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PERFORMANCE-RELATED PAY, UNIONS AND PRODUCTIVITY IN ITALY: EVIDENCE FROM QUANTILE REGRESSIONS

Mirella DAMIANI — Andrea RICCI

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Performance-Related Pay, Unions and Productivity in Italy: evidence from quantile regressions

Mirella Damiani* and Andrea Ricci**

ABSTRACT

Purpose – This study analyses the effects on productivity of Performance-Related Payments (PRP) and unions, and examines to what extent heterogeneity between firms characterises these influences.
Design - For the Italian economy, the study presents firm-level quantile regressions for Total Factor Productivity (TFP) and controls for various observed characteristics of firms, worker composition and labour relations.
Findings - The paper shows the significant effect of PRP and unions on the whole economy and on firms operating in the manufacturing industries. In these industries, the *uniform* incentive effects of PRP but the *increasing* impact of unions are estimated along the productivity distribution. Conversely, the role of management - significant in all sectors- is more efficacious in prospering large firms operating in services.
Research limitations – The adoption of PRP schemes and the presence of unions maybe endogenous to firms' productivity, and our estimates do not prove causal links but simply suggest correlations.
Practical implications - The limited incentive effects of PRP schemes in services contribute towards explaining the slowdown in Italian productivity, whereas the role of unions is quite uniform among sectors.
Originality- The paper addresses the hitherto poorly developed issue of firm heterogeneity and TFP, and offers the first Italian study of PRP and unions, which covers all dimensional classes of firms and non-agricultural sectors of the Italian economy.

JEL Classification: J33; D24

Keywords: Performance – related pay, productivity

*Mirella Damiani, Professor of Economics, Department of Economics, Finance and Statistics, University of Perugia, Via Pascoli 20, 06123 Perugia, Italy, email:mirella.damiani@gmail.com.
**Andrea Ricci, Researcher, Area di Analisi e Valutazione delle Politiche per l'Occupazione, ISFOL, Roma, Via G.M. Lancisi 29, 00161 Rome, Italy, email: andr.ricci@gmail.com.

1. Introduction[1]

Starting from the early 1990s, several labour market reforms have been enacted in many European countries, to favour the 'flexibility' of industrial relations and to link wage increases to the dynamics of labour productivity. The efficacy of this type of reform raises many unsolved issues (OECD, 2004; ch. 3).

One theoretical question regards the positive expected results of wage flexibility and performance - related payments (PRP) on productivity, but also side - effects (negative), due to new opportunities for rent-sharing opened up by firm level agreements. The trade-off has already been pointed out by the German *Mitbestimmung* literature, which advocates separating factors determining firm outcome results from those related to their distribution. This theme has engendered new interest in the recent empirical literature; it has shown that in two European economies, Germany (Gürtzgen, 2009) and Belgium (Rusinek and Rycx, 2008), the disadvantages of distributive, rent-sharing rules overcome the positive effects of flexible wage structures.

Another critical issue concerns the strategic role of complementary workplace practices which influence the actual impact of performance management systems. For instance, Black and Lynch (2001) found that, in the American economy, unionised plants, where joint decision-making accompanies incentive pays, show higher productivity performance than non-unionised establishments. The adoption of 'high involvement' systems is thus a necessary condition to making contingent pay settings effective on productivity growth, as explored by growing empirical literature (see survey by Godard and Delaney, 2000).

Both fields of research indicate the existence of alternative reasons for expecting that links between productivity and wage incentives are weaker or stronger. This is confirmed by micro - evidence revealing that disparities in efficiency gains may persist even *among firms* within a single country. Indeed, it is now widely recognised (after the contribution on trade of Melitz, 2003) that firms are heterogeneous with respect to key variables, including productivity and wage setting. The controversial impact of PRP

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thus seems to find its natural place within the literature on heterogeneity. Nevertheless, there are few empirical studies for European countries on wage rules, productivity and heterogeneity (Wagner *et al.*, 2004 for Germany; Bastos *et al.*, 2009, for Portugal); there is no evidence for the Italian economy.

The present work integrates these elements - the role of PRP and firms' heterogeneity- and makes a start at filling this gap. One additional point that motivates our analysis is that in Italy PRP systems differ across regions and sectors, and PRP firms show the higher presence of unions, as reported recently by Damiani and Ricci (2009)[2]. But is the divide between winners and losers also *within* sectors and regions? Do firms improve their performance *differently* by exploiting or not exploiting these remuneration systems? Is the overall union influence on productivity more pronounced in some group of firms?

Other good reasons suggest that Italy is an interesting case study. In 1993, the country began a large-scale reform of its industrial relations system, aimed at providing more space to wage compensation related to efficiency gains. However, since the mid-1990s, Italian labour productivity growth started to record a significant slowdown. Also, as reported by Daveri and Jona-Lasinio (2005), growth accounting revealed the crucial impact of the Total Factor Productivity (TFP), the component which cannot be due to capital deepening but to organisational strategies represented by innovation in human resources practices. An additional question is to what extent do firm heterogeneities in PRP practices and union action influence this aggregate effect?

The present paper starts exploring these issues by using a unique dataset which collects firm-level information for both manufacturing and services sectors. This dataset, was obtained by merging longitudinal information on balance-sheet data from the AIDA archive for the period 2002-2005 and cross-sectional information on the adoption of PRP, and the presence of unions and other workplace characteristics from the ISFOL Employer-Employee (RIL) survey for 2005[3].

The basic idea was to use a two-step estimation procedure, similar to that used by Black and Lynch (2001), and quantile regressions. In the first step, we estimate a classical

[2]Damiani and Ricci (2009) found a higher presence of unions in PRP firms (91%), as opposed to 15% in non-PRP firms.

