WAGE CHANGES, ESTABLISHMENT GROWTH, AND THE EFFECT OF COMPOSITION BIAS

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INTRODUCTION

The correlation between real wages and aggregate employment growth has been the object of several empirical studies conducted with both aggregate and micro data. Despite the new availability of linked employer-employee data, however, we still have limited empirical evidence [Belzil, 2000] to describe how real wage cyclicality can be explained by what happens between workers and employers at the firm level. This paper makes a contribution by making use of Italian data to explore whether a positive relationship between wage growth and employment growth is induced mainly by an establishment effect or by an industry effect, at least as long as these effects are measured in terms of employment changes.

As in the case of wage cyclicality studies, this research takes into account the consequences that a composition effect can have on the factors that affect the employee earnings in each establishment. When a firm is growing, as well as in the growth phase of a cycle, new workers enter the job market. They are traditionally low-skill employees or young people or previously "discouraged" workers. They earn low wages, and so lower the average wage in the firm. This can explain the negative or insignificant correlation between real wages and employment level that has been found in several studies conducted at the aggregate level. For the first time, this study tests the existence of a composition bias with firm-level data where both employment and wage growth can be measured for each establishment. Checking whether employment growth, within firms and within sectors, differently affects the change in the firm's average wage or the mean of the individual wage changes does this.

This research makes use of 1981-83 records for a sample of Italian firms. Information about each establishment is combined with information about its employees. The study explores cases in which firms are experiencing an employment decline, an employment increase, or no more than the national rate of labor turnover. The same analysis is conducted for categories of workers that, within the same firm, differ because of job qualifications or gender.

The paper is organized as follows: part 2 presents some of the theories concerning the relationship between wage changes and employment growth. It also illustrates the problem of a possible composition bias. Part 3 presents the empirical framework. Part 4 describes the data set used for the estimations. Part 5 discusses the results. The conclusions summarize the major findings.

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THE RELATIONSHIP BETWEEN FIRMS' EMPLOYMENT GROWTH, WAGE GROWTH, AND THE COMPOSITION EFFECT

As far as the relationship between levels of employment and real wages is concerned, the early evidence collected by exploiting aggregate time series had indicated acyclical, or very weak, pro cyclical real-wage behavior [Geary and Kennan, 1982]. This result has been criticized, however, by some more recent research that has relied on individual longitudinal data and has suggested the existence of a positive, significant correlation between real wages and aggregate employment levels [Abraham and Haltiwanger, 1995].

This disagreement suggests the need to explore how this correlation grows out of what happens at the establishment level. This evidence could then be used to infer the validity of theories that changes in the level of employment and of real wages are not due to shifts of the labor supply, but to shifts of the labor demand curve along a positively sloped supply curve.

On one side, the human capital theory provides a framework in which wages can increase with employment because of the higher pay that some workers will be able to claim when their skills are scarce and in high demand. Employees can accumulate some skills when they and/or their firm invest in their human capital. If these skills are industry specific, the employees should be able to command a high alternative wage. Then, the employer who wants to keep these workers and save in mobility costs is left with the option of increasing their salaries. If this is the case, an empirical test should show that changes in employees' wages are explained by the changes in the level of employment that occurs in sectors where worker expertise is required.

A positive relationship between wage changes and employment growth could also be consistent with a different story that describes a power struggle within each firm. Within the same human capital framework, this situation could be caused by the monopsonistic power that some workers gain because of their accumulation of the firm's specific skills [Brown, 1989; Neal, 1998], although this explanation could probably explain the wage behaviors of only a few rare, skilled workers.

The predominant role of "inside" effects could also be predicted on the basis of other theories that model how employees can capture some of the rents generated by their expanding firm [Layard, Nickell, and Jackman, 1991; Lindbeck and Snower, 2001]. The sociological models of the efficiency wage theory, for example, are consistent with a situation in which an expanding firm may be willing to pay higher wages to its employees to guarantee their cooperative behavior. On one side, the workers' efforts can be positively related to the degree of fairness that they perceive in their wage contracts both in terms of relative wage comparisons and in terms of their entitlement to some of the firm's profits. At the same time, the same employer can value a cooperative environment because it affects directly, and indirectly through the effect on profits, his utility function. This scenario can be the result of individual bargaining as well as of wage levels achieved with the intervention of unions.

Models that describe how employees can gain from their firm's increase in profitability have been empirically tested.[1] Blanchflower and Oswald [1988] and Levine [1992] have shown that the firm's productivity is a main determinant of wages, but researchers have differed in the choice of firm-performance measurement. Abowd, Kramarz,

and Margolis [1999] have measured productivity in terms of real value added and real sales per employee and found that high-wage firms are more productive per worker. Nickell and Wadhwani [1990] have found a significant role for the output price and for other measures of financial wealth, such as the deposit/current liabilities ratio and the debt/equity ratio. In Hildreth and Oswald [1997], long-run changes in wages are correlated with profit per employee. Brunello and Wadhwani [1989], Brown and Medoff [1989], and Troske [1999] have stressed the importance of firm size as part of this set of "inside" factors.

In the following analysis, I consider the expansion of a firm's labor force as an additional index of the firm's economic performance. I test the relationship between wage growth and employment growth to draw some additional insights on the validity of rent-sharing models and of firm-specific human capital models, versus theories stressing the importance of industry effects, that is, of the shortage of an industry's specific human capital. In particular, by comparing the effect of a labor force expansion at the firm or industry level, I try to infer the relative power of "inside" versus "outside" factors in wage determination.[2] Moreover, by comparing the results between expanding and declining firms, I explore to what extent this effect is symmetric across "good" and "bad" times.[3]

This analysis runs into the same difficulty, however, that has generally characterized studies of real wage cyclicality: the potential composition bias first described by Stockman [1983]. In fact, a study that relies just on aggregate measures of wage changes risks drawing incorrect conclusions because of a statistical artifact. If the labor force is heterogeneous and the groups that enter or exit the labor force during expansions or depressions are not random, then the aggregate average wages will reflect the presence of these different groups of workers. Indeed, lessons learned from studies concerned with the decomposition of industry productivity [Haltiwanger, 1997; Baily, Hulten and Campbell, 1992] imply that changes in industry aggregate real wages can be driven by four different effects: changes in wages occurring within individual firms, changes driven by the reallocation of employment shares between firms, changes driven by the entry of workers, and changes driven by the exit of workers.

