

# Collective Bargaining and the Evolution of Wage Inequality in Italy

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## Abstract

This paper studies the evolution of Italian male wage inequality over a two-decade period, showing that pay differences have increased since the mid-1980s at a relatively fast pace. By accounting for worker and firm fixed effects, it is shown that observed and unobserved heterogeneity of the workforce have been major determinants of increased wage dispersion, while variability in firm wage policies has declined over time. The growth in wage dispersion has entirely occurred between *livelli di inquadramento*, *i.e.* job titles defined by national and industry-wide collective bargaining institutions, and for which specific minimum wages apply. These results suggest that the underlying market forces determining wage inequality have been largely channelled into the tight tracks set by the country's fairly centralized system of industrial relations.

**JEL Codes:** J00, J5, J31, J40.

**Keywords:** Wage Inequality; Collective Bargaining; Firm Wage Policy; Two-Way Fixed Effects; Matched Employer-Employee Data.

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## 1 Introduction

Wage inequalities have risen in most western countries during the last decades of the past century. Several hypotheses have been put forward to rationalize this secular trend. Some authors have pointed out that technological progress is largely responsible for the increased wage dispersion. A commonly held view is that advances in the production process may have led to a growth in the demand for skills that, due to demographic and schooling developments, outpaced their supply, eventually resulting in an increase of the returns to unevenly distributed workers' characteristics (e.g. Katz and Murphy [1992]). A more nuanced hypothesis, also related to technological progress, is that recent advances in the production process may have modified the demand for routine versus non-routine based occupations, increasing the polarization of the wage structure (e.g. Autor et al. [2008]). Other theories state that changes in labour market institutions, such as declining minimum wages and union strength (e.g. Di Nardo et al. [1996]), or changes in social norms (e.g. Piketty and Saez [2003]) are the main drivers of the observed secular rise in wage differentials.

More recently, several studies analysing matched worker-firm databases have pointed out that one important component of pay inequality is represented by differences in the wage policies between observationally similar firms (e.g. Abowd et al. [1999]). Card et al. [2013] have shown that firm-specific components of the wage variance can explain up to one fourth of the inequality growth occurred in West Germany between the late-1980s and the beginning of the new century. These authors link the rise in the dispersion of firms' wage premiums to the changes that have occurred in the wage bargaining system since the early 1990s. Indeed, during these years German firms often exploited the possibility of *opting-out* from national contractual agreements, deviating from collective bargaining provisions and resorting to establishment-level negotiations. Dustmann et al. [2014] argue that this decentralization in the wage setting process has allowed to cut unit labour costs and to improve international competitiveness, fostering the German economic growth observed in the last decade.

In this paper, we apply the methodology of Card et al. [2013] on Italian matched employer-

employee data from administrative sources. We study the entire population of private-sector workers and firms in Veneto, the second most populous region in northern Italy, which represents around 10% of the national GDP. Focusing on the male sample, we study the evolution over the period 1982-2001 of the following components of pay dispersion: time-varying characteristics of the workforce, time-constant individual characteristics, firm-specific wage premiums, along with the contribution arising from the correlation between each of these components. Moreover, we apply a related variance decomposition method, in order to test whether the growth in wage inequality has occurred mostly within or between the fine job title categories defined by the country's collective bargaining institutions.

An in-depth analysis of the Italian case is interesting in itself, but it also offers insights for evaluating the relevance of the various theories rationalizing the secular growth in wage inequality experienced elsewhere. The Italian labour market is characterized by sector-wide collective bargaining and, like other western countries, the Italian economy has been exposed to international competition and has experienced the challenges posed by the introduction of new technologies. Moreover, the manufacturing sector is very large in northern Italy, and particularly in Veneto, a feature that makes its economy quite similar to the German one. Therefore, the analysis of the Italian case represents an interesting case-study from a comparative perspective.

Our study is connected to a (moderately sized) literature that has studied Italian wage inequality from the early 1980s onward, documenting a growth in pay dispersion. The main data sources that have been used are the *Bank of Italy Survey on Income and Wealth* (e.g. Brandolini et al. [2002], Manacorda [2004] and Naticchioni and Ricci [2009]) and the *Worker History Italian Panel* (WHIP), or similar administrative data containing samples of the private sector of the entire Italian territory (see, in particular, Devicienti and Borgarello [2001], Cappellari [2004] and Cappellari and Leonardi [2016]). Only a few studies have specifically looked at the role played by collective bargaining institutions in the evolution of wage inequality. In particular, Dell'Aringa and Lucifora [1994] and Erickson and Ichino [1995], using a sample of metal-mechanical workers in the metropolitan

area of Milan, argue that the centralized system of industrial relations plays a pivotal role in determining the Italian wage structure. Beyond their narrower coverage, the data employed in these studies have other limitations that impede the estimation of a two-way fixed effect model, and of the related wage variance decomposition (e.g., an insufficient coverage of each firms' entire workforce or a limited panel dimension). The two-way fixed effects model has been estimated on Italian data in different contexts (e.g. Iranzo et al. [2008] and Macis and Schivardi [2016]). However, none of these studies has focused on wage inequality and on its evolution over time.

Differently from previous studies on the Italian wage structure, in the present analysis we directly look at the contributions of firm's wage policies, workers' heterogeneity and assortative matching to the evolution of pay dispersion. Moreover, relying on information about the collective bargaining agreement applied to each worker, we uncover the role played by institutions from a more comprehensive perspective.

Our analysis shows that, during the overall period considered, pay dispersion has grown in Veneto at a similar pace than the one documented by Card et al. [2013] for Germany. However, in the Italian case there has not been a growth in firms' wage premiums dispersion, given that the variance of this wage component is even declining over time. Considering that Italian wage setting mechanisms are highly centralized at the sector-wide level and have not undergone the same renewal processes characterizing the German labour market during the 1990s, our results suggest that the amount of wage flexibility granted to employers by such system has not grown over time. That is to say, Italian firms have been unable to opt-out, or diverge in any other significant way, from the wage dynamics settled within the relevant industry-wide collective agreements.

We find that a large proportion of the growth in earning dispersion over the entire period considered is due to raising heterogeneity in the *portable* component of a worker's pay, namely the part of the wage attributable to individual-specific characteristics equally rewarded across employers. In principle, a growing contribution of workers' heterogeneity to the total wage variance may simply reflect the underlying dynamics of supply and demand factors. However, we show that in practice this component of inequality is closely

linked to the wage pay scales and seniority wage increments bargained at the industry level by the main union confederations and employers' associations. Hence, we interpret the finding of rising workers' heterogeneity as yet another outcome induced by the Italian system of industrial relations, which seems to impose significant constraints on wage dynamics.

To substantiate our claim, we divide the variance of (log) wages and of workers' *portable* pay components into a *within* and a *between* job titles part. Job titles (called *livelli di inquadramento* in Italian) are occupations defined by the relevant sectoral collective agreements, for which a specific minimum wage applies regardless of a worker's union membership. We find that the growth in the *between*-variance component virtually explains the entire inequality trend observed in the data, an evidence that, partly owing to data limitations in past research on Italian wage inequality, has never been so extensively documented before.

Our analysis shows also that another important component of the growth in wage inequality has been more positive sorting between firms' pay premiums and the human capital of the workforce. Despite a low level of correlation between these two components in each time period, a clear increasing tendency emerges from our estimates. Although we were unable to present conclusive evidence on the determinants of such trend, it is tempting to associate at least part of the growth in assortative matching to the general labour market deregulations experienced by Italy since the mid-1980s.

The paper is organized as follows. In the next section, we provide a brief institutional framework on Italian wage setting institutions. Section 3 describes the database and preliminary evidences on pay dispersion. Section 4 reviews the main econometric model employed in the analysis and discusses its assumptions. Section 5 presents the main results. Finally, Section 6 contains the concluding remarks.

## **2 Institutional Context**

During the years considered in this study (1982-2001), and largely still today, Italy has been characterized by a wage setting mechanism fairly centralized at the sector-wide na-

tional level. Collective contracts are *de-facto* binding for all employers and all workers, irrespective of union membership. Such agreements are signed (typically every two years) by the major trade unions and employers' associations at the industry-wide level. It is important to notice that there are no *opting-out clauses* in the Italian system. That is to say, firms cannot decide to resort to firm-level contractual agreements derogating to the wage standards settled at the sectoral level. Regional- or firm-level agreements can only distribute *top-up* wage components, typically related to indicators of profitability or productivity.

Each industry-wide collective contract regulates specific job titles (*livelli di inquadramento*) and the contractual minimum wages that is to apply for each of them. Such *livelli di inquadramento* are job classifications defined by collective bargaining agreements, which are based on the complexity of workers' tasks and, in some circumstances, also on qualifications and seniority levels. It follows that such job titles can be considered similar to occupations, with the important differences that, depending on the sector of activity, the same type of job could be classified in more than one *livello di inquadramento* and that for each of these groups a specific binding minimum wage applies.