[3]RIL: *Rilevazione sulle Imprese e sui Lavoratori.*

production function, using longitudinal data on balance-sheet variables for the period 2002-2005. In the second step, we use quantile regression to estimate the influence of PRP, unions and other workplace characteristics on the distribution of the average values of residuals, obtained in the first step. This allows us to analyse whether the role of some leading institutional factors, such as unions and PRP practices, changes greatly across the distribution of the firm-specific time-invariant component, i.e., across the distribution of TPF.

In this context, we find two main results. First, the adoption of PRP exerts a positive effect on the TFP - more significant in manufacturing sectors, where efficiency gains associated with PRP are quite homogenous throughout the whole distribution. Second, the presence of unions has a positive influence on firms' unobserved productivity across all quantiles, being significantly higher for best-performing firms (those placed at the highest quantile of the productivity distribution). These significant effects, found for two important institutions (PRP and worker representations), are particularly meaningful since they were obtained from ample coverage and including all size classes.

Other minor results which deserve further research are the effects obtained due to worker composition, which change significantly among the different quantiles. In particular, we found a negative influence exerted by the share of women on TFP, although its estimated coefficient decreases significantly along the distribution, to the point of being statistically insignificant at the highest quantiles.

This paper is organised as follows. In Section 2 we briefly discuss the theoretical and empirical literature. In Section 3, we present data and offer descriptive statistics. Section 4 illustrates the econometric framework. Section 5 presents the estimation results, and Section 6 concludes.

2. Productivity, performance payments and unions: a short reappraisal

Our research is related to various fields of theoretical and empirical literature. One field is that of the 'employee financial participation' literature, which advocates that payments of *collective* bonuses such as profit-sharing schemes reveal a commitment device to motivate group of workers and their collaborative relationships. However, it

has also points out that the collective nature of bonuses may induce employees to free-ride on the efforts of others and thus cut productivity. In these circumstances, the best ways of overcoming free-riding and achieve peer pressure are participative employee practices and good-quality employee-management relationships, as shown by a growing body of empirical research (see, among others, Kruse *et al.*, 2003). In any case, the net effects are encouraging: more than twenty country experiences offer a wide consensus on the positive or, at least, neutral effects on productivity, and empirical differences may be attributed "to differences in participatory practices in firms with profit-sharing plans" (Pérotin and Robinson, 2003, p. 22).[4]

A second field of literature emphasises that *individual* bonuses linked to firm performance reveal a commitment device to motivate single employees. Incentive designs, reviewed by Prendergast (1999), should properly minimise risk-sharing properties, as well as magnify promotion of firm-specific human capital investments. This literature has also shown that the 'power of incentives', arises as the outcome of two distinct effects: motivation and sorting. Pay settings that change from rewards based on input measures to payments related to output outcomes may induce dramatic improvements, and half the change is explained by the attraction of workers of higher ability (Lazear, 2000). Even in this field, which focuses on individual incentive agreements, interactions with other packages of good workplace practices, have received greater attention and have given rise to many studies exploring nationally representative samples of enterprises (Black and Lynch, 2001) or insider econometric case studies from within firms (Ichniowski and Shaw, 2003) on the "value of the complementary role of human resource practices".

A third (fragmented) body of literature opens up a more problematic line of inquiry. Scepticism has been emphasised according to the market power approach. It has been argued that, in conditions of imperfect competition and high levels of unionisation, company wage agreements cause redistribution of rents as well as collusive behaviour between management and employees. Germany itself and its institutional architecture prove how influential this position has been, since collective bargaining is separated from all aspects of codetermination. Empirical support is offered by Hübler and Jirjahn

[4]The experience of employee financial participation in the EU has recently been discussed by Uvalic (2009).

(2003) who found that, in German firms with uncovered industrial regimes negotiating compensations at company level with their unions, rent-sharing effects were more pronounced.

The role of collective action calls attention to unions. Much of the literature on unionism still adopts the "two face approach" originated by Freeman and Medoff (1984). The *good* face implies improvements in productivity, decreases in earnings dispersion and greater space reserved for the workers' voice, accompanied by a proper management response. The *bad* face is generated by the monopolistic bargaining power of workers' representations, which lead to wage distortions, rent appropriations and decreases in productivity.

On empirical grounds, the effects of unions on efficiency are not easily detectable - for various reasons, reviewed by Addison and Hirsch (1989). First, union productivity differentials may be overstated, since they result from a natural competitive process in which less productive unionised firms are simply selected out from the system. In addition, if unionised firms pay higher wages, the positive productivity effects may simply be due to a firm response in terms of employment contraction along the labour demand schedule. Conversely, this response is not fully supported by empirical studies: evidence shows that contractual solutions are quite often reached by the efficient bargaining model, not by the wage-employment negative relation, as theoretically hypothesised by McDonald and Solow (1981).

Lastly, indirect (negative) effects are exerted by union action on profitability, which leads to lower investments and innovation activity, a long-term effect which short-term analyses, however, often fail to estimate (see various empirical studies discussed by Addison and Hirsch, 1989).

The specific channels through which productivity growth is accelerated or slowed down may relate to their role in investments in *human* and *physical* capital. On one hand, it has been contended that unions have positive effects by enhancing job security, greater loyalty in employees and more investment in firm-specific skills, leading to higher efficiency growth. The rationale behind this thinking is that, when unions are absent, employers may adopt opportunistic actions with respect to training, performance pay and promotions (Ricci and Waldman, 2006). On their part, employees

withhold effort and do not accumulate firm-specific human capital when they anticipate opportunistic action in the form of low fixed minimum wages or promised promotions or promised training. On the other hand, the presence of unions, enforcing commitment and trust, prevents employers from reneging on informal and implicit agreements with their workforce, creates motivation, and enhances productivity.