This same decomposition problem has to be considered when we study the behavior of expanding and contracting single firms. As explained in Bils [1985], Solon, Barsky, and Parker [1994], and Abraham and Haltiwanger [1995], the aggregate statistics of wages are measured as the ratio of the total wage bill, B_t, to the total number of hours H_t (or days, months) worked in the economy (or in the firm) in period t:

$$W_t = (B_t / H_t) \,. \tag{1}$$

Therefore, the aggregate wage statistics, W_t, is a weighted average of the individual wages w_{it}:

$$W_t = \sum_{i=1}^{n} (h_{it} / H_t) w_{it}, \tag{2}$$

where the weights are given by the share of working hours worked by each individual (or group), i, during period t. h_{it} corresponds to the total hours worked by the individual, and H_t represents the total amount of hours worked in the economy (or in the firm).

It is clear that the firm average wage could be affected by changes experienced by current employees *within* the firm, such as increases in individual wages or internal reallocation of workers between low and high paying jobs. At the same time, "outside" factors leading to the entry or exit of groups of workers having specific characteristics that affect wages will also lead to a different average level of real wages. If, during an expansion, low-skilled people enter the labor market, this will have a countercyclical effect on the average wage of the economy or, simply, a negative effect on the average wage of the single establishment. At the same time, when a firm runs into a recession, it will usually dismiss employees who earn low wages: low-skilled workers, women, and young people. If the magnitude of these external changes outweighs the role played by within-firm changes in determining the firm's average wages, then these phenomena can lead to the incorrect conclusion that the firm's aggregate wages are inversely related to employment growth.

This study tries to correct for this composition bias to infer how wages respond to the expansions and contractions of firms. It provides, for the first time, some evidence about the magnitude of this bias in a study in which the average wage measures have been calculated at the firm level. To do so, the analysis considers the firm as the unit of observation, but also controls for the characteristics of the individuals employed in each establishment. To check for the existence of a composition effect, it examines the behavior of different measures of the mean wage growth as employment changes within the firm and within the industry. The wage statistics are aggregated within each establishment.

Once the results are corrected for this potential source of bias, the analysis can examine how wages respond to changes in the level of employment. In particular, it checks whether wage changes are explained mainly by an industry effect, or whether they respond to changes in employment level at the firm level.

THE DATA

The data used in this study come from the archives of the Italian Social Security Administration (Istituto Nazionale per la Previdenza Sociale-INPS). This department keeps records on all employed workers, with the exception of agricultural workers and self-employed individuals.

Once a year, every Italian employer is required to submit to the INPS information on the gross earnings of its employees and the total amount of time they worked for him. These records are then used to estimate the total amount of money the firm will have to pay both to the tax collection agency, on behalf of its employees, and to the Social Security Administration, as contributions for the workers' health insurance, family allocations, and pension funds. These forms are thus comparable to a combination of a firm's social security records and records of payroll deductions made to the Internal Revenue Service in the United States.[4]

The data set used for this study was constructed with records of firms that had been randomly sampled from the archives of Turin, Italy, over the 1981-83 period. Turin is situated in the northern part of the country and is one of the most industrialized cities in Italy. This city was one of the main destinations for the large flow of migrants who moved from the South to the North during the 1950s and 1960s. The

flow of migrants was mainly induced by the presence of FIAT, the largest Italian car manufacturer, which generated a very large number of other industrial activities. The heavy concentration of both large and small firms in this city explains its role as the main center for changes in industrial relations in 1981, 1982, and 1983. This role became especially evident during the years of this study, 1981, 1982, and 1983, which represent a crucial period in the evolution of Italy's labor relations and labor regulations. The years 1975-79 had been a period of high union power. Unions had pressured the government to introduce solidarity policies that drastically reduced wage differentials. These policies produced a clash of interests between low-skill and high-skill employees, however. This resulted in a deep fracture within the union movement. After the period of compression of skill differential, the years 1980-85 were characterized by stable or declining real wages; increases in productivity, profits, and working hours; and a decline in absenteeism and employment.

The main characteristic of this data set is that it combines information about the firms and about all the employees who were working in them. The individual financial records include annual earnings and the calendar months during which the employee received at least some remuneration. To calculate real monthly wages, the nominal values of wages were deflated by using the national CPI. The sampling procedures, and the criteria used to construct a preliminary data set, are described in detail in Galizzi and Lang [1998].

The data set includes records for all the workers for whom observations were available except for ones deleted because of inconsistency in some records (about gender, age, etc.). The data also exclude records concerning workers suspected to be employed under the CIG, the Italian unemployment insurance system. In fact, although it is possible to tell if workers are still under contract and whether they are being paid, the Italian unemployment compensation scheme complicates the detection of separations. Under the "Cassa Integrazione Guadagni" (CIG), workers received 80 percent of their wages from the government (they were paid through the Social Security System). The CIG was very popular during the period spanned by the data set (1981-83). In the industrial sector, the percentage of employees in CIG went from 2.7 percent in 1980 to 9.9 percent in 1984 [Barca and Magnani, 1989, 67]. There is some uncertainty about the way these cases were recorded in the original Social Security data, however, and the original data set was reduced by 6.81 percent after deletion of cases of suspected CIG.[5]

This new sample contained a total of 1,274 firms employing 24,808 individuals. Workers' records were used to calculate firms' average wages and average workers characteristics, as well as the average wages for each gender and skill level within each firm and each two-digit industrial sector. The total number of firms was further reduced to include only the 1,130 establishments for which it was possible to calculate the value of real monthly wage changes and of employment growth over at least two years. More specifically, 1,034 firms had records over three consecutive years (1981, 1982, and 1983), and 96 firms had records only over two consecutive years. The final firms unbalanced panel data set was then made out of 3,294 yearly observations.

Table 1 presents some preliminary descriptive statistics for the original sample. It shows that this sample is composed mainly of very small establishments. Eighty-seven percent of the observations are of firms with 15 or fewer employees. As the

econometric analysis will show, I have chosen this size as a threshold to conduct the estimations on separate groups of firms because of the different meaning that a given rate of employment growth can have in a very small establishment or in a medium to large establishment. Moreover, if a firm had fewer than 16 employees, Italian employers were exempt from following the labor laws.