In 1993 a major reform of collective bargaining was approved, in order to achieve the following main objectives (Casadio [2003]): (*i*) coordination across industries and moderation on wage growth to achieve low inflation targets; (*ii*) growth of regional differences in wages to adapt them better to the heterogeneous cost of living and labour market conditions at the local level; (*iii*) distribution of premiums related to performance (*on top* of the sectoral minimums) and negotiation of some other contractual provisions not related to compensation at the firm-level. This reform resulted in an increase of geographical differences in top-up components of negotiated wages. However, Devicienti et al. [2008] find that overall the amount of flexibility in bargaining agreements introduced by the 1993 reform has been quite limited. In particular, using a sample covering around 60% of national private-sector contracts, these authors show that the average share of all top-up components over total wages increased from around 18% during the mid-1980s, to only 22% by the end of the 1990s.

Figure B.1 (in the Appendix) provides an overview of the long-run evolution of the standard deviation of log weekly wages, computed from the social security records of male private sector workers in Veneto. It can be noticed that inequalities declined sharply until around 1983. Previous research (*e.g.* Leonardi et al. [2015] and the analysis of Manacorda [2004], based on nation-wide household survey data) has attributed this remarkable trend to the strong compressing effects of the *Scala Mobile*.

The *Scala Mobile* was a cost-of-living allowance added quarterly to the bargained contractual minimum wages, an institution provided from the 1970s until 1993, but which was weakened and extensively reformed in 1984 and then through a referendum in 1985. Since this wage-adjustment mechanism had been particularly disadvantageous for more qualified white-collars and skilled workers, from 1987 on most nation-wide collective bargaining agreements attempted at further mitigating its egalitarian effects. As a consequence, the compensations associated to the qualifications embedded in each *livello di inquadramento* were improved, widening the gaps in the minimum wages stipulated for each of these job titles (this tendency is highlighted by industrial relations reports of the time, such as CESOS [1989]). The right panel of Figure B.1 shows indeed that the period 1982-2001, the one on which we focus our analysis, is instead characterized by a very persistent growth in pay inequality.

### 3 Data and Preliminary Evidences on Inequality

#### 3.1 Database and Descriptive Statistics

The Veneto Working Histories (VWH) database, which is studied here, contains earnings data from social security records for all dependent workers of the private sector in the Veneto region.<sup>1</sup> The database contains the *population* of private sector firms whose headquarters are located in Veneto, and the *population* of their employees. Workers of these firms are observed also if they change job and move outside of the Veneto region, as long as they continue working in the private-sector. They are instead not followed if they move to the public-sector. In order to analyse a sample of workers more homogeneous and consistent across time, we have divided the data by gender and, throughout this paper,

we discuss only results obtained among men.

A limitation of these data, dictated by their current availability, is that they allow to estimate a two-way fixed effect regression model for only one region of the country. Other currently available country-level matched employer-employee data are either not suitable for our aims, or they entail other kind of trade-offs (such as a lack of representativeness for what concerns the large bulk of small-sized firms). For example, the Worker History Italian Panel (WHIP) is a 1:90 sample of dependent workers, entailing that for many firms only a handful of workers are observed.<sup>2</sup> The only other employer-employee data source that has been analysed in the literature (*i.e.* the one studied by Iranzo et al. [2008] and Macis and Schivardi [2016]) allows to observe the entire workforce of each firm, but only relatively large firms are included in the sample.

Despite the limited coverage of the Italian territory, the main inequality trends observed in the VWH data are similar to those obtained from other national level samples of social security records. Figure 1 compares the standard deviation observed in the VWH data with the one derived from WHIP. In computing both series, we have selected job spells longer than four months and excluded wages below the first and above the 99th percentiles. In general, the level of this statistic is lower when focusing on Veneto only, an evidence mostly attributable to the relevant regional differences in economic conditions across Italy. However, if we consider the trend in wage dispersion, which is provided in the right panel of the figure, a fairly similar pattern between the two series emerges. In both cases inequality increases at a fast pace until the late 1980s. Then a period of slower or flat growth follows until around 1994, when inequalities start to increase more rapidly again. The similarity between the trend observed in Veneto and the national one is attributable to two main factors: first, to the disproportionate large size of northern Italy with respect to the national population of private-sector workers and, secondly, to the presence of several important institutional and economic similarities shared by all Italian regions, which are particularly strong across the more northern and central parts of the country.

Other factors characterize Veneto as a particularly informative case-study. First, this



region has a well-developed manufacturing sector and is fairly large, given that its population amounted to 4.5 millions in 2001 and its economy represented around 11% of the national GDP in the same year. Moreover, focusing on inequalities considering only one region of Italy has also some advantages. In particular, the approval of the 1993 industrial relations reform, which introduced more flexibility at the regional level in order to better link wages to local market conditions, could induce an over-estimation of trends in pay dispersion when studying national-level data, given the difficulty in controlling for genuine adjustments of wages to the local market conditions. On this topic, Devicienti et al. [2008] document a tenuous *resurrection of the Italian wage curve* after 1993, mostly driven by greater regional differences in wages.

The data contained in social security records, even if not rich on some workers' characteristics, is highly accurate and reliable, since employers are obliged to report such information correctly by law. The VWH database covers the years from 1975 until 2001, but we consider only the last two decades of the data. In particular, in the rest of the paper we study the years from 1982 to 2001, since our main purpose is to shed light on the determinants of the inequality growth, which takes place during this most recent period. As typical for Italian social security data, the information on pay is gross of taxes and inclusive of all cash benefits, but it excludes all in-kind benefits. We choose log gross *daily* wages, adjusted to the 2003 level, as the unit of measurement for earnings. Other available alternatives (*e.g.* weekly or monthly wages) are less precise in controlling for time worked since, by the law, employers have to report all weeks and months during which an employee has worked *at least one day*.

We have taken a number of steps that are relatively standard in the literature using similar data. First, for each employee with multiple jobs during the same year, we have selected the longest spell in terms of months, weeks and days worked; to break the few remaining ties, we have selected the spell with highest earnings. Second, we have excluded from the sample all spells shorter than approximately four months (16 weeks) and, finally, we have trimmed wages at the 1st and 99th percentiles calculated over a six-year period. To estimate the two-way fixed effect model of Abowd et al. [1999] we have divided the 1982-2001

years of data into five, partially overlapping, six-years panels. All the results derived from the VWH database are computed considering only firms of Veneto, but we have included employment spells outside this region in the estimation sample of the two-way fixed effect model. The rationale of these choices is further discussed in the section providing the details of our econometric method.

Table 1 contains descriptive statistics for each of the five panels that we have constructed. It emerges that the composition of the sample is quite homogeneous across periods. Given that public-sector workers are excluded from the social security archives, the secondary sector is relatively large and this pattern is reflected in the occupational composition of the sample, where the majority of individuals are blue-collars. Tenure is slowly growing over time, but the result is driven by the fact that this variable is left-censored at the year 1975. To correct for this problem, in the empirical analysis we control for tenure by adding dummy variables for the first six years of tenure, leaving higher seniority levels as the reference category. The percentage of part time contracts is relatively low and it grows over time, a tendency attributable to the fact that such contracts have been introduced in the Italian legislation only since 1985. Finally, Table 1 shows that real wages have been quite flat during the overall period considered, while their dispersion, as measured by the standard deviation, steadily increases. In the next paragraph, we present a more accurate description of this trend.

### *3.2 Preliminary Evidences on Inequality*

Figure 2 describes the evolution of log daily wages at the 10th, 50th and 90th percentiles of the earning distribution. It can be noticed that the 50th-10th and 90th-50th wage percentile ratios have all increased. Another evidence is the very flat growth of wage levels at the bottom of the distribution. In particular, men's earnings at the 10th percentile have remained stable over the whole period, while median wages have risen by only slightly less than 10%. Instead, the 90th percentile of the pay distribution has risen by more than 25% in real terms, even if it has been stagnating during most of the 1990s.

In the left panel of Figure 3 we test the predictive performance of a series of log-linear con-

ditional wage models. To construct this figure, we have run year-by-year OLS regressions on the workers of firms located in Veneto, using different sets of controls. The highest line represents the unconditional log wage standard deviation. The other lines represent the root mean squared error (RMSE) of year-specific regression models. In each model, we have used the same set of baseline covariates, namely: a quadratic term in age, occupation dummies, tenure dummies, log of firm size (number of employees), around thirty sector fixed effects, national industry-wide collective contract fixed effects, a set of interactions (age with occupation and age with tenure).

