuals, this index is

$$C = \frac{2}{n\mu} \sum_{i=1}^n y_i R_i - 1 \quad (2)$$

where  $\mu$  is the mean injury index and  $R_i$  is the fractional rank of the  $i$ -th individual in the income distribution.

<sup>14</sup> Table 5 shows that such changes are statistically significant and that the counterfactual scenario in 2002 is identical to the actual one.

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