TABLE 1
Summary Statistics for Turin, Italy

	All Firms (n = 3,294)		Size > 15 (n = 427)	
Variables	Mean	Sdt. Dev.	Mean	Std. Dev.
Ln (Firm's Average W_t)	6.35	0.39	6.76	0.51
Ln (Firm's Average W_t) – Ln (Firm's Av. W_{t-1})	0.04	0.21	0.01	0.08
Σ (Ln (w_i)) / n	6.33	0.41	6.60	0.36
Σ [Ln (w_{it})] /n – Σ [Ln ($w_{it\text{-}1}$)] /n	0.04	0.26	0.02	0.12
Σ [Ln (w_{it}/w_{it-1})]/n	0.03	0.13	0.01	0.05
Ln (*Firm's Employment*$_t$) – Ln (*Firm's Emp.*$_{t-1}$)	–0.06	0.47	–0.05	0.23
Ln (*Industry's Emp.*$_t$) – Ln (*Industry's Emp.*$_{t-1}$)	–0.01	0.30	–0.02	0.04
Size of the Firm	16.03	66.44	94.17	164.07
Average Age of Firm's Employees	29.75	9.07	35.86	5.21
% Men	0.67	0.38	0.75	0.24
% Trainees	0.15	0.29	0.01	0.04
% Blue-Collar Workers	0.53	0.39	0.66	0.27
% White-Collar Workers	0.30	0.37	0.28	0.26
% Managers	0.01	0.09	0.03	0.11
% Home Workers	0.001	0.02	0.003	0.03
% Changes in Skill Level	0.19	0.27	0.10	0.09
Dummy for year = 1983	0.32	0.46	0.30	0.45

The descriptive statistics also show the changes that occur in the data set when we go from the sample containing very small establishments to the one that just includes establishments with more than 15 employees over two consecutive years. In this case, on average, the employees are older (the average age of the firm's workers rises from 30 to 36 years), firms employ a larger percentage of male workers (the percentage rises from 67 to 75 percent), and different percentages of individuals are in different, mainly higher, skill qualification groups (the percentages go from 15 to 1 percent of trainees, from 53 to 66 percent blue collar, from 30 to 28 percent white collar, and from 1 to 3 percent managers).

Finally, these data reflect the previously mentioned years of deep recession for the Italian economy. The level of employment in the Italian manufacturing sectors had fallen by 0.4 percent between 1979 and 1980, by 2.9 percent between 1981 and 1982, by 4.5 percent between 1982 and 1983, and by 1.1 percent between 1984 and 1985. The recovery started only in 1985 [Barca and Magnani, 1989, 35]. This situation is reflected in the data set, where the mean employment growth rate for the three years was -0.06 for the entire sample and -0.05 for the establishments with more than 15 employees.

The limited number of firms experiencing employment growth complicates the interpretation of this analysis, which tries to detect possible different relationships between wages and employment growth among expanding and declining firms. In addition to the estimations conducted for firms that experienced employment growth greater or smaller than zero, therefore, I also tried to check the consistency of some results by looking at firms in which employment grew by at least -5 percent over two consecutive years.[6]

THE EMPIRICAL FRAMEWORK

The model that I estimate to study how real wages respond to the expansion and contraction of firms originates from a general specification of the log wage equation. Because my unit of observation is the single firm, I want to define a firm's mean wage equation, and I derive it from an individual wage equation.

For an individual i employed at time t, the real wage equation can usually be described as a function of personal (individual specific, $\mathbf{x}_i$, and time varying, $\mathbf{x}_{it}$) characteristics, as a function of the level of the firm's economic activity, Y (measured by the level of employment in the establishment), and as a function of the alternative job opportunities the individual could have (measured by Z, the level of employment of the industry for which he/she has desirable skills). Therefore:

$$\ln w_{it} = \beta_{0t} + \mathbf{x}_i\beta_1 + \mathbf{x}_{it}\beta_2 + Y_t\beta_3 + Z_t\beta_4 + \varepsilon_{it} \tag{3}$$

and the error term can be decomposed as

$$\varepsilon_{it} = \alpha_i + \lambda_{it} + \mu_t\,, \tag{4}$$

where α_i is the individual-specific effect, λ_{it} is the error component that varies over individuals and time, and μ_t is the time-specific effect. Then, taking the first-differences eliminates both the individual-specific regressor $\mathbf{x}_i$ and the individual "fixed-effect" error component, α_i:

$$\ln (w_{it} / w_{it-1}) = (\beta_{0t} - \beta_{0t-1}) + (\mathbf{x}_{it} - \mathbf{x}_{it-1})\,\beta_2 \tag{5}$$

$$+ (Y_t - Y_{t-1})\,\beta_3 + (Z_t - Z_{t-1})\,\beta_4 + (\lambda_{it} - \lambda_{it-1}) + (\mu_t - \mu_{t-1})\,.$$

If a data set provides only information about aggregate statistics, such as the wage bill and the level of employment of different establishments, then it is only possible to reproduce the individual wage equations in terms of log of the mean level of real wages. In this situation, if I call W_j the mean level of real wages in each establishment j, I am just able to estimate:

$$\ln (W_{jt}) = \alpha_{0t} + Y_{jt}\alpha_1 + Z_t\alpha_2 + \theta_{jt} \tag{6}$$

and the change of the firm's mean level of wages becomes:

$$\ln (W_{jt} / W_{jt-1}) = (\alpha_{0t} - \alpha_{0t-1}) + (Y_{jt} - Y_{jt-1})\alpha_1 + (Z_t - Z_{t-1})\alpha_2 + (\theta_{jt} - \theta_{jt-1})\,, \tag{7}$$

where the term $(\theta_{jt} - \theta_{jt-1})$ just contains the firm's time-specific effect and the time-specific effect of the error term.