The opposite views emphasise the negative influence of unions (see ample discussion in Addison and Hirsch, 1989). Wage bargaining over quasi-rents from capital expenses causes lower returns for firms, hold-up behaviour and under-investments; a firm may face a credible threat of strike promoted by workers and their unions to appropriate part of these returns, and in such circumstances, it reduces investments in tangible and intangible capital.

In sum, the expected effects of unions on pay settings and productivity are ambiguous, and it is not surprising that international evidence shows contradictory findings. For instance, for the US, Black and Lynch (2001) estimate, that unionised establishments which adopt incentive—based compensations (associated with joint decision-making) have higher productivity than other similar non-union plants. For our case study, Italy, Origo (2009) reports the opposite: for the metal-working sector, she estimates that productivity gains are higher within low-unionised firms, whereas high-unionised companies are more oriented to rent-sharing.

We test these findings by means of our estimates in other sectors of the Italian economy and examine to what extent ambiguous outcomes are affected by firm heterogeneities.

3. Data and descriptive statistics

Our empirical analysis was based on a nationally representative sample of manufacturing and non-manufacturing firms, obtained by merging information from two different sources: balance-sheet data from the Bureau Van Dijk AIDA archive and firm-level information on performance-related pay and other workplace practices from the ISFOL Employer and Employee Survey (RIL).

For 2005, the ISFOL-RIL survey collected cross-sectional information about personnel organisation, recruitment strategies, position of employees, training investments, presence of unions, adoption of PRP schemes and other workplace characteristics. The

RIL survey refers to firms operating in the non-agricultural sector, sampling both partnership and limited companies, for a total sample of 21,728 firms.

The AIDA database contains annual accounts for limited companies with turnover of over 100,000 Euros for 2004 (the turnover threshold was previously 500,000 Euros). This database is a source of information on sales, value added, capital, labour, and R&D for the period between 1997 and 2005.

In order to link information concerning workers' characteristics to indicators of firm performance and accounting variables, a sub-sample of the RIL dataset was merged with balance-sheet from the AIDA archive for a period of four years (2002-2005), using company tax codes. Thus, the merged RIL-AIDA sample exploits cross-sectional information about employees' participation and other workplace practice, for 2005, and the longitudinal structure of accounting data for the period 2002-2005.

According to the characteristics of the RIL-AIDA dataset, the representativeness of the merged sample is reduced to limited companies. Also, we excluded firms with fewer than five employees. This filter was applied to identify firms characterised by a minimum level of organisational structure and internal labour market, and allows us to avoid all phenomena connected with self-employment, beyond the scope of the present paper.

After matching and data validation, we obtained an unbalanced panel of 6160 firms. The sample coverage is representative of the population of the Italian firms.

3.1 Descriptive statistics

In this section, we present descriptive statistics of the AIDA-RIL merged sample for the year 2005. Given the focus on the relationship between labour market institutions and firms' heterogeneity, we distinguish three groups of firms, according to their productivity performance over the period 2002-2005: 'low performers' fall in the group between the 1st and 25th percentiles of the average value-added distribution, 'middle performers' are the group of firms whose productivity falls between the 50th and 75th percentiles of the average value-added distribution, and 'high performers' are those firms with productivity higher than the 75th percentile.

We then examine the main characteristics of these different groups of firms, as well as of the whole sample. As regards enterprise characteristics, we examine the value added, fixed capital, a dummy variable indicating whether the firms compete in the international market, four dimensional classes (5-9, 10-49, 50-249, and more than 250 employees), four geographical macro-areas (the North-West, North-East, Central and Southern regions of Italy) and seven 2-digit sectors[5]. Workers characteristics include the share of women, the professional composition of employees (managers and supervisors, white-collar workers, blue-collar workers, and the shares of fixed-term contracts and trained workers. For workplace characteristics we included two dummy variables indicating the adoption of PRP and the presence of unions at firm level, respectively. We also take into account the local unemployment rate and the vacancy rate for each firm, with the main aim of controlling for labour market tightness.
Table 1 lists the summary statistics for these variables.

[Table 1 about here]

First, we consider a group of variables related to firm strategies: capital accumulation, internationalisation, and incentive wage settings. Our database clearly describes the overall picture which describes the typical profile of high-performer firms: they are more active in terms of capital accumulation, more frequently represented in international markets, and more oriented towards adopting incentive pay systems. The opposite is true for the low performers; companies in the intermediate quantiles of productivity growth also occupy an intermediate position in terms of capital accumulation, exposure to international competition, and adoption of performance-related payments.
Second, differences were also shown in workforce characteristics between firms ranked by productivity. As expected, over-achiever firms have more trained employees

[5]In particular, we group 2-digit sectors into six categories: 1)- Manufacturing (mining and quarrying; electricity, gas and water supply, manufacturing); 2)- Construction; 3)- Trade, hotels and restaurants; 4)- Transport and communication; 5)- Financial intermediation and other business services; 6)- Education, health and other public services

and make less use of fixed-term contracts; they have also lower percentages of women on the staff.

Third, the role of industrial relations is clearcut: over-performers show high levels of unionisation and higher labour market tightness (as shown by low local unemployment rates), but also fewer recruitment problems in filling vacant jobs.

Lastly, the ranking order of companies is probably influenced by other firm features, since the success of firms may also depend on specific internal conditions (size and sector) and external factors (geographical location). Table 2 sheds some lights on these issues.