In addition to these covariates, each regression model is fully saturated for one of the following categories: (1) job titles (*livelli di inquadramento*), (2) firms or (3) both. National industry-wide collective contract fixed effects are not collinear with *livelli di inquadramento*, since the latter are specific job titles (usually between five and ten) defined by the former. Instead, firm fixed effects are collinear with sector fixed effects and, typically at least, also with industry-wide contracts fixed effects. The procedure adopted in constructing job title and collective contract fixed effects is discussed in more detail in Section 5.3. The RMSE provides a measure of the performance of each model in explaining total wage variation. In general, the trend in residual wage variance is fairly flat, while the total pay variance shows a clear increasing pattern. This is a preliminary evidence that workforce composition and returns to its characteristics do a good job in explaining the rise in wage dispersion over time, and are becoming increasingly relevant over time. Obviously, none of the estimated models reported here does control for constant unobserved individual characteristics. Nevertheless we can see that a fairly small proportion of the unconditional wage variation remains unexplained, especially when we estimate a model fully saturated for job titles and firms. Firm fixed effect explain a greater proportion of wage variation than job title fixed effects. However, when focusing on the evolution of the RMSE across time, the same pattern does not hold.

In order to better compare the evolution of the relative performance of each of the three regression specifications, in the right panel of Figure 3 we normalize each year-specific RMSE to the 1982 level of the corresponding model. In interpreting the graph, notice

that the *absolute* predictive performance of a model has to be evaluated with respect to the unconditional wage variance. The right panel of Figure 3 is useful in order to compare the *relative* predictive performance of a model with respect to the others, but not the *absolute* one, which indeed tends to grow over time for all specifications.

When considering the right panel of the figure, a clear pattern emerges, as over time the explanatory power of fixed effects for job titles gains importance with respect to the models where firm effects are controlled for. Since *livelli di inquadramento* are defined by sector-wide collective agreement, and a particular minimum wage is set for each of these occupational positions, we interpret this result as a preliminary evidence of the importance of collective bargaining in shaping the evolution of the pay distribution. In Section 5.3, employing a more informative regression framework, we analyse this point in more detail.

#### 4 Econometric Methodology

The contributions of firm-specific, time-constant and time-varying components of wages to raising inequality are identified relying on the higher-dimensional linear panel model of Abowd et al. [1999] (we will alternatively refer to this method as *two-way fixed effects model* and AKM regression). Moreover, in order to make inter-temporal comparisons, we adopt the same strategy of Card et al. [2013], dividing the years under study into different sub-periods. In this section, we briefly review the chosen econometric methodology, we explain the required assumptions, and we discuss the interpretation of the model.

Let  $i$  index a specific worker,  $t$  the time period, and  $j = \iota(i, t)$  the firm in which  $i$  is working at  $t$ . Moreover, let  $y_i$  represent a  $T \times 1$  vector of log wages,  $x_i$  a  $T \times P$  matrix of time- and firm-varying individual characteristics. Then, the two-way fixed effects model can be specified as follows

$$y_{it} = x_{it}\beta + \phi_j + \eta_i + e_{it}$$

where  $y_{it}$  and  $x_{it}$  are rows of  $y_i$  and  $x_i$ ,  $\beta$  is a  $P \times 1$  vector of parameters, while  $\phi_j$  and  $\eta_i$  are respectively firm-constant and time-constant components of individual wages, which are allowed to be arbitrarily correlated with any of the characteristics in  $x_i$ , and which

could be not perfectly observable. We will often refer to  $\eta_i$  with the term *unobserved individual heterogeneity*, and to  $\phi_j$  with *firm wage premium* or *firm wage policy*.

In the above equation  $e_{it}$  is the error term, which we assume to have an expected value equal to zero in all periods. Moreover, it is an idiosyncratic shock, which is not allowed to be correlated with any of the elements in  $x_i, \phi_j$  and  $\eta_i$ . This assumption, which we define as *strict exogeneity*, can be stated formally as

$$E [e_{it} | x_{is}, \phi_{j=\iota(i,s)}, \eta_i] = 0 \quad \forall s, t$$

The above assumption rules out any pattern of endogenous mobility of workers between firms. Any realization of  $\iota(i, s) = j$  should be uncorrelated with  $e_{i,t}$ , so that, for example, negative idiosyncratic shocks in wages should not lead to mobility towards a certain type of firms. However, any correlation between  $\iota(\cdot)$  and  $\eta_i$  or  $\phi_j$  is possible, so that workers of a given type can move toward firms with certain wage policies and vice-versa. If strict exogeneity holds, the model can be consistently estimated by OLS, via inclusion of dummies for individuals' and firms' effects.

The hypothesis of exogenous worker mobility across firms, conditional on individual observable and time-constant unobservable characteristics, has been criticised, e.g. by Eeckhout and Kircher [2011] who point out that many search and matching models of the labour market are inconsistent with the additive linearity of the AKM approach. Card et al. [2013] develop several tests to support the validity of the strict exogeneity assumption. These tests have been conducted on German data (Card et al. [2013]), Portuguese data (Card et al. [2016b]) and, in particular, on Italian Social Security earnings data covering a sample of firms above 50 employees over a period similar to the one analysed here (Macis and Schivardi [2016]). All papers find no evidence in support of the endogenous workers' mobility hypothesis and conclude that the AKM model provides a good approximation of the wage process.

The baseline control variables included in the AKM model are a quadratic term for age, a dummy for part-time workers, three dummies for occupation, the log of the number of employees, six dummies for the first five years of tenure and a full set of time fixed

effects. Moreover, in order to account better for the seniority profile of earnings, we add interactions between age and occupation dummies and age and tenure dummies. To better control for business cycle volatility, we add interactions between firm size and time dummies.

Workers' fixed effects measure the personal earning capacity that is constant over time, and largely portable as individuals move to other firms during their labour market career. Instead, firm fixed effects measure how much differences in wages paid by observationally similar employers matter, keeping constant employee time-constant characteristics and other observable factors. Unlike a simple average of the workers' wages in the firm,  $\phi_j$  can be interpreted as a firm-specific wage policy because the AKM model controls for worker observed and unobserved heterogeneity, and hence accounts for the potential non-random sorting of workers to firms. However, firms' wage premiums can not be directly interpreted as indexes of efficiency or performance, since such variable depends not only on workers' skills, but also on the technology, which is endogenous to the wage (Eeckhout and Kircher [2011]). Nevertheless, since the focus of this analysis is on the determinants of *wage dispersion*, rather than on firms' performance variability, the parameter  $\phi_j$  is still highly informative for our purposes.

There are several reasons why similar firms may adopt differentiated wage policies. As highlighted by a vast stream of literature, firms might offer wages higher than the equilibrium level as part of an *exchange of gifts* with their employees (as in the *efficiency wage theory* set forth by Akerlof [1982]). Moreover, similar firms might adopt a so-called *wage posting behaviour*, offering higher wages in order to reduce the cost of vacancies (e.g. Burdett and Mortensen [1998]). Finally, firms might differ in the degree of rent-sharing, a phenomenon which Card et al. [2014] found to be small, but significant in magnitude, in the labour market analysed here (Card et al. [2014]).

In the AKM regression each firm wage effect is computed with respect to an arbitrary reference category and, as shown by Abowd et al. [2002], it is identified only by workers who changed at least one employer within a given *mobility group*. This is the group containing all workers who ever worked for any of the firms in the group, and all the firms at which

any of the workers in the group were ever employed. In our analysis we have considered only the largest connected set of firms, since this restriction ease the interpretation of firm fixed effects, it implies the loss of an extremely small proportion of observations (around 1-2 %, depending on the period of observation), and it is a quite standard procedure (*e.g.* Card et al. [2013]).

The estimates of firms wage premiums could be biased whenever mobility across workplaces is low and the entire workforce is not observable (Andrews et al. [2008]). For this reason, we report the main results including only for firms located in Veneto, *i.e.* those for which we can observe all their employees. However, firms outside this region are included in the regression, since otherwise we would have a loss in efficiency due to the exclusion of observable job mobility episodes from the estimation sample.

Given the linearity of our panel model, and under the assumption of *strict exogeneity*, the total variance of log wages can be decomposed as follows

$$\begin{aligned} \text{Var}(y_{it}) = & \text{Var}(\phi_{j=l(i,t)}) + \text{Var}(\eta_i) + \text{Var}(x_{it}\beta) + \text{Var}(\epsilon_{it}) + \\ & + 2\text{Cov}(\phi_{j=l(i,t)}, x_{it}\beta + \eta_i) + 2\text{Cov}(\eta_i, x_{it}\beta) \end{aligned} \quad (1)$$

Each component in the right-hand side of the above equation can be recovered from the estimated parameters of our regression model. It follows that we can measure which are, among firm-specific, time-constant and time-varying factors, the main drivers of wage dispersion, and which forces lessen their magnitude over time. With the exception of the error term, the effect of each component on the total variance is mediated by the covariance terms. Of particular interest is the covariance associated to firms' pay premiums, since it measures positive or negative sorting of individuals with given earning ability into types of firms adopting specific wage policies. Instead, the term  $\text{Cov}(\eta_i, x_{it}\beta)$  measures whether workers with higher wage components related to their time-varying characteristics also tend to exhibit higher (positive covariance) or lower (negative covariance) components related to their time constant unobserved heterogeneity.