In the case of this study, however, the data set also provides information about the n_t individual workers who were employed in each firm j in different time periods t. I can therefore derive the following specification of the firm's aggregate value of wages by exploiting directly the individual wage equation presented in Equation (3):

$$\sum_{i=1}^{n_{jt}} \ln\left(w_{ijt}\right)\Big/ n_{jt} = \alpha_{0t} + X_j\alpha_1 + X_{jt}\alpha_2 + Y_{jt}\alpha_3 + Z_{jt}\alpha_4 + \theta_{jt}\,, \tag{8}$$

where

$$X_j = \sum_{i=1}^{n_{jt}} \left(\mathbf{x}_{ij}\right)\Big/ n_{jt}$$

represents the firm's mean value of $\mathbf{x}_{ij}$, the individual-specific variables that are fixed over time, while X_{jt} corresponds to the firm's average values of the regressors $\mathbf{x}_{ijt}$ that vary both over time and individuals. Here, Y_{jt} and Z_{jt} indicate the level of employment of the establishment j and of its industry. The last term, θ_{jt}, is the average of the error terms of the individual log wage equations by firm and can be decomposed as:

$$\theta_{jt} = \left[\sum_{i=1}^{n_{jt}} \left(\alpha_{ij} + \lambda_{ijt}\right)\Big/ n_{jt}\right] + \mu_t\,.$$

It is important to note that the aggregation of logarithmic individual wage equations in Equation (8) produces a geometric firm average wage, and therefore a value that differs in nature from the arithmetic average wage displayed in Equations (6) and (7).[7] With this caveat, I use Equation (8) to derive the change of the new firm's mean level of wages:

$$\begin{aligned}
&\sum_{i=1}^{n_{jt}} \ln\left(w_{ijt}\right)\Big/ n_{jt} - \sum_{i=1}^{n_{jt-1}} \ln\left(w_{ijt-1}\right)\Big/ n_{jt-1} = \left(\alpha_{0t} - \alpha_{0t-1}\right) \\
&+\left[\sum_{i=1}^{n_{jt}} \left(x_{ij}\right)/ n_{jt} - \sum_{i=1}^{n_{jt-1}} \left(x_{ij}\right)/ n_{jt-1}\right]\alpha_1 \\
&+\left[\sum_{i=1}^{n_{jt}} \left(x_{ijt}\right)/ n_{jt} - \sum_{i=1}^{n_{jt-1}} \left(x_{ijt-1}\right)/ n_{jt-1}\right]\alpha_2 \\
&+\left(Y_{jt} - Y_{jt-1}\right)\alpha_3 + \left(Z_{jt} - Z_{jt-1}\right)\alpha_4 + \left(\theta_{jt} - \theta_{jt-1}\right),
\end{aligned} \tag{9}$$

where the two terms containing the differences of the average values of the **x** regressors indicate how a change in the mean value of some of the employees' characteristics and potential entry and exit of workers affects the growth rate of the firm's mean wage. These are the terms that could induce a *composition bias* and, therefore, a different estimated effect of employment growth on wage growth, once aggregate wages, instead of individual wages, are considered.

To eliminate this bias, I construct a new measure of the firm's aggregate wage growth that consists in the mean of the individual wage changes experienced only by those *f* workers who were employed at least for two consecutive years in each different establishment *j*:

$$\begin{aligned}\sum_{i=1}^{f_{jt}} \ln\left(w_{ijt} / w_{ijt-1}\right)/f_{jt} = \delta_0 + \left[\sum_{i=1}^{f_{jt}} \left(\mathbf{x}_{ijt} - \mathbf{x}_{ijt-1}\right)/f_{jt}\right]\delta_2 \\ + \left(Y_{jt} - Y_{jt-1}\right)\delta_3 + \left(Z_{jt} - Z_{jt-1}\right)\delta_4 \\ + \sum_{i=1}^{f_{jt}} \left[\left(\lambda_{ijt} - \lambda_{ijt-1}\right) + \left(\mu_t - \mu_{t-1}\right)\right]/f_{jt}.\end{aligned} \tag{10}$$

This new aggregate statistic is still a function of the changes of the time-specific characteristics of each individual and of the statistics that measure the variations in the firm's and industry's employment level; however, this new measure of wage changes only captures effects *within* the firms. In this last model, the effect of employment growth on wage growth is no longer biased by the changes that can occur in the mean characteristics of the firm's employees when workers enter or exit the firm.

THE EMPIRICAL EVIDENCE

The aim of this paper is to cast some light on the relative power of firms' and industries' effects that can induce a positive correlation between real wages and employment growth. The following results are derived from the estimations of the different models described in Equations (7), (9), and (10) and that relate real wage growth with the changes in employment level both at the establishment level and the industry level.

A first step is to detect the magnitude of the composition bias that occurs when different aggregate measures of employment growth are used. After correcting for such a bias, I estimate to what extent wages respond to employment changes in firms of different sizes (for all the firms that are contained in the data set and for those that reported more than 15 employees over two consecutive years). I then compare the different results for expanding and declining firms, and for firms that experienced no more than the national rate of turnover (–0.05 percent).[8]

Because this data set consists of unbalanced panel data, the estimations are conducted with robust standard errors corrected for potential heteroskedasticity and correlation of the error terms across firms and across years.

The Effect of Composition Bias

Tables 2 and 3 present different estimations of wage growth models in which the aggregate measure of wage changes has been calculated using different procedures. The two tables refer to two different samples: the first contains all the establishments and the second contains only firms with more than 15 employees over two consecutive

years. All model specifications include a variable that indicates whether the changes are measured for the 1982-83 period.