[Table 2 about here]

Table 2 shows that regional gaps still persistent in terms of productivity performance, and the highest gains are recorded in the North-West, whereas North-Eastern regions do not show clear characterisation in terms of company success. One unambiguous result is obtained for the dimensional aspect, which reveals a clearcut element of firm efficiency, as shown by the highest incidence of high performers among large-sized firms.

In addition, Table 2 reveals sectoral imbalances, showing diverging patterns between industrial and services sectors: the majority of under-achiever firms are in trade, hotels and restaurants (30% in the 1st quantile); the best performers are in manufacturing (55% of firms in the upper quantile). It should be noted that our findings are consistent with those obtained from other studies which have analysed the performance of Italian companies from various perspectives. For instance, the literature on internalisation shows that firms generating higher added value and higher productivity are also more exposed to international competition, are larger and employ more capital per workers (Mayer and Ottaviano, 2007). Our summary statistics reveal that, across Italian firms, differences in size are related to productivity performance and, with sector specialisation, contribute towards characterising disparities between successful and unsuccessful Italian firms. This result is consistent with that of Pagano and Schivardi (2003), who show that size (through its influence on innovation activity) is important for growth and plays a role in cross-country comparisons for European countries, including Italy.

4. The econometric framework

The econometric strategy used to analyse the relation between PRP and firm productivity is based on a two-step estimation procedure and quantile regression methods.

The two-step procedure is similar to that used by Black and Lynch (2001) and allows us to exploit the specific structure of the AIDA-RIL merged sample, where each firm presents longitudinal information on balance-sheet variables for the period 2002-2005 and cross-sectional information on PRP adoption and other workplace characteristics for 2005. In the first step, panel data methods are used to estimate the parameters of time-variant input factors (i.e., capital and labour) of a classical Cobb-Douglas production function. The quantile regression method is used in the second step to estimate the impact of PRP and other workplace characteristics (obtained from the 2005 RIL survey) over the *whole distribution* of firm-specific fixed effects estimated in the first step[6].

The coefficients of the production function can be estimated consistently with the fixed-effect estimator. However, the within-estimator tends to go too far in discarding potentially valuable cross-sectional information, because the influence of observed (almost) time-invariant factors, such as the industry sector, PRP, and other quasi-fixed variables in the production function cannot be identified, or measurement errors may explain a large part of their variance (Ichniowski, Shaw and Prennushi, 1997; Griliches and Mairasse, 1995, Dearden, Read and Van Reenen, 2000). This feature proves to be a crucial hindrance in our case, because we only know whether or not an establishment adopted PRP in 2005 and this institutional variable does not change much over time. As PRP is treated as a quasi-fixed variable, we assume that firms which adopted PRP in 2005 also adopted a PRP scheme before and after that year.

[6]The quantile regression method offers significant advantages over the least- squares method when the influence of PRP varies significantly across the distribution of firm productivity. This happens, for example, when unobserved firm heterogeneities in terms of management quality and norms of industrial relations map the observed distribution of firm productivity. Quantile estimates are also robust relative to least-squares estimates when significant heterogeneity occurs, because they assign less weight to outliers and are robust to departures from normality.

The two-step procedure is described below.

In the first step, we estimate a classical Cobb-Douglas production function with two input factors, capital and labour. The following specification is thus used:

$$\ln Y_{it} = \alpha \ln K_{it} + \beta \ln L_{it} + T_t + a_i + \varepsilon_{it} \qquad \text{for } i=1,\ldots,6160 \text{ ; } t=2002,..2005 \tag{1}$$

where Y_{it} is the value added of firm *i* at time *t*, K_{it} is physical capital, L_{it} the number of employees, T_t the year dummies, to control for the business cycle, a_i the unobserved firm-specific fixed effect, and ε_{it} the idiosyncratic error term. Then equation (1) is estimated with a within-estimator.

On the basis of these first-step estimates, for each firm we calculate the average of estimated fixed effect a_i in the period 2002-2005, in order to obtain an estimate of the establishment-specific fixed component over the observed period. Then, the distribution of this component is regressed over the establishment variables, which are quasi time-invariant, and employment characteristics collected by the 2005 RIL survey.

In particular, the second-step estimation is performed with quantile regressions over the following equation:

$$\hat{a}_i = \delta_\theta PRP_i + \alpha_\theta U_i + \eta_\theta X_i + u_i \tag{2}$$

where *i=1,…N* is the number of observations in 2005, θ the *th*-quantile being analysed, $\hat{a}_i$ the estimate of unobserved firm fixed effects obtained from the first step (equation 1), PRP and U are dummy variables indicating respectively the presence of PRP and unions at firm level, and X is a vector of other control variables[7]. The vector of coefficients δ_θ, α_θ' and η_θ are estimated at the selected quantile; the idiosyncratic error term, u_i, is such that $Q_\theta(u_i \mid PRP, U, X) = 0$[8].

[7]The other control variables included in the baseline specification of equation (2) are the same as those previously used for descriptive statistics: the share of women, professional composition of employees, shares of fixed-term and trained workers, vacancy rate, and local rate of unemployment, a dummy variable indicating whether the firm sells its products abroad, four dummies for firm size, four dummies for geographical macro-areas, and six aggregated 2-digit sectors.

[8]For a detailed discussion on methodological issues and techniques used to perform point and interval inferences, see Koenker and Basset (1978) and Buchinsky (1994).