In practice it is often difficult to provide an economic intuition for which human capital factors are absorbed by unobserved heterogeneity, and what drives the sorting be-

tween time-varying and time-constant characteristics of workers, since to some extent  $\text{Cov}(\eta_i, x_{it}\beta)$  is also determined by how well given workers' skills are measured by the time-varying characteristics included in the regression. For example, Card et al. [2016a] show that separately identifying  $\eta_i$  and  $x_{it}\beta$  can be problematic whenever  $x_{it}$  contains year effects and a linear age term, while the sum of the two components is not affected by this identification problem. Therefore, in presenting our results we more often rely on the following, more parsimonious decomposition

$$\text{Var}(y_{it}) = \text{Var}(\phi_{j=l(i,t)}) + \text{Var}(\eta_i + x_{it}\beta) + \text{Var}(\epsilon_{it}) + 2\text{Cov}(\phi_{j=l(i,t)}, x_{it}\beta + \eta_i) \quad (2)$$

This decomposition is equivalent to the previous one, with the only exception that in equation (2) the term  $\text{Var}(\eta_i + x_{it}\beta)$  captures the joint effect of workers' time-constant and time-varying characteristics. Considering only the variability of the term  $(\eta_i + x_{it}\beta)$ , which is a more comprehensive measure of employees' earning abilities, ease the interpretation of the results by providing a more concise information. In the analysis below we often refer to this term with the expressions *workers' portable pay component* or *workers' wage premium*.

## 5 Main Results

We have estimated the two-way fixed effect model focusing on the evolution of its parameters over time, and the results of this analysis are presented in the next paragraph. Section 5.2 discusses some institutional features that have most likely influenced the evolution of the wage structure in the Italian case, and compares the results of the AKM regressions with those obtained on German data by Card et al. [2013]. Finally, in Section 5.3 we conduct an empirical analysis to assess the extent to which the variability of unconditional wages and of worker's pay premiums, as defined by equation (2), has been influenced by collective bargaining institutions.



### 5.1 Variance Decomposition from the AKM Regressions

We have calculated the variance decomposition of equation (1) on five, partially overlapping, six-years panels. In each panel, we have computed two-way fixed effects regressions controlling for human capital and aggregate shocks in wages. The coefficients associated to the regressors included in  $x_{it}$  were all significant and had the expected sign. The regression R-squared ranged between 0.69 and 0.77. For each period, Table 2 reports the wage variance decomposition.

During the overall period considered, the total wage variance, as computed on each six-years panel, has increased from 0.083 to 0.131, growing by almost 45%. When looking at the behaviour of the various components of pay, some noticeable features emerge. First, in each period, the largest contribution to the total variance derives from the joint effect of worker heterogeneity, both observed and unobserved. In general, the variance of  $\eta_i$  dominates the variance of  $x_{it}\beta$ . However, as mentioned in the previous section, interpreting correctly what drives the relative contributions of the two workers' components is often difficult, given that unobserved heterogeneity is estimated as a residual. Also the covariance of these two terms shows a quite erratic behaviour, with high negative values in the sub-periods where the variance of  $x_{it}\beta$  is relatively larger. This is the main reason why, in the rest of the paper, we tend to focus on the more parsimonious decomposition of equation (2).

A second feature of the results is that the component related to firms' wage premiums provides a smaller contribution to overall wage dispersion than worker's heterogeneity. Importantly, employers' pay policies are more relevant in the first period of the sample (1982-1987), but lose importance thereafter. Finally, the estimated correlation between firm wage effects and worker's heterogeneity (considering both its observed and unobserved components) tends to be negative in the earliest years, but it is clearly increasing over time and positive during the last period considered. Hence, there is a significant tendency towards positive sorting of firms' wage premiums with workers' overall human capital.

To show these trends more clearly, Table 3 reports the decomposition of equation (2),

computed in the first and in the last panel only. In this less detailed decomposition the wage component related to a worker's time-varying observable characteristics and the component deriving from his/her time-constant unobservable skills are jointly considered. It emerges from the table that during both periods (1982-1987 and 1996-2001) the most important determinant of total wage dispersion is the variance of the term  $(\eta_i + x_{it}\beta)$ , which constitutes between two thirds and three fourth of the total pay variance. This evidence is also coherent with previous results on Italian wage dispersion. In particular, Iranzo et al. [2008] analysing a sample of large Italian firms find that roughly two thirds of the total wage variance during the period 1981-1997 is explained by worker-specific pay premiums, but they do not provide evidences on the temporal evolution of wage inequality and of its components.

The lower part of Table 3 shows the evolution of earning dispersion from the earliest to the latest panel. For each component of the total variance, we have computed the difference across samples, the percentage change, and the contribution of this change as a percentage of the change in total wage variance. Between these two periods, total wage variance has risen by almost 45%. More than 52% of this growth is driven by higher dispersion in our comprehensive measure of workers' skills. On the contrary, the dispersion in firms' wage premiums declines between the first and the last panel, providing a *negative* contribution of about 15% to the growth in wage dispersion. Finally, increasing assortative matching between highly paid workers and better paying firms provides another positive contribution to the growth in inequalities. This component represents around 64% of the total trend, even if the correlation between individual skills and  $\phi_j$  is relatively small and close to zero in all sub-periods.

The determinants of raising assortativeness are complex and can not be fully explored within the scope of the present paper. However, at least two tendencies can be associated with this outcome. First, it is tempting to relate the growth in sorting to some evolutions occurred in the Italian labour market and in its legislation since the 1980s. In common with other EU countries, Italy has indeed experienced a general trend of labour market liberalization that may have gradually reduced search and matching frictions, eventually

improving allocative efficiency. For instance, in the 1980s, hiring typically involved only open-end contracts, while temporary contracts were gradually liberalized only starting from the second half of the 1990s. Moreover, during the first years of study, by the law manual workers had to be selected almost exclusively from the unemployment workers' lists held by the public employment service, and not via direct selection mechanisms, as the hiring process was fully liberalized only in the early 1990s.

The second potential reason behind the growth in assortativeness is more technical and linked to the strong wage compression characterizing the early 1980s. Since pay differences between skill groups were generally small in that period, the workers' portable component of wages may reflect individual productivity less accurately during the first years of study. Thus, increased positive sorting of better paid workers to high paying firms may also be induced by a stronger relationship between wages and actual productivity across time.

In the next section we turn the discussion on how changes in the industrial relation system might have had a more direct bearing on the other two main findings of the paper, *i.e.* declining dispersion in firm wage policies and positive contribution of worker-specific wage components to the overall inequality growth. In doing so, it is useful to assess the experience of the second largest manufacturing economy in Europe (Italy) in light of what has already been documented for its manufacturing leader (Germany).

## *5.2 Wage Inequality and Institutions: A Comparative Perspective*

Since we have used a sampling strategy and a method similar to the one that has been applied by Card et al. [2013] on German data, it is particularly interesting to compare their evidence with that provided in our study. Table 4 reports the decomposition of equation (2) applied on the results of Card et al. [2013] and on our sample, considering a comparable period of time. As can be noticed, the level of the variance is higher in West Germany. Beside differences in the definition of wages across samples, another reason for this discrepancy is the sample composition. Our analysis is based on a database covering the Veneto region only, which is a more homogeneous population with a smaller and less developed tertiary sector with respect to Germany.

When considering the evolution over time, it emerges that male earning dispersion has increased in Italy at a similar pace than in West Germany. However, the determinants of this trend are different in the two countries. Card et al. [2013] show that, considering differences between the period 1996-2002 and the period 1985-1991, only 34% of the total growth in wage variance can be attributed to greater individual heterogeneity dispersion, while the same amount is more than 51% in the case of Veneto. Between the same periods firms' pay premiums dispersion rose by almost 25% in Germany, while it has reduced by almost 8% in our sample. Finally, Card et al. [2013] also find that the sorting between firm-specific and employee-specific pay premiums contributed for another 36% to the overall growth in earnings inequality, which is a weaker figure than what we have documented for Italy.

Card et al. [2013] link their findings, and in particular the growth in firms' wage policies dispersion, to the major changes occurred in the German industrial relation system since the early 1990s. As discussed by Dustmann et al. [2009], rather than in legislation reforms, such changes were laid out in contracts and mutual agreements between employer associations, trade unions and works councils. In response to the challenges of the post-reunification period (e.g., increasing threats of firms' off-shoring and massive migration flows), these actors allowed for an unprecedented decentralization of the German wage-setting process since the early 1990s. Deviations from industry-wide agreements through "opting-out", "opening" or "hardship" clauses were all increasingly used, even though the dominating system of industry-wide bargaining basically remained unchanged. On this respect, Card et al. [2013] observe that firms' pay premiums, as computed on the 1996-2002 sample, are disproportionately lower among establishments that had *opted out* from national collective agreements, a tendency that enlarges the overall dispersion in such wage components. Thus, in Germany the growth in the variance of firm-specific wage policies ( $\text{Var}(\phi_j)$ ) was associated to a growth in the share of workers not covered by any kind of union agreement and to a rise in the number of firm-level deviations from industry-wide union agreements.