TABLE 2
Estimations of Firms' Aggregate Wage Growth for All Firms

Dependent Variable:	$\text{Ln}(W_t) - \text{Ln}(W_{t-1})$	$\Sigma[\text{Ln}(w_{it})]/n_t - \Sigma[\text{Ln}(w_{it-1})]/n_{t-1}$	$\Sigma[\text{Ln}\ (w_{it}/w_{it-1}]/n$			
Variables	(1)	(2)	(3)	(4)	(5)	(6)
Intercept	0.05	0.05	0.03	0.09	0.08	0.10
	(6.1)	(4.9)	(9.9)	(8.2)	(5.8)	(10.6)
Ln (*Firm's Employment*$_t$)	–0.05	–0.08	0.03	0.02	0.02	0.02
–Ln (*Firm's Employment*$_{t-1}$)	(–2.9)	(–4.0)	(3.8)	(3.4)	(3.2)	(3.2)
Ln (*Industry's Employment*$_t$)	–0.002	–0.01	–0.02	–0.01	–0.01	—
–Ln (*Industry's Employment*$_{t-1}$)	(–0.1)	(–0.4)	(–1.2)	(–0.9)	(–0.9)	
Dummy for year = 1983	–0.03	–0.03	–0.01	–0.01	–0.01	—
	(–2.8)	(–2.9)	(–2.4)	(–2.1)	(–2.2)	
(Average Age$_t$ of Firm's Employees) /100	—	—	—	–0.20	–0.19	–0.19
				(–5.8)	(–5.5)	(–6.4)
Industry Dummies	—	—	—	—	Yes	Yes
Industry Dummies x Year	—	—	—	—	—	Yes
(Average Age$_t$ Employees) – (Average Age$_{t-1}$ Employees)	—	0.01	—	—	—	—
		(0.95)				
(Average Age$_t$ of Employees)^2 – (Average Age$_{t-1}$ Employees)^2	—	–0.00	—	—	—	—
		(–0.5)				
(% Male Employees$_t$) – (% Male Employees$_{t-1}$)	—	0.20	—	—	—	—
		(3.63)				
(% Trainees$_t$) – (% Trainees$_{t-1}$)	—	0.26	—	—	—	—
		(2.7)				
(% Blue Collar$_t$) – (% Blue Collar$_{t-1}$)	—	0.35	—	—	—	—
		(4.0)				
(% White Collar$_t$) – (% White Collar$_{t-1}$)	—	0.51	—	—	—	—
		(4.9)				
(% Managers$_t$) – (% Managers$_{t-1}$)	—	1.22	—	—	—	—
		(6.5)				
Number of observations	2,132	2,132	2,023[a]	2,023[a]	2,023[a]	2,053[a]

Note: The estimations that are presented in this and in the following tables have been conducted with robust standard errors corrected for potential heteroskedasticity and correlation of the error terms across firms and across years. t-statistics are in parentheses.

a. The smaller number of observations is due to the existence of very small establishments in which all employees changed from year to year and for whom it was therefore impossible to calculate the dependent variable. Also, the different sample sizes across model specifications (5) and (6) are the consequence of the lack of observations for the industry's employment in industry 51.

TABLE 3
Estimations of Firms' Aggregate Wage Growth for Firms with more than 15 Employees

Dependent Variable:	$\text{Ln}(W_t) - \text{Ln}(W_{t-1})$	$\Sigma[\text{Ln}(w_{it})]/n_t - \Sigma[\text{Ln}(w_{it-1})]/n_{t-1}$		$\Sigma[\text{Ln}\ (w_{it}/w_{it-1}]/n$		
Variables	(1)	(2)	(3)	(4)	(5)	(6)
Intercept	0.01	0.03	0.01	0.09	0.06	0.05
	(1.1)	(1.5)	(1.4)	(4.0)	(2.1)	(2.0)
Ln (*Firm's Employment*$_t$)	–0.06	–0.03	0.06	0.06	0.06	0.07
–Ln (*Firm's Employment*$_{t-1}$)	(–1.3)	(–0.6)	(3.3)	(3.3)	(3.5)	(3.7)
Ln (*Industry's Employment*$_t$)	–0.07	–0.01	0.09	0.09	–0.10	—
–Ln (*Industry's Employment*$_{t-1}$)	(0.6)	(–0.1)	(1.5)	(1.5)	(–1.6)	
Dummy for year = 1983	–0.004	–0.02	0.001	0.002	0.003	—
	(–0.3)	(–1.2)	(0.2)	(0.4)	(–0.5)	
(Average Age$_t$ of Firm's Employees) /100	—	—	—	–0.23	–0.16	–0.17
				(–3.8)	(–2.1)	(–2.2)
Industry Dummies	—	—	—	—	Yes	Yes
Industry Dummies x Year	—	—	—	—	—	Yes
(Average Age$_t$ Employees) – (Average Age$_{t-1}$ Employees)	—	0.08	—	—	—	—
		(1.40)				
(Average Age$_t$ of Employees)^2 – (Average Age$_{t-1}$ Employees)^2	—	–0.001	—	—	—	—
		(–1.4)				
(% Male Employees$_t$) – (% Male Employees$_{t-1}$)	—	0.30	—	—	—	—
		(1.60)				
(% Trainees$_t$) – (% Trainees$_{t-1}$)	—	–0.35	—	—	—	—
		(–0.3)				
(% Blue Collar$_t$) – (% Blue Collar$_{t-1}$)	—	–0.30	—	—	—	—
		(–0.3)				
(% White Collar$_t$) – (% White Collar$_{t-1}$)	—	0.06	—	—	—	—
		(0.06)				
(% Managers$_t$) – (% Managers$_{t-1}$)	—	0.46	—	—	—	—
		(0.4)				
Number of observations	259	259	259	259	259[a]	265[a]

Note: t-statistics are in parentheses.
a. The different sample sizes across model specifications (5) and (6) are the consequence of the lack of observations for the industry's employment in industry 51.

Columns 1 and 2 in Tables 2 and 3 present the results the study would produce if I did not account for a possible composition bias. Column 1 presents the results the study would produce if I had only observations about the wage bill and the level of employment for each establishment and industry in our sample. In this case, the dependent variable would be the rate of growth of the firm's arithmetic average wage. This case is presented to resemble the type of relation that has usually been estimated in studies that have dealt with the issue of wage cyclicality by using aggregate statistics. This first regression suggests a negative relationship between wage growth and employment changes.

A similar result is derived by the second estimation described in Column 2. Here, the average wage growth rate is estimated for each firm by exploiting the information

about the individual workers' Log (wage) equations and is calculated as the difference between two geometric averages. This regression contains both information about the change in the level of employment both by firm and by industry and information about the employees who were working at each firm.[9] In particular, I include information about the age, gender, and skill level of the employees. The choice of these regressors is justified by the theoretical and empirical literature that has shown that age is positively related to the level of labor earnings, but also negatively affects the rate of growth of wages. At the same time, career patterns, and therefore the changes in wages, are known to differ among male and female employees.