In our framework, coefficients δ_θ and $\alpha_\theta^{'}$ capture the *quantile treatment effect* of PRP and union presence across the distribution of the estimated firm-specific unobserved heterogeneity. By verifying whether estimated coefficients $\delta_\theta^{'}$ $\alpha_\theta^{'}$ differ across the quantile distribution of $\hat{a}_i$, we then can infer how these labour market institutions affect firms' unobserved fixed components.

It is worth noting that fixed effects, estimated in the first step, can be interpreted as average firm-specific differences to productivity predicted on the basis of variable inputs - in other words, the TFP. Therefore, the estimated fixed effects for the period 2002-2005 indicate whether firms' TFP was below or above the average of other firms during the observation period. Hence, with quantile regressions, we can infer whether the key variables have differential influences across the distribution of the average TFP. It should be emphasised that our two-step approach does not take into account any endogeneity at the second-step: firms' decisions to adopt PRP or the presence of unions may be related to productivity performance. The occurrence of such reverse causality may generate biased estimates of quantile regressions, and we interpret the econometric results as simple correlations between the unexplained part of productivity and labour market institutions[9].

5. Estimation results

This section presents the main econometric results. As mentioned above, the first step consists of estimating equation (1) for the unbalanced panel of firms sampled for the period 2002-2005 with a within-estimator.[10] In the second step, quantile regressions are applied to equation (2) to measure the influence of PRP and unions at different points of the firm-specific fixed effect distribution, i.e., at the 0.10th , 0.25th, 0.50th, 0.75th and 0.90th quantiles.

[9] The existence of a virtuous cycle between PRP, unions and firms' productivity was explicitly verified in a previous work (Damiani and Ricci, 2009).

[10]For the purpose of estimation, value added and fixed capital have been deflated, respectively, by the value added and fixed investment deflators at 2-digit sectoral level, gathered from national accounts provided by ISTAT (Italian Institute of Statistics).

Table 3 shows the results. Columns 1-2 of Table 3 list the estimated coefficients of the production function (1). Note that the first-step estimates of the fixed capital and number of employees have the expected signs and high statistical significance. We do not comment further on these results.

Our focus is on the OLS and quantile estimates for the second-step regressions (columns 3-11 of Table 3).

[Table 3 about here]

Among the main results, we point out that the estimates of PRP and unions are positive and statistically significant (error level of 1%) across the whole distribution.

The positive and significant coefficient of PRP wage contracts confirms the theoretical assumptions advanced in Section 2. Incentives increase the efficiency of establishments and our findings follow other results in the Italian case: financial participation schemes give rise to significant gains in productivity (Biagioli and Curatolo, 1999; Amisano and Del Boca, 2004).

The positive and significant role of unions is also remarkable: one interpretation is that PRP are more effective as incentive devices when they are promoted in environments characterised by cooperative behaviour, which minimises free-riding and promotes collaborative attitudes. However, the point estimates of PRP are quite uniform across the distribution, ranging from 0.17 at the 10^{th} and 75^{th} quantiles to 0.22 at the 90^{th} quantile.

Conversely, the positive influence of the union dummy variable increases significantly at the highest quantiles, being 0.24 in the 1^{st} and 0.30 in the 75^{th} and 90^{th} quantiles[11]. These results may be explained by arguing, as suggested by Addison and Hirsch (1989, p. 76), that "union and non-union establishments may differ systematically in the quality of unmeasured organizational factors, so that *firm effects* are not independent of union status. For example, inputs such as managerial supervision and the quality of labor relations may be correlated with unionism, and omission of these factors may bias

[11]The null hypothesis that the estimates are equal between pair-wise quantiles (and across all quantiles) is tested by the variance-covariance matrix of the coefficients of the system of quantile regressions. Consequently, the null hypothesis about the union dummy variable is rejected at the conventional level of significance for the 0.10 *vs* 0.90 quantiles; conversely, the null hypothesis of equality of the coefficient of the PRP variable is accepted across the entire distribution.

the union coefficient". Our additional estimates, by sector allow checking whether unions generate pervasive and *homogenous* effects in the Italian economy.

As for the other results, the strong negative influence associated with the share of women should be noted, with a decreasing pattern along the distribution, which varies from -0.48 at the 10th quantile to +0.19 at the 90th quantile. This finding reveals that the proportion of women penalises the unexplained component of productivity, especially for under-performer firms, being lower at the highest quantile. It is also related to wage discrimination against women in the labour market, as other studies have found, and confirms that, in Italy, the (unexplained) gender wage gap is lower at the highest quantile of the wage distribution (Naticchioni and Ricci, 2009).

Table 3 also shows other findings which concern workers characteristics, such as those due to employment positions: the white- and blue-collar component has a negative influence with respect to the omitted category (managers and supervisors), mainly at the highest quantiles. The positive influence of managerial and male personnel confirms that job positions play a significant role, especially for firms with better performance: managers and executives have a positive influence on productivity. Among other factors, this may be due to their role in providing better-designed pay schemes, to induce optimal effort from their subordinates.

As regards other workforce characteristics, an interesting result is the negative influence of fixed-term workers across the whole distribution, with a magnitude that decreases at higher quantiles and becomes statistically insignificant at the 90th quantile. Conversely, the estimated coefficient of trained workers is positive, but is significant at 1% only at the median value of the distribution.

Lastly, our estimates confirm that the size and geographical location of firms are important determinants of their efficiency. The positive relationship between firm size and unexplained productivity is significant at all quantiles analysed. As expected, regional gaps highlight the worst productivity performance of Southern firms (the

omitted category), although the estimates do not show a clear pattern across the distribution[12].