Italy's system of industrial relations shares many features of the German one, particu-

larly for what concerns the importance of industry-wide collective bargaining. However, in many respects the Italian system has not shown the flexibility demonstrated by the German one, nor have the reforms occurred in Italy during the mid 1990s significantly weakened the influence of collective bargaining on wage setting. Italian firms have never been able to opt-out from the industry-wide settlements, adjusting wages downwardly whenever the local or firm-specific economic conditions so required (see Section 2). This may explain why, unlike in the German case, the variance of Italian firms' wage policies has not widened over time, despite the fact that also Italy has been exposed to the long-run challenges posed by the introduction of new technologies and increased international competition.

Notice that, according to our estimates, the variance of firm wage policies actually decreased from the mid 1980s to the early 2000s. Unable to deviate from the industry-set minimum wages, Italian firms could still have resorted to *incremental* firm-level wage bargaining to differentiate their firm wage policies. Our data do not allow us to observe which firms or workers were covered by firm-level agreements. Nevertheless, the available evidence suggests that the incidence of firm-level agreements declined over time (e.g., Sestito and Rossi [2000]), partly as a consequence of a reduction in unionisation rates, as shown for Veneto by Vaona [2006]. The resulting standardization of compensation schemes across employers is consistent with our finding of a decreasing dispersion in firms' pay policies.

Table 4 shows that the dispersion of observed and unobserved individual heterogeneity has instead been a major contributing factor to the overall wage inequality growth in the Italian case. While in principle this trend may reflect the underlying labour market forces, e.g. demand and supply of skills, in the following section we argue that such market forces have been largely "channelled" into the tracks set by the Italian system of industrial relations, particularly through the sectoral-level bargaining process. We do so by showing that the growth in individual heterogeneity dispersion has been almost entirely driven by broadened differences in pay between the job title categories (*livelli di inquadramento*) defined by industry-wide contracts.

### 5.3 The Impact of Collective Bargaining on Wage and Human Capital Dispersion

In this section we show that overall pay dispersion is mostly determined by *between job titles* earning variability and we link this outcome to the evolutions occurred within collective bargaining agreements. This result is further analysed in the Appendix A, where we show that alternative explanations for this trend have limited ground.

We have applied a variance decomposition methodology that divides total variation of a given quantity, which is partitioned into groups, into differences between groups and differences between members of the same group. Keeping fixed a given period  $t$ , let  $y_{ij}$  represent wages (or another quantity of interest) of worker  $i$  in group  $j$ , let  $n$  be the total number of workers, let  $J$  be the number of groups, and let  $n_j$  be the set of employees in group  $j$ . Define  $\bar{y}_j$  as the average level of wages within group  $j$ , and define the within group variance as

$$V_j = (\|n_j\| - 1)^{-1} \sum_{i \in n_j} (y_{it} - \bar{y}_j)^2$$

where we indicate by  $\|n_j\|$  the cardinality of the set  $n_j$  (*i.e.* the number of employees in group  $j$ ). Using the above notation, we can decompose the total wage variance into a *within group component*, and a *between group component* as follows

$$\text{Var}(y) = \frac{1}{n-1} \left( \underbrace{\sum_{j=1}^J (\|n_j\| - 1) V_j}_{\text{within component}} + \underbrace{\sum_{j=1}^J \|n_j\| (\bar{y}_j - \bar{y})^2}_{\text{between component}} \right) \quad (3)$$

Since the term  $(\eta_i + x_{it}\beta)$  in the AKM regression model, which represents individual-specific productive abilities, is one of the main determinants of inequality, we have applied the decomposition technique defined above on this worker's *portable* wage component, albeit for comparison we have applied the same procedure also on raw earnings. In this section we present results obtained by using *livelli di inquadramento*, as defined by collective bargaining institutions, to partition the population, while the Appendix A presents results obtained by applying the same decomposition on firms.

The allocation of workers to a given *livello* is typically related to time-invariant personal

characteristics, mostly captured by the fixed effect embedded in the workers' portable pay component. The effect of promotion to higher ladders of the scale, as well as the (fairly automatic) seniority wage premiums stipulated at each ladder by the relevant collective contract, are reflected in the time-varying component of the estimated worker premium. Notice that individual firms can affect pay differentials between *livelli di inquadramento* only for what concerns the part above the statutory minimum wages, which are set at the industry-wide level. Moreover, by the law employers are not allowed to downgrade workers into less remunerative job titles, an element providing further rigidity in firms' wage adjustment decisions. In principle, firms can obviously affect the overall composition of job titles through their hiring policies, or by moving upward their current employees. We propose a test for assessing the importance of these last two tendencies in Appendix A, showing that over the years considered in this study there is no clear evidence of a shift in the workforce composition across job titles.

Given this institutional context, the *between* job titles variance can be considered an informative parameter to quantify the impact of collective bargaining on wages. A different measure is proposed by Torres et al. [2013], who include occupation dummies in an AKM model to study the effect of job title membership on wages. However, in the Italian context, our approach is more suitable for studying the influence of collective bargaining on *wage dynamics*. Indeed, in Italy the rules for assigning each worker to a job title are set by the relevant collective contract and change frequently over time. For example, several managerial occupations have started to be regulated by autonomous industry-wide collective contracts since the end of the 1980s. The resulting shift in the segregation of workers across minimum wage levels defined by collective contracts is a source of challenges on how to compare and interpret the variance of job title fixed effects across time. Instead, the proposed variance decomposition, computed on a yearly basis, allows to capture to a full extent such institutionally-driven shifts in the segregation of workers across various minimum wage levels.

Before presenting the decomposition results, we provide further information on how *livelli di inquadramento* have been identified in the data. As mentioned in Section 2, several

economic activities, despite being similar in their nature, can be regulated by more than one collective contract and the number of such industry-wide agreements, as well as the number of job titles defined by them, changes frequently over time. Therefore, we have not attempted at harmonizing the definition of job titles across years. We have instead considered the year-specific definition of *livelli di inquadramento*, based on their classification code. As an inclusion rule, we have adopted the criteria of considering as a legitimate job title only those for which at least 150 observations were present in a given year in the largest connected set of Veneto firms.<sup>3</sup> The total number of *livelli di inquadramento* included in the decompositions ranges between 432 (in 2001) and 520 (in 1984). Moreover, the percentage of observations which we have been able to include in our decompositions, ranges between 83% of the total in 2001 and 70% in 1986.

Figure 4 reports the results of the variance decomposition into a between- and a within-job titles components applied year-by-year. The graphs show that practically all of the growth in the dispersion of wages and of workers' *portable* wage components is accounted for by *increased variability between livelli di inquadramento*. Indeed, both in the case of unconditional wages and of individual heterogeneity, the *between* part of the total variance shows a growing trend, with the partial exception of the second half of the 1990s, while the within component is persistently flat. As a consequence, in relative terms this latter source of variation loses importance as a determinant of overall inequality. Finally, there is a discontinuity in the *between* component of the total variance in 1989, but this outcome is probably due to the measurement error induced by a major change contracts' classification codes, which occurred that year.

Figure 5 reports the evolution of between- and within-job titles workers' wage premiums dispersion by sector (secondary and tertiary)<sup>4</sup> and by broad occupation (white and blue collars), computed by normalizing the 1982 levels of dispersion to 100. A trend similar to the one implied by the right panel of Figure 4 is observed for all categories of workers, but the growth of between job titles dispersion in human capital is somewhat stronger among production workers and in the secondary sector.

A potential explanation for the trend toward higher between-job titles differences in wages



could be that firms have increasingly assigned employees to higher *inquadramento levels*, as a way to raise the base wage of highly-skilled and performing workers. In the Appendix A we show that the role of this re-assignment has been relatively limited, as it can explain only a modest proportion of the between job-title variance displayed in Figure 4. Moreover, we also show that the growth of inequality was not linked to a process in which skill-intensive firms were able to grant better economic conditions.

The results presented in this section, together with the supplementary analysis of Appendix A, show that almost all of the inequality growth has arisen from differences in pay between job titles that are defined and protected by the industry-wide collective agreements. It remains unclear to which extent institutions have simply reacted to market forces, or whether they have represented a distortion to the wage structure. Nevertheless, we can conclude that the growth in Italian wage inequality has been allowed by the opening of the pay gaps between the various *livelli di inquadramento* stipulated in a fairly centralized way at each industry-wide contract renewal, combined with the gradual dismantling of the egalitarian wage indexation system since the mid 1980s.