By taking the average of the individual Log (wage) equation (that is quadratic in age and that includes the workers' skill qualifications among the regressors), I obtain the following specification for the model presented in Equation (9) to describe the rate of growth of the average wage in each firm j:

$$
\begin{aligned}
&\sum_{i=1}^{n_j} \ln(w_{ijt}) / n_{jt} - \sum_{i=1}^{n_{jt-1}} \ln(w_{ijt-1}) / n_{jt-1} = \\
&\qquad \alpha_0 + \alpha_1 \left(Firm's\ Emp._t - Firm's\ Emp._{t-1} \right) \\
&\qquad + \alpha_2 \left(Industry's\ Emp._t - Industry's\ Emp._{t-1} \right) + \alpha_3 (t = 1983) \\
&\qquad + \alpha_4 \left(Age_{jt} - Age_{jt-1} \right) + \alpha_5 \left(Age_{jt}^2 - Age_{jt-1}^2 \right) + \alpha_6 \left(\%Men_{jt} - \%Men_{jt-1} \right) \\
&\qquad + \alpha_7 \left(\%Different\ Skills_{jt} - \%Different\ Skills_{jt-1} \right) + \left(\theta_{jt} - \theta_{jt-1} \right).
\end{aligned} \tag{11}
$$

This is the specification presented in column 2 of Tables 2 and 3. As in the case of the estimation in column 1, and of the studies that have dealt with the issue of wage cyclicality by making use of only aggregate data, this model specification suggests a negative relationship between wage growth and employment changes. Furthermore, as expected, firms with an increasing percentage of male workers register a larger average wage growth. This result is consistent with the generally accepted evidence that men usually command higher wages. It is also not surprising that this effect is more significant for the larger sample including the smaller firms (Table 2, column 2 versus Table 3, column 2), given that these smaller establishments employ a larger percentage of female workers, as shown by the descriptive analysis. It also seems reasonable that the coefficients of changes in the fraction of different skill-level groups increase in magnitude according to a hierarchic order. But this last effect is insignificant for all the skill qualification groups when I just consider the sample with larger firms (Table 3, column 2). For this same set of firms, the effect of the average age of employees, together with its quadratic value, has a stronger, but still not very significant, effect. This seems to indicate that tenure considerations play a larger role within the larger firms. This result is quite consistent with the hypothesis that small firms represent a temporary work experience for most employees.

All these available regressors can only very imperfectly capture some important factors, such as tenure and ability, which have been proven to have a strong influence on individual wage growth. Therefore, this estimation is probably still affected by a composition bias.

To correct for such a bias, I present the estimations of columns 3 and 4 (Tables 2 and 3). Here, the dependent variable is still an aggregate measure, but it has been constructed by averaging the individual wage *changes* within each firm. A first specification, including just the changes in employment levels and the dummy for year (column 3), is once again expanded to include the average employee age in each establishment.[10] The presence of this regressor is justified on the assumption of a quadratic relationship between age and earnings. Then, according to what was presented in the model of Equation (10), I can write:

$$\begin{aligned}\sum_{i=1}^{f_{jt}} \ln\left(w_{ijt}/w_{ijt-1}\right)/f_j = {} & d_0 + d_1\left(Firm's\ Emp._{jt} - Firm's\ Emp._{jt-1}\right) \\ & + d_2\left(Industry's\ Emp._{jt} - Industry's\ Emp._{jt-1}\right) + d_3\left(t = 1983\right) \\ & + d_4\left(Age_{jt}\right) + \sum_{i=1}^{f_{jt}}\left[\left(\lambda_{jt} - \lambda_{jt-1}\right) + \left(\mu_{jt} - \mu_{jt-1}\right)\right]/f_{jt}\,.\end{aligned} \tag{12}$$

This new set of results (columns 3 and 4 in Tables 2 and 3) shows clearly that very different conclusions can be drawn when an analysis explicitly accounts for the change in the labor force composition that occurs within each firm j as employment changes. In fact, once I present a "correct" average measure of the firms' wage changes, I reverse the previous findings as far as the adverse effect of employment on earnings is concerned. This last estimation of the mean of individual wage changes suggests that firms' employment growth and wage growth are positively and strongly related. At the same time, the industry effect, measured by the change in the sector's employment, is completely insignificant.[11] This finding is still valid for the category of larger firms (the estimations are presented in Table 3).

To test further for the role of additional industry effects, I then estimate two additional similar models (columns 5 and 6 in Tables 2 and 3), in which I first add the industry dummies and then consider the interactive effect of these dummies with the one indicating the year to which the observations refer. Columns 5 and 6 of Tables 2 and 3 show that the establishment effect is still one of the largest and most significant regressors in the "corrected" aggregate wage growth model, while the coefficient of the industry's employment growth remains insignificant. At the same time, a joint significance test conducted on the industry dummies permits me to reject the null hypothesis that their coefficients are simultaneously zero. This same result was also confirmed in the model specification including the interactive effect of the industry dummies with the year.

This evidence contradicts those models that explain a positive relationship between wage changes and employment growth as the result of the shortage of industry-specific human capital, therefore, at least as far as this shortage is captured by the changes in industry employment levels. At the same time, the results seem to suggest that the same relationship can be mainly induced by "inside" effects, such as some rent-sharing mechanisms or the monopsonistic power of employees that have accumulated the firm's specific human capital. The same analysis does not permit us to rule out the role played by other changes happening at the industry level, however, whose effects

are captured by the industry dummies. This finding is actually quite plausible given the Italian institutional setting, in which wage bargaining takes place largely at the industry level. This does not contradict the main result of our analysis, however, which shows how employment growth affects wages mainly through an establishment effect and not through an industry effect.

As far as the other variables are concerned (Tables 2 and 3, columns 4, 5, and 6), I find the expected signs of the coefficients. For both the entire sample of establishments and for the smaller subset, an older labor force induces, on average, a rate of wage growth that is smaller. This result is consistent with the generally accepted finding that workers experience the largest wage growth during their youth. Finally, the dummy variable that indicates the year 1983 is significantly negative for the entire sample and very small and insignificant for the smaller subset of larger firms. These results confirm the effects of the deep recession that hit Italy at the beginning of the 1980s, the largest losses of which (both in terms of employment and of labor earnings) occurred in 1983 and 1984. The findings suggest that the smaller firms were more deeply affected by this national economic crisis.