6. Robustness checks: manufacturing and services sectors

The role of firm and sectoral disparities are examined in this section. To ascertain whether the relationship between labour institutions and the unobserved part of productivity depends on firm sectoral specialisation, we replicated the preceding analysis for the manufacturing and services sectors, separately[13]. The econometric strategy and estimation methods are the same as those used for the whole economy, and do not require further explanation.

Table 4 displays the results for manufacturing. The second-step estimates confirm the positive and significant effects of PRP and unions across all quantiles. However, the magnitudes of the estimated coefficients for both variables are higher than those found for the whole economy, and are quite uniform across all quantiles.

The magnitude of the estimated coefficient of the women's share is stronger in manufacturing, and decreases significantly at higher quantiles, not being statistically significant for under-performer manufacturing firms.

The professional composition of the workforce reveals no clear interpretation: the coefficients associated with the share of blue- and white-collar workers are positive at the 10th quantile and negative at the 75th quantile, but are not statistically significant at other quantiles. Trained workers have a positive influence across the whole distribution, except at the 90th quantile. Conversely, the share of fixed-term workers has a negative effect on the unexplained productivity component, mainly at the 75th and 90th quantiles.

The roles played by firm size and geographical location in the manufacturing sectors are similar to those found for the rest of the economy: there is a positive relationship

[12]Given our focus on institutions, we do not comment on other significant estimates of quantile regressions: the positive role exerted by firms which compete on international markets, and the negative impact of the vacancy rate variable. Both results deserve future study.

[13] In particular, the manufacturing sector includes: mining and quarrying; electricity, gas and water supply; manufacturing; construction. The service sector includes: trade, hotels and restaurants; transport and communication; financial intermediation and other business services; education, health, and other public services.

between size and location in Northern regions and unobserved productivity at all quantiles of the distribution.

Concerning the services sector (Table 5), the main difference with respect to the manufacturing sector is that the positive effect of PRP holds only at the 25th and 50th quantiles.[14]. Our estimates thus signal that productivity enhancements, due to PRP, are more questionable and reveal a remarkable gap between industries. The insignificant effect of PRP on productivity in the private tertiary sector is particularly meaningful, and is a critical aspect for this labour-intensive sector, where promotion of organisational and motivational innovation is expected to enhance TFP productivity growth.

Conversely, the union dummy variable continues to be positive and significant across the entire distribution, with a higher influence at the 75th and 90th quantiles (around 0.30).

In addition, the negative effect of women's share in services is significant and decreases across quantiles, although its magnitude is lower than that found in manufacturing. Interestingly, trained workers play no significant role, whereas the share of fixed-term workers is detrimental at all quantiles of the distribution.

For under-performer companies, we also found that occupational categories with respect to managerial and supervisory staff (the omitted group) have a negative and significant effect, higher than that in firms characterised by low and medium productivity increases. This last finding also suggests that management counts more in a sector like the tertiary, where production processes are the results of the intangible competences of human capital[15].

Lastly, size and location in Northern regions also favour productivity growth in the services sector, as found for manufacturing. One probable reason behind the role of size is that larger firms are expected to be associated with superior managerial competence,

[14]Damiani and Ricci (2009) already showed the limited diffusion of PRP contracts which are only adopted in a small number of firms in services. The present work complements these findings by showing the moderate efficacy of wage premiums granted in this sector, a result which appears near-universal, being a common feature for all groups of firms in the private tertiary sector.

[15]In another study, on Italian manufacturing firms, Piva, Santarelli and Vivarelli (2005) showed that organisational improvements, combined with technological innovation, jointly affect the demand for labour and skill composition, proxied by white- and blue-collar shares.

an omitted variable which is caught by the dimensional feature. Indeed, the best performers (represented by larger firms) can afford costly strategies such as the upgrading of management: this leads to implementation of better practices, which allow them to enjoy greater efficiency results. In addition, in large companies, economies of scale reduce implementation costs per employee and explain why benefits are expected to exceed costs.

Our results, in any case, call for further investigation of the importance of the competences of mangers in establishing a climate of successful cooperation with workers and their representatives. Thus, complementary factors -interactions of participation and high performance work practices- would allow us to verify the importance of the 'high commitment' alternative, according to which employers seek to obtain competitive advantages with quality, worker participation and involvement, as found in other researches (see Ichniowski et al. 1997).

6. Conclusions

Efficiency is expected to be higher when more incentives - in terms of wage premiums - are offered. This expectation is confirmed from our estimates, which show the positive and significant role of PRP agreements for the whole economy. However, our research also finds a considerable gap *between* sectors: higher significant effects of wage agreements are found for firms operating in manufacturing industries, uniform along the whole productivity distribution; for services, no significant influences are obtained for any groups of firms. Rent-sharing and limited implementation of systems of complementary human resources practices thus partly explain the slowdown in Italian productivity, mainly due to the poor performance of private services.

Other main findings concern the positive and significant role of a second important institutional factor - the presence of unions. For this variable too, estimates for the whole economy show that significant differences do exist between firms: unions and, plausibly, collective bargaining, which minimise free-riding behaviour and promote cooperative attitudes, are revealed as more powerful in over-achiever firms.

Other heterogeneities concern innovative management and best work practices. These practices, costly to design and implement are significant in all sectors and groups of firms, but more efficacious in prospering large enterprises operating in the services sector, where organisational issues play a greater role. One suggested interpretation, which should be thoroughly explored, is that different channels, management-led initiatives, and employee representations, often stigmatised as opposite paradigms in the relevant literature (Godard and Delaney, 2000), both occur in Italy, but in distinct sectors and groups of firms.

Another robust finding refers to the role of women' s share on efficiency growth - negative in all sectors, but absent in over-achiever firms - a puzzling result that should be better investigated.