## 6 Conclusions

In this paper we have analysed the evolution of Italian wage inequality over a two decades period, documenting a substantial growth in several measures of pay dispersion. To interpret this trend, we have decomposed the wage variance into components capturing heterogeneity in firm pay policies, heterogeneity in workers' time-varying and time-constant characteristics, as well as their sorting. We have found that earnings dispersion has been mostly driven by differences in the workers' *portable* component of wages. Instead, the variability of employer-specific pay premiums has reduced over time.

Our results are different from evidences documented for other countries, and Germany in particular. On this respect, we have provided an indirect support to the conclusions of Card et al. [2013]. These authors report evidence of a growth in firms' pay premiums dispersion. They attribute this finding to firm-level deviations from the dispositions of industry-wide collective agreements (e.g., the *opting-out* clauses), which were allowed by

the German system and became increasingly used since the mid 1990s. We have documented the lack of such a flexible adaptation process in a similar manufacturing-oriented economy, which has undergone qualitatively different reforms in its system of industrial relations. Italian firms have been unable to apply heterogeneous pay policies, and to circumvent the constraints to wage dynamics imposed by the sectoral level of bargaining. To shed further light on the role played by collective bargaining in the observed inequality trend, we have analysed the evolution of pay differentials across so-called *livelli di inquadramento*. These are job titles defined by nation-wide sectoral collective agreements, for which specific minimum wages hold and apply regardless of a worker's union membership. A simple variance-decomposition exercise allowed us to show that the growth in both, wage and human capital dispersion, has almost entirely occurred between such job titles.

Overall, our results show that market forces have been largely “channelled” into the tight tracks set by the rules governing the country's fairly centralized system of industrial relations. Moreover, during the overall period considered, firms have been granted very limited margins of wage flexibility. The extent to which the bargaining system may have been able to provide the adequate signals about the *appropriate* wage adjustments, i.e. the adjustment required by underlying market forces, remains an open question.

## Appendix

### A Related Evidence on Between Job Titles Pay Dispersion

In this section we provide further evidences related to the evolution of wage inequality between the so-called *livelli di inquadramento*. In particular, we test whether this type of dispersion has been driven by a trend in the composition of the labour force, which could have become more likely to be employed at relatively low-paid (or high paid) occupations. Moreover, we test whether differences in wages and human capital arise mostly within or between firms.

The left panel of Figure A.6 shows the proportion of workers within each quartile of the job titles' average pay distribution. In constructing the graph, we have computed

year-by-year the average wage within each job title, separately considering workers in the secondary and tertiary sectors. For each of these two sectors, we have classified each job title according to the quartile of the job titles' average pay distribution to which it belongs. Then, we have computed year-by-year the proportion of workers within each quartile group of job titles. Notice that, since we have not weighted this distribution by the number of observations within each job title, a given percentile of the job titles' average pay distribution can be quite different from the same percentile of the wage distribution.

In the right panel of Figure A.6 we replicate the analysis described above, this time considering the worker-specific component of the wage, as estimated by the AKM regression model. In particular, we have computed the average level of *skills* (*i.e.* observed and unobserved individual heterogeneity) within each job title. We have used this information to rank job titles into quartiles, and we have computed the proportion of workers within each quartile group.

The left panel of Figure A.6 shows that the proportion of workers within each quartile of the job title pay distribution has been fairly constant during the overall period considered. There are some exceptions to this general trend. In particular, in the years 1982 and 1983 the proportion of secondary sector workers belonging to the upper quartiles of the job title distribution is quite low. This tendency is probably induced by the wage adjustment mechanisms in place up until 1984, which were shifting upward wages at the bottom of the pay scale. Moreover, during the same two years the proportion of workers in the two lowest quartiles of the tertiary sector was smaller than in subsequent years. During the years between 1984 and the beginning of the 1990s, both in the secondary and tertiary sectors there is a small growth in the proportion of workers in the highest quartile of job titles. However, at least in the secondary sector, this tendency is only cyclical, given that, from the early 1990s onwards, this same proportion decreases to levels similar to the ones in place during the early 1980s. Finally, in the service sector only, there is a small growth in the proportion of workers belonging to the lowest quartile of the job title distribution during the early 1980s. Other discrepancies across time tend to be year-specific, and are

most likely attributable to differences in the job title classification codes from one year to the other.

The right panel of Figure A.6 shows that even when differences in the characteristics of employers are accounted for, most tendencies remain similar to the ones described in the left panel. The growth in the proportion of service sector workers belonging to the first quartile of job titles is confirmed and it is even stronger in this case. However, also here other trends seem to be either year specific, or relatively small in magnitude.

Overall, by analysing the composition of job title categories across time, we can conclude that the main channel driving greater wage dispersion is linked to differences in how the same occupations are rewarded across time. Thus, with the partial exception of the service sector, where employers have become more likely to hire workers belonging to less remunerative job title categories, there is no evidence of a process of *polarization* of the workforce.

The growth of pay differentials between job titles, which we have documented in Section 5.3, could also derive from a process of segregation of the more qualified workers into given enclaves of firms. Such market-driven process would then probably be reflected in collective bargaining dynamics, given that the more skill-intensive firms could be able to grant better economic conditions to selected groups of job titles. On the other hand, if pay differentials between firms are low, despite a general growth in job title heterogeneity, we may think that firms are constrained by the sectoral bargaining standards, given that most of the inequality growth occurs within establishments, instead of across them. We test this hypothesis computing year-by-year the decomposition of equation (3), this time using firms as the partitioning group of the population.

Figure A.7 reports the within- and between-firms variance decomposition, applied on wages and on the estimated individual heterogeneity of the workforce. The left panel of the figure shows that wage variation was almost equally split into a within- and a between-firms component during the early 1980s. Since then, the importance of earnings variance among co-workers rises sharply with respect to differences in average wages between plants. Nevertheless, the years under study are characterized also by a small growth

in the unconditional wage variance *between firms*. This latter process can be mostly ascribed to increased sorting of workers' wage premiums with firms' pay premiums, a result which emerged from the AKM variance decomposition.

In the right panel of Figure A.7 we compute the same variance decomposition using workers' wage premiums alone, instead of total wages. It emerges that the dispersion *between employers* of this component of the pay, which controls for heterogeneity in firms' wage residuals, has even declined over the entire period. Therefore, we find no evidence of greater segregation of workers' skills across employers.

The low level of between-firms pay dispersion documented here is coherent with previous studies on Italy (such as Iranzo et al. [2008]), but it is a quite peculiar result when compared with evidences available for other European countries and the US.<sup>5</sup> Moreover, our finding is particularly robust, given that the sample includes also very small firms and the private service sector, which are two categories whose exclusion could drive the estimates of between-plants pay differentials down.

Overall Italy is not characterized by strong pay differences between firms, which could have been relevant if, for example, greater dispersion in productive performance across employers, often considered an outcome of technological changes and international competition, had induced greater heterogeneity in wages between plants. Instead, the relevance of pay dispersion between job titles, which is documented by Figure 4, suggests that, in the Italian case, the growth of inequality has entirely occurred within the collective bargaining framework. Based on our results, we can conclude that over the years such institution has granted more heterogeneous conditions for selected categories of workers (*i.e.* job titles), while it has provided limited margins of flexibility for the firms.

## Notes

<sup>1</sup>The VWH dataset has been developed by the Department of Economics of the University of Venice Ca' Foscari under the supervision of Giuseppe Tattara, on the basis of administrative records of the Italian Social Security Institute (INPS).

<sup>2</sup>The WHIP dataset is derived from INPS social security archives processed in a public-use file by LABORatorio Revelli. For more information, see [www.laboratoriorevelli.it/whip](http://www.laboratoriorevelli.it/whip)

<sup>3</sup>This inclusion rule has been chosen to mitigate measurement error issues which are embedded in job titles' classification codes. When computing the variance decomposition using different thresholds, we did not find great sensitivity in the results.

<sup>4</sup>By secondary sector, we define manufacturing and constructions sector. The primary sector (agriculture, forestry, fishing and mining) is excluded from these computations. The service sector is defined as the residual category.

<sup>5</sup>Among studies focusing on between-plant wage inequality in other countries, see for example Faggio et al. [2010] on UK. Card et al. [2013] show that in Germany firms pay premiums dispersion has risen over time also when accounting for employees' sorting across plants.