The Different Responses to Employment Growth in Expanding and Declining Firms

So far I have shown that once I correct for the possible causes of composition bias, I find some support for the prevailing role of "inside" effects in wage setting mechanisms. In fact, the results presented in Tables 2 and 3 show a strong and significant firm effect and an insignificant industry effect, as long as this effect is captured by the changes in the employment level.

TABLE 4

Estimations of $\Sigma[\text{Ln}(w_{it}/w_{it-1})]/n$ by Firm's Employment Growth

Firms Categories:	Employment Growth > 0	Employment Growth < 0	Employment Growth ≥ –0.05
Variables	(1)	(2)	(3)
Intercept	0.11	0.09	0.09
	(4.8)	(5.1)	(5.7)
Ln (*Firm's Employment*$_t$)	0.026	0.014	0.024
– Ln (*Firm's Employment*$_{t-1}$)	(1.4)	(1.3)	(1.8)
Ln (*Industry's Employment*$_t$)	–0.007	–0.017	–0.012
– Ln (*Industry's Employment*$_{t-1}$)	(–0.4)	(–0.5)	(–1.0)
Dummy for Year = 1983	–0.01	–0.021	–0.183
	(–1.2)	(–2.3)	(–4.4)
(Average Age$_t$ of Firm's Employees)/100	–0.27	–0.22	–0.007
	(–4.2)	(–3.8)	(–1.1)
Number of Observations	548	787	1,261

Note: t-statistics are in parentheses.

The next part of the study examines whether this general positive relationship differs among firms that are either expanding or declining. Table 4 presents the finding. The results are presented for the sample containing all establishments. The analysis

is conducted for three different cases: firms that were increasing in employment, firms that were decreasing in employment, and firms that did not lose more than 5 percent of their employees (the national turnover rate during that period) over two consecutive years.[12]

While the negative and insignificant effect of industry employment change is confirmed across all samples, the effect of the firm's employment growth on wage changes is positive for both expanding and declining firms. The coefficient of this regressor is not significant at the 95 percent level, however. To gain insight about the direction of the establishment effect, I calculated a Chow test on the parameter values of the regressions conducted for expanding and contracting firms. For our data set containing all establishments, I could not reject the null hypothesis of equal coefficients (Table 4, column 1 versus column 2), and this finding could suggest the existence of symmetry in the role played by "inside" factors among expanding and declining firms.[13]

An Analysis by Skill Level and Gender

Firms' policies about wage setting can vary widely for different groups of workers. This happens because different groups have different skill characteristics, but also because of discriminatory practices and institutional forces. These factors can systematically affect the bargaining process between workers and employers. This was certainly the case in Italy, where a large fraction of individual wages were decided at a centralized level when unions bargained with the employers' confederation to set wages for the different categories of workers.

TABLE 5

Estimations of $\Sigma[\text{Ln}\,(w_{it}/w_{it-1})]/n$[a] for Different Categories of Employees

	Firm's Size > 15			
Variables[a]	Men (1)	Women (2)	Blue-Collar Workers (3)	White-Collar Workers (4)
Intercept	0.06	0.5	0.07	0.10
	(2.6)	(3.1)	(2.8)	(4.3)
Ln (*Firm's Employment*$_t$)	0.04	0.01	0.04	0.04
– Ln (*Firm's Employment*$_{t-1}$)[a]	(2.1)	(1.4)	(2.3)	(1.9)
Ln (*Industry's Employment*$_t$)	0.13	0.04	0.17	0.04
– Ln (*Industry's Employment*$_{t-1}$)	(1.7)	(0.6)	(2.3)	(0.5)
Dummy for year = 1983	0.00	0.00	0.17	0.01
	(1.0)	(0.5)	(0.88)	(2.1)
(Average Age$_t$ of Firm's Employees) /100[a]	–0.17	–0.14	–0.18	–0.28
	(–2.6)	(–2.7)	(–2.7)	(–4.0)
Number of Observations	235	233	241	237

Note: t-statistics are in parentheses.

a. Both the dependent variable and the regressors are group specific.

This evidence suggests the need to explore how employment growth affects wage growth by disaggregating the data among different job categories and between workers of different gender. Table 5 illustrates the results of this analysis. The results are

presented for the sample containing medium and large firms. The wage growth, the employment growth, and the employees' average age have been calculated for each group of workers.

Table 5 shows, once again, that the average age of each single group has the expected negative effect on wage growth, while the increase in the level of firms' employment affects the wages of each group of workers positively and significantly. This result is consistent across the different workers' categories. Therefore, it seems to be difficult to claim that "inside" factors exist because of the bargaining power of those few workers that have accumulated the firm's specific human capital. This analysis shows that the wages of each group of workers within an establishment are responsive to the firm's expansion. Then, the findings seem more supportive of theories that stress the role that some rent-sharing mechanisms can have in determining wages within the firm.

The establishment's effect is weaker only in the case of female workers (both in terms of the magnitude of the estimated coefficients and of the significance level). This finding confirms previous results by Belzil [2000] and by Solon, Barsky, and Parker [1994] in studies concerning real wage cyclicality. As an aggregate phenomenon, they suggested that this result could be explained both by the fact that the cyclical shifts in labor demand are smaller in the case of women, and by the possibility that women's short-run labor supply is more elastic. The insignificance of the coefficient that captures the industry effect in our analysis seems to confirm the second hypothesis. It also suggests that women probably have much less bargaining power when it comes to capturing some of the rents produced within their firm.

Finally, this step of the analysis also shows that blue-collar workers are the only workers whose wages seemed to respond to changes in employment at the industry level. This finding is difficult to interpret because the data do not permit me to distinguish different levels of employment growth among different categories of workers at the industry level. This evidence is consistent, however, with the loss in bargaining power that started to characterize Italian blue-collar workers in the early 1980s, as the period of national solidarity was ending and the labor market was experiencing a reopening of wage differentials. In this context, the last finding seems to confirm the new labor market flexibility created by the Italian recession of early 1980s.

CONCLUSIONS

This paper provides evidence about the effect that employment growth has on real wages, both at the firm level and the industry level. The analysis tries to cast some light on those micro phenomena that affect the relationship between wages and aggregate levels of employment, which is usually examined in studies dealing with real wage cyclicality.