The main limitation of our study concerns the possible endogeneity of institutions and human resources management, perhaps due to firm productivity.

Future research will aim at exploring this issue by exploiting the second wave of the RIL survey, which allows longitudinal tracking of the adoption of PRP and the presence of unions at firm level. In this perspective, it should also evaluate whether employee financial participation turns out to be a superior strategy for those groups of unionised Italian companies which better exploit the participatory content of these practices. Further research may be an additional step in detecting the reasons behind the successes and failures of Italian firms.

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Table 1: Statistics by firm performance - year 2005

	Low		Medium		High		Whole sample	
variable	Mean	St. D.	Mean	St. D.	Mean	St. D.	Mean	St. D
Av.(log) value added 2002-2005							8,38	1,30
Av.(log) fixed capital 2002-2005	6,26	1,61	7,85	1,53	10,19	1,56	7,37	1,95
PRP	0,01	0,09	0,06	0,23	0,38	0,48	0,06	0,24
Union	0,04	0,21	0,16	0,37	0,62	0,49	0,15	0,36
% Women	0,49	0,31	0,33	0,26	0,31	0,22	0,40	0,29
% Managers	0,13	0,18	0,06	0,11	0,09	0,11	0,09	0,14
% White-collar workers	0,47	0,32	0,45	0,31	0,47	0,28	0,46	0,31
% Blue-collar workers	0,41	0,32	0,48	0,31	0,44	0,30	0,45	0,31
% Trained workers	0,13	0,28	0,18	0,30	0,22	0,29	0,16	0,29
% Fixed-term contracts	0,15	0,18	0,10	0,14	0,09	0,12	0,12	0,16
Foreign	0,29	0,45	0,40	0,49	0,63	0,48	0,37	0,48
Unempl. rate (2004)	7,43	5,08	6,48	4,45	6,05	4,26	6,85	4,75
Vacancy rate	0,11	0,16	0,05	0,10	0,02	0,04	0,08	0,13
Obs.	1388		3180		1592		6160	

Table 2: Statistics by firm performance- year 2005

	Low		Medium		High		Whole sample	
	Mean	St. D.	Mean	St. D.	Mean	St. D.	Mean	St. D
Firm size								
< 10 employees	0,66	0,47	0,14	0,35	0,01	0,12	0,35	0,48
10-49 employees	0,34	0,47	0,80	0,40	0,27	0,44	0,55	0,50
50-249 employees	0,00	0,04	0,05	0,23	0,58	0,49	0,08	0,27
>= 250 employees	0,00	0,02	0,00	0,05	0,14	0,35	0,01	0,12
Macro-region								
North-West	0,32	0,47	0,38	0,49	0,43	0,50	0,36	0,48
North-East	0,19	0,39	0,25	0,43	0,27	0,44	0,22	0,42
Centre	0,24	0,43	0,19	0,39	0,17	0,37	0,21	0,41
South	0,24	0,43	0,18	0,38	0,13	0,34	0,20	0,40
Sector								
Manufacturing	0,27	0,44	0,43	0,49	0,55	0,50	0,37	0,48
Construction	0,17	0,38	0,19	0,39	0,04	0,20	0,17	0,37
Trade and Restaurant	0,30	0,46	0,21	0,41	0,17	0,37	0,25	0,43
Transport and Telecom.	0,03	0,18	0,05	0,22	0,10	0,30	0,05	0,21
Fin. Interm.,Business services	0,17	0,38	0,09	0,29	0,10	0,30	0,12	0,33
Educ., Health, other Public Services	0,05	0,23	0,03	0,18	0,05	0,21	0,04	0,20
Obs.	1388		3180		1592		6160	

Table 3: Two-step estimates- whole economy

	First Step		Second Step									
Dep. Variable	Log (v.a.)		**ols**		**q10**		**q25**		**q50**		**q75**		**q90**	
	coeff.	st. er	coeff.	st. er	coeff	st.er.	coef	st.er.	coef	err.	coef.	st.er	coef.	st.er.
Log(fixed capital)	0,12 *	0,01												
Log (employees)	0,24 *	0,01												
Year dummies		(Yes)												
constant	7,64 *	0,05	-1,13 *	0,12	-2,73 *	0,24	-1,6 *	0,13	-1,13 *	0,13	-0,29 ***	0,18	0,64 **	0,31
PRP			0,20 *	0,03	0,17 *	0,04	0,19 *	0,03	0,20 *	0,03	0,17 *	0,04	0,22 *	0,06
Union			0,26 *	0,03	0,24 *	0,04	0,27 *	0,03	0,25 *	0,03	0,30 *	0,03	0,30 *	0,05
% Women			-0,34 *	0,04	-0,48 *	0,06	-0,4 *	0,03	-0,35 *	0,03	-0,26 *	0,05	-0,19 *	0,07
% White - collar workers			-0,13	0,10	0,93 *	0,20	0,20 ***	0,12	-0,19 ***	0,10	-0,62 *	0,16	-1,30 *	0,28
% Blue - collar workers			-0,18 ***	0,10	0,92 *	0,20	0,16	0,12	-0,22 **	0,10	-0,70 *	0,15	-1,37 *	0,28
% Trained workers			0,06 **	0,03	0,13 **	0,04	0,04	0,03	0,09 *	0,03	0,09 **	0,04	0,04	0,05
% Fixed- term contracts			-0,43 *	0,07	-0,78 *	0,14	-0,5 *	0,08	-0,28 *	0,06	-0,21 *	0,08	-0,14	0,13
Foreign			0,09 *	0,02	0,12 *	0,04	0,06 ***	0,02	0,10 *	0,02	0,08 *	0,03	0,08 **	0,04
unempl. 2004			0,01 *	0,00	0,01	0,01	0,01	0,00	0,01 *	0,01	0,01 ***	0,01	0,01	0,01
vacancy rate			-0,56 *	0,10	-1,05 *	0,23	-0,6 *	0,14	-0,45 *	0,11	-0,35 *	0,12	-0,34 **	0,18
North-West			0,47 *	0,05	0,45 *	0,11	0,39 *	0,06	0,48 *	0,05	0,38 *	0,07	0,35 *	0,09
North.East			0,40 *	0,05	0,44 *	0,11	0,33 *	0,06	0,41 *	0,05	0,31 *	0,07	0,23 **	0,10
Centre			0,37 *	0,05	0,34 *	0,09	0,28 *	0,05	0,36 *	0,05	0,27 *	0,06	0,29 *	0,09
10-49 employees			0,59 *	0,02	0,56 *	0,05	0,56 *	0,03	0,56 *	0,02	0,63 *	0,03	0,65 *	0,05
50-249 employees			1,53 *	0,03	1,45 *	0,06	1,41 *	0,04	1,48 *	0,04	1,58 *	0,04	1,61 *	0,08
> 250 employees			2,31 *	0,05	2,14 *	0,10	2,28 *	0,07	2,39 *	0,04	2,46 *	0,06	2,41 *	0,10
Sector dummies			(Yes)		(Yes)		(Yes)		(Yes)		(Yes)		(Yes)	
N. of firms	8604		6060											
Pseudo R-squared			0,592		0,3162		0,3566		0,4051		0,4326		0,4236	