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## Figures and Tables

Table 1: Summary Statistics (Mean and St. Dev.) by Period

<b>Period</b>	<b>1982-1987</b>	<b>1984-1989</b>	<b>1988-1993</b>	<b>1992-1997</b>	<b>1996-2001</b>
Log daily wages	4.782	4.801	4.855	4.866	4.874
<i>St. Dev.</i>	0.287	0.303	0.337	0.350	0.362
Age	36.76	36.37	35.94	35.83	35.81
<i>St. Dev.</i>	11.07	11.04	10.91	10.40	9.85
Firms' workers	7.884	7.392	7.031	7.500	7.419
<i>St. Dev.</i>	55.30	48.77	39.05	52.09	49.023
Tenure	5.072	5.552	6.013	6.451	6.479
<i>St. Dev.</i>	3.631	4.325	5.494	6.252	6.823
<i>Proportions</i>					
Part Time	0.002	0.004	0.007	0.011	0.016
Apprentice	0.016	0.020	0.025	0.025	0.035
Blue Collar	0.730	0.729	0.723	0.723	0.708
White Collar	0.247	0.243	0.242	0.244	0.250
Manager	0.007	0.007	0.008	0.007	0.007
Primary Sect.	0.043	0.045	0.045	0.044	0.042
Secondary Sect.	0.626	0.631	0.648	0.651	0.663
Tertiary Sect.	0.331	0.324	0.307	0.305	0.295
<b>Total Workers</b>	<b>698,378</b>	<b>724,448</b>	<b>753,753</b>	<b>777,019</b>	<b>845,984</b>
<b>Total Firms</b>	<b>64,972</b>	<b>72,605</b>	<b>80,159</b>	<b>80,572</b>	<b>85,104</b>

*The sample is composed of firms located in Veneto belonging to the largest connected set. Part-time contracts have been introduced only since 1985. Tenure is censored at 1975. Average firms' size is non-weighted and measured by the number of employees working for at least six months in a year*

Table 2: Variance Decomposition of Log Daily Wages

Period	Var( $\phi_j$ )	Var( $\eta_i$ )	Var( $x_{it}\beta$ )	Var( $\epsilon_{it}$ )	2Cov( $\phi_j,$ $x_{it}\beta + \eta_i$ )	2Cov( $\eta_i,$ $x_{it}\beta$ )	TOTAL VAR.
1982-1987	0.031	0.050	0.006	0.008	-0.019	0.007	0.083
1984-1989	0.027	0.100	0.089	0.008	-0.011	-0.121	0.092
1988-1993	0.026	0.101	0.094	0.008	0.001	-0.116	0.113
1992-1997	0.028	0.076	0.007	0.007	0.000	0.006	0.123
1996-2001	0.024	0.130	0.153	0.007	0.012	-0.195	0.131

*The estimation sample is composed of all workers in the largest connected set, provided they were employed for at least four months. Results are computed only for firms located in Veneto.*

Table 3: Decomposition of the Total Wage Variance Evolution

Period	Var( $\phi_j$ )	Var( $\eta_i +$ $x_{it}\beta$ )	Var( $e_{it}$ )	2Cov( $\phi_j, \eta_i +$ $x_{it}\beta$ )	TOTAL VAR.
1982-1987	0.031	0.063	0.008	-0.019	0.083
<i>% of Total</i>	<i>37.3</i>	<i>75.9</i>	<i>9.6</i>	<i>-22.9</i>	<i>100</i>
1996-2001	0.024	0.088	0.007	0.012	0.131
<i>% of Total</i>	<i>18.3</i>	<i>67.2</i>	<i>5.3</i>	<i>9.2</i>	<i>100</i>
<b>Difference</b>	-0.007	0.025	-0.001	0.031	0.048
<b>% <math>\Delta</math></b>	-25.5	33.1	-13.3	200.0	44.9
<b>% <math>\Delta/\Delta_{TOT}</math></b>	<b>-14.6</b>	<b>52.1</b>	<b>-2.1</b>	<b>64.6</b>	<b>100.0</b>

Percentage changes for a given quantity  $z$  from  $t - 1$  to  $t$  are computed using a reference value  $z_r$  defined as  $z_r = \frac{|z_t| + |z_{t-1}|}{2}$

Table 4: Wage Variance Evolution in Germany and Italy

Veneto Working Histories Data, Male Sample					
Period	Var( $\phi_j$ )	Var( $\eta_i + x_{it}\beta$ )	Var( $e_{it}$ )	2Cov( $\phi_j, \eta_i + x_{it}\beta$ )	TOTAL VAR.
1984-1989	0.027	0.068	0.008	-0.011	0.092
<i>% of Total</i>	<i>29.3%</i>	<i>73.9%</i>	<i>8.7%</i>	<i>-12.0%</i>	<i>100.0%</i>
1996-2001	0.024	0.088	0.007	0.012	0.131
<i>% of Total</i>	<i>18.3%</i>	<i>67.2%</i>	<i>5.3%</i>	<i>9.2%</i>	<i>100.0%</i>
% $\Delta$	-11.8%	25.6%	-13.3%	200.0%	35.0%
% $\Delta/\Delta_{TOT}$	<b>-7.7%</b>	<b>51.3%</b>	<b>-2.6%</b>	<b>59.0%</b>	<b>100.0%</b>
German IAB Data, Male Sample (from Card et al. [2013])					
Period	Var( $\phi_j$ )	Var( $\eta_i + x_{it}\beta$ )	Var( $e_{it}$ )	2Cov( $\phi_j, \eta_i + x_{it}\beta$ )	TOTAL VAR.
1985-1991	0.025	0.095	0.014	0.005	0.139
<i>% of Total</i>	<i>18.1%</i>	<i>67.9%</i>	<i>10.2%</i>	<i>3.8%</i>	<i>100.0%</i>
1996-2002	0.038	0.112	0.017	0.023	0.190
<i>% of Total</i>	<i>19.9%</i>	<i>59.0%</i>	<i>8.9%</i>	<i>12.3%</i>	<i>100.0%</i>
% $\Delta$	39.3%	16.6%	17.6%	125.5%	30.5%
% $\Delta/\Delta_{TOT}$	<b>24.6%</b>	<b>34.2%</b>	<b>5.5%</b>	<b>35.7%</b>	<b>100.0%</b>

Percentage changes for a given quantity  $z$  from  $t - 1$  to  $t$  are computed using a reference value  $z_r$  defined as  $z_r = \frac{|z_t| + |z_{t-1}|}{2}$

Figure 1: St. Dev. of Log Daily Wages in Italy and Veneto

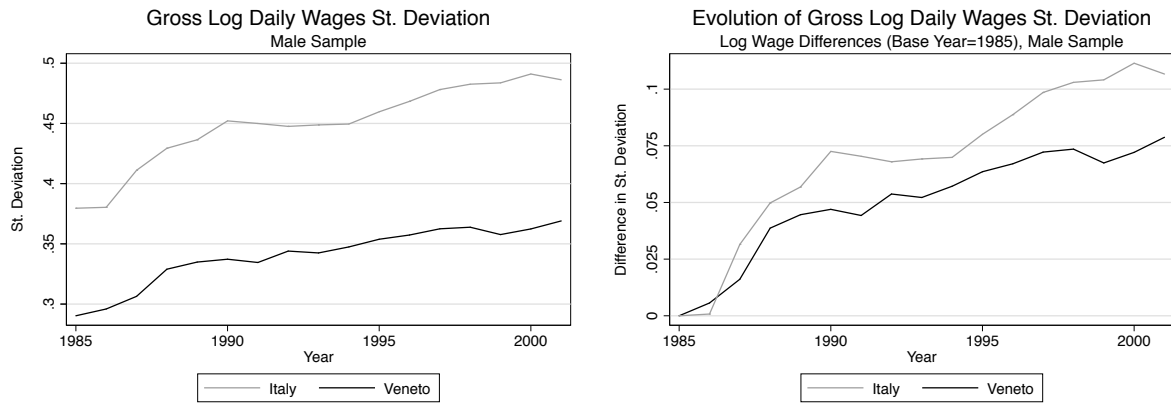


Figure 2: Evolution of Log Daily Wages at by Percentile and Year

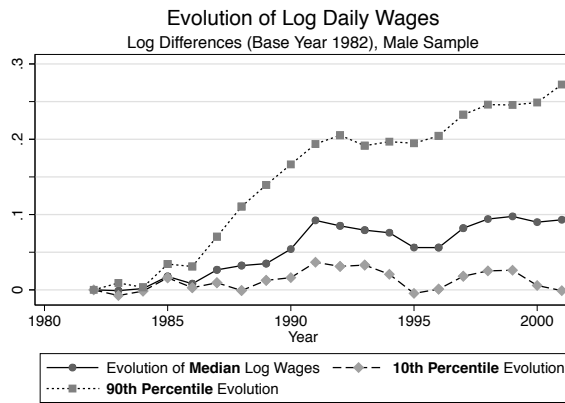
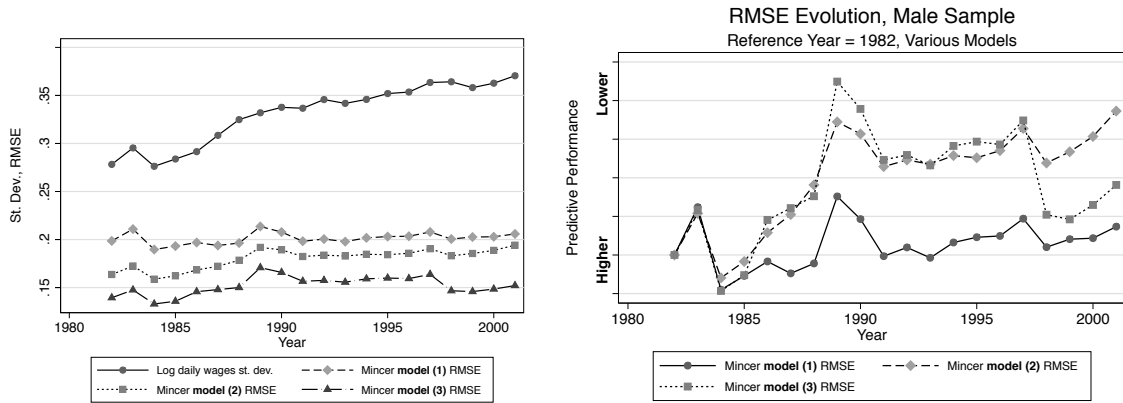