Overall, real wage growth is positively and significantly related with firm-level employment growth, but not with industry-level employment growth. This result applies to both expanding and declining firms. Wage changes do not seem to be caused by the shortage of industry-specific human capital, therefore, as long as this shortage is captured by the changes in the industry's employment level. Instead, this finding suggests the prevailing role of "inside" effects. This could refer to a situation in which

wage changes occur because of the power gained by those employees who have accumulated some firm-specific skills. The consistency of the establishment's effect across all the observed workers' categories seems to be more supportive of other theories that stress the importance of different rent-sharing mechanisms, however.

The study also shows that a composition bias can lead to incorrect conclusions in the case of studies dealing with the relationship between aggregate wages and employment. The possibility of conducting an analysis at the establishment level has confirmed that it is likely to observe very different patterns of wage changes if different aggregate measures of real wage growth are used. A first model was estimated by using the firm's average wage growth as the dependent variable and indicated a negative relationship between wages and employment. The same finding was reversed, however, once the mean of individual wage changes was chosen as an alternative aggregate statistic.

Finally, because these results refer to a period of employment decline and conflicts for Italian industrial relations, further studies should test their validity in the context of some more recent years characterized by a more stable and increasingly deregulated labor market.

NOTES

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1. Also, the large body of evidence that has been collected on interindustry wage differentials has usually been seen as a possible proof of the validity of these rent-sharing models. In particular, the fact that high-wage industries pay higher wages across all job categories has been as a strong piece of evidence of the existence of rents [Kruger and Summers, 1988; Dickens and Katz, 1987].
2. In their study about the earnings losses of high-tenure displaced workers, Jacobson, LaLonde and Sullivan [1993], suggest that wage premiums are better explained by firm-specific skills or internal labor markets than by industry-specific human capital accumulation.
3. For a review of studies about the asymmetry of "inside effects," see Layard, Nickell, and Jackman [1991]. The authors conclude that the evidence on this topic is quite inconclusive.
4. Unfortunately, both tax evasion and the existence of a large underground economy affect the completeness of information obtainable with this data. de Luca and Bruni [1993] report that "irregular wage workers" represented 9.5 percent of total job holders in Italy in 1980. Firms in the underground economy ignore labor market regulations and therefore can adapt much more quickly to market changes. The lack of records about these workers and their firms could then downward bias my estimates of the relationship between wages and firm or industry employment changes. The consequences of this problem should be limited, however, because historically the underground economy has been more relevant in southern Italy while here I study records from a northern city. Furthermore, my data include many small firms that by law were also exempted from following labor laws.
5. It is also worth pointing out that, in this study, I measure the size of the firm from the total number of individual workers' records that I have for each year in correspondence of each firm ID. This number is calculated by detecting the records on employees who have been excluded from the analysis (because they were under the CIG system at different points in time), but whose real wage changes qualify them again as regular employees at some different times. Consequently, entries and exits from the CIG system were reconsidered to adjust and change the size of the establishments for each year. The Pearson correlation coefficient between this new measure of firm size and the corresponding original record of the data set was 0.945 (or 0.907 in terms of the

Spearman correlation coefficient). I have also deleted 2,121 individual observations corresponding to workers for whom there were doubled records, and I have deleted 897 observations regarding a firm whose change in employment over the three years was such that I have easily detected an error in the data collection.

6. Unfortunately, as with other studies using social security data, I cannot distinguish directly between quits and layoffs. Unlike in most such studies, however, I am able to use information about the firm to detect the data of separations that are likely to result from layoffs or solely from quit behavior. To do so, I detected the establishments whose growth rate of employment exceeded –5 percent in order to limit the number of separations due to layoffs included in the sample. To the best of my knowledge, the only available study regarding quit rates in the Italian labor market [Dell'Aringa, 1986] reports values of 6.6 percent and 5.5 percent for the quit rates in 1982 and 1983, respectively. A similar methodology has been used previously by Galizzi and Lang [1998] and by Jacobson, LaLonde, and Sullivan [1993] for the United States.
7. I thank an anonymous referee for highlighting this point.
8. It is possible to express some concerns on the validity of the following results on the basis of the consideration that this data set does not permit us to control for the presence of hours. If overtime hours were used, then higher monthly wages could just capture this phenomenon. By itself, this critique could be dismissed by claiming that the hourly wage is not necessarily a statistic that is superior to the one that measures the monthly wage. However, to infer the possible consequences of this critique, I have checked the results by correcting the aggregate wage statistics by the indexes of average yearly worked hours that are reported by the Italian labor statistics for the three years that are the object of studies [ISTAT, 1986, 105]. Because the reported national statistics only apply to the manufacturing sectors, and to the category of blue collar workers, I have compared two set of results: some original results that I obtained for those subgroups of workers, and a set of estimations that I derived using the group-specific aggregate wage measures after they had been "corrected" on the basis of the hourly indexes. As far as the magnitude and the significance level of the coefficient of the firm's employment growth, I do not find any significant difference between the two sets of findings.
9. I also estimated an additional model with the same dependent variable but only information about the year and the changes in employment for the establishment and the industry. The results were very similar to the ones that are reported in column 1.
10. I also tried to include a regressor indicating the percentage of workers who had changed their skill level over the period. The results did not change. This additional regressor is not included in the presented specification, however, because a detailed analysis of the individual data has suggested that several of these changes indicate a downgrading of the worker's qualification. This finding complicates the interpretation of the role played by this additional independent variable.
11. This result is consistent with the findings of Weinberg [2001], who found a weak relationship between industry employment growth and industry-level wages even after controlling for possible composition bias.
12. The analysis that is presented in Tables 4 and 5 was also conducted with the two previously discussed model specifications that include the industry dummies. I also found confirmation of the jointly significant role played by these dummies; however, the inclusion of these regressors did not change the results that are emphasized here, as far as firms' and industries' employment growths are concerned.
13. The interpretation of these results is again complicated by the fact that, in the very small firms, a small change in employment is reflected in very large percentage change. Furthermore, the small Italian firms were exempted from applying the Labor Laws. To account for these problems, I also studied the case of establishments with more than 15 employees. Then, I found that the positive effect of the firm's employment growth was only confirmed among the declining firms. The very small and different sizes of these subsamples (84 versus 153 observations for the growing and declining firms, respectively) did not permit me to draw conclusions about this additional finding, however.

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