Figure 3: Wage St. Dev. and RMSE from Alternative Wage Models

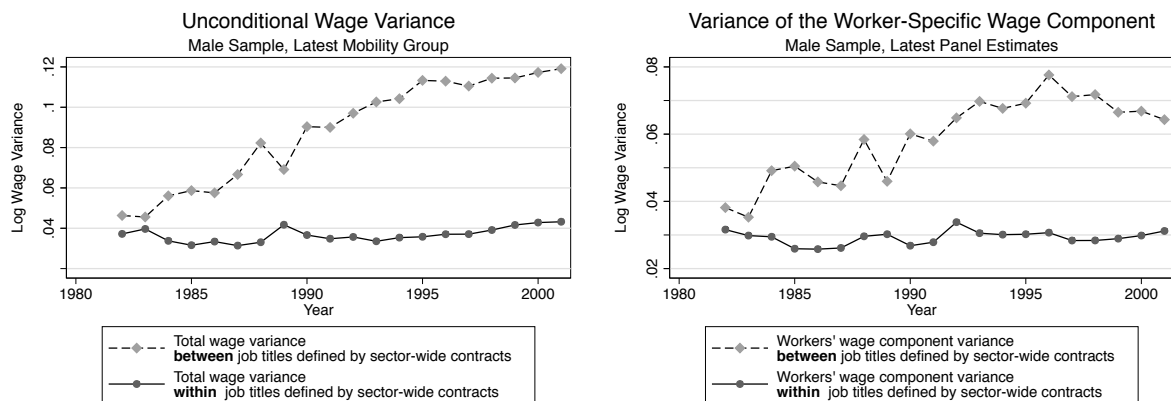


**Baseline controls:** age (quadratic), tenure dummies, four qualification dummies, log of employees number, sector fixed effects, national industry-wide collective contract fixed effects.

**Models' definition:** (1) job title (*livello di inquadramento*) fixed effects; (2) firm fixed effects; (3) fully saturated fixed effects for job titles and firms.

**Note:** national collective contracts vary within and across sectors, and might be not homogeneous across years. *Livelli di inquadramento* are job titles determined by each national collective contract, and are not homogeneous across years.

Figure 4: Unconditional Wage Variance and Workers' Wage Premiums  
Variance Decomposition Within- and Between Job Titles



Job titles (*livelli di inquadramento*) are defined within each sector-wide collective contract. In each year, we have selected only job titles represented by at least 150 workers in the largest connected set of Veneto firms, including a total number of distinct job titles between 432 (in 2001) and 520 (in 1984).

Figure 5: Workers' Wage Premiums Variance Within- and Between Job Titles by Sector and Occupation

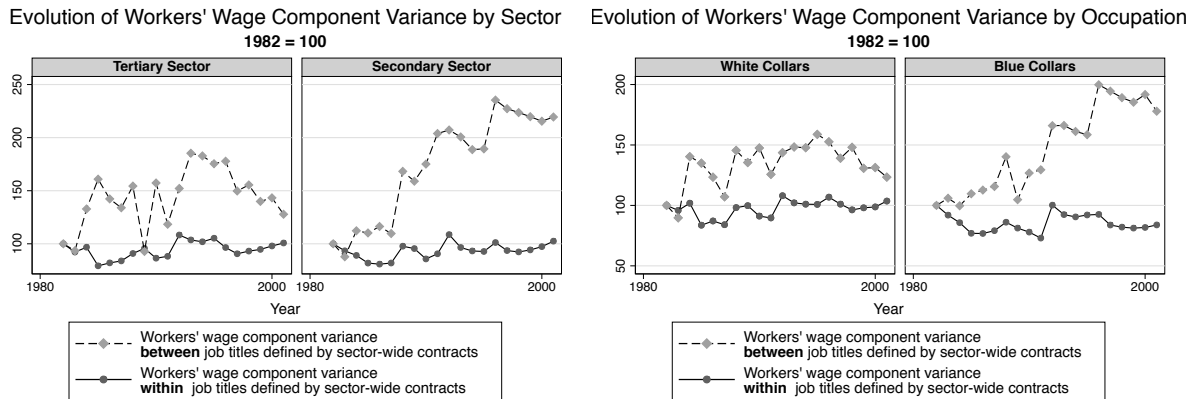


Figure A.6: Proportion of Workers Within Quartiles of the Job Titles' Average Pay and Skills Distribution

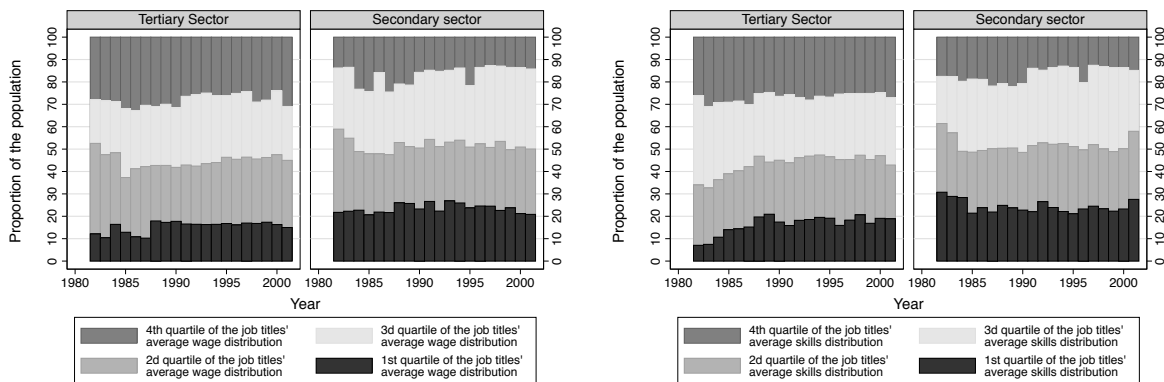
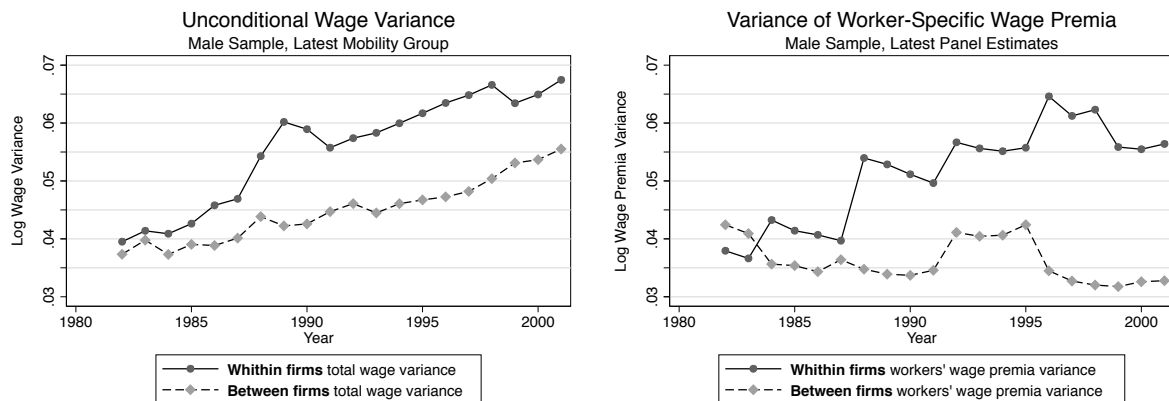


Figure A.7: Within- and Between-Firms Decomposition of Unconditional Wage Variance and Workers' Wage Premiums Variance



Worker's wage premiums variance is defined as  $\text{Var}(\eta_i + x_{it}\beta)$ . Since each panel that we have constructed is partially overlapping, for each year we report only estimates of  $\text{Var}(\eta_i + x_{it}\beta)$  from the latest available period. For each year, the unconditional wage variance is computed on the largest connected set in the latest panel. Only firms located in Veneto are considered.

## B Other Figures

Figure B.1: Long-Run Evolution of Gross Weekly Wages