Note: omitted category: managers, firms with less than 10 employees, South; * significant at 1%, ** significant at 5%, *** significant
In quantile regression , bootstrapped errors with 200 replications

Table 4: Two–step estimates, manufacturing industries

	First Step		Second Step									
Dep. Variable	log(v.a.)		**ols**		**q10**		**q25**		**q50**		**q75**		**q90**	
	coeff.	st. er	coeff.	st. er	coeff	st.er.	coef	st.er.	coef	err.	coef.	st.er	coef.	st.er.
log(fixed capital)	0,13 *	0,01												
log (employees)	0,29 *	0,01												
Year dummies	(Yes)													
constant	7,38 *	0,08	-1,25 *	0,17	-2,60 *	0,33	-1,74 *	0,19	-1,29 *	0,25	-0,68 ***	0,25	0,02 **	0,39
PRP			0,23 *	0,04	0,22 *	0,05	0,20 *	0,04	0,25 *	0,03	0,21 *	0,05	0,29 *	0,08
union			0,26 *	0,03	0,23 *	0,05	0,27 *	0,03	0,25 *	0,04	0,31 *	0,05	0,29 *	0,06
% females			-0,31 *	0,05	-0,60 *	0,10	-0,38 *	0,05	-0,32 *	0,06	-0,17 *	0,06	-0,10	0,10
% white collars			0,03	0,15	0,76 *	0,26	0,22	0,16	-0,05	0,17	-0,34 *	0,20	-0,56	0,36
% blue collars			-0,03	0,14	0,73 *	0,27	0,23	0,15	-0,08	0,17	-0,47 *	0,19	-0,70 **	0,35
% trained			0,13 *	0,04	0,18 *	0,04	0,11 *	0,04	0,15 **	0,05	0,19 **	0,05	0,09	0,07
% fixed term			-0,22 **	0,09	-0,35	0,23	-0,35 *	0,13	-0,02	0,10	-0,16 *	0,11	-0,35 **	0,19
foreign			0,09 *	0,03	0,23 *	0,05	0,09	0,03	0,09 *	0,03	0,05 *	0,04	-0,01	0,04
unempl. 2004			0,01	0,01	0,01	0,01	0,00	0,01	0,00	0,01	0,01 ***	0,01	0,00	0,01
vacancy rate			-0,42 *	0,15	-1,30 *	0,33	-0,57 *	0,21	-0,15	0,17	-0,13 *	0,19	-0,08	0,24
North-West			0,32 *	0,07	0,37 **	0,12	0,32 *	0,07	0,35 *	0,10	0,29 *	0,14	0,18 **	0,10
North.East			0,27 *	0,07	0,31 **	0,14	0,22 *	0,08	0,28 *	0,11	0,25 *	0,14	0,12	0,11
Centre			0,23 *	0,06	0,25 *	0,12	0,17 *	0,07	0,22 **	0,09	0,17 *	0,12	0,06	0,10
10-49 employees			0,52 *	0,03	0,53 *	0,05	0,56 *	0,04	0,58 *	0,03	0,64 *	0,04	0,66 *	0,06
50-249 employees			1,33 *	0,05	1,35 *	0,07	1,39 *	0,05	1,51 *	0,05	1,58 *	0,06	1,67 *	0,09
> 250 employees			2,10 *	0,07	2,11 *	0,11	2,34 *	0,10	2,42 *	0,08	2,50 *	0,07	2,59 *	0,12
N. of firms	3856		2784											
Pseudo R-squared			0,6365		0,3162		0,3566		0,4051		0,4326		0,4236	

Note: omitted category: managers, firms with less than 10 employees, South; * significant at 1%, ** significant at 5%, *** significant a
In quantile regression , bootstrapped errors with 200 replications

Table 5: Two–step estimates, services sectors

	First Step		Second Step											
Dep. Variable	log(v.a.)		**ols**		**q10**		**q25**		**q50**		**q75**		**q90**	
	coeff.	st. er	coeff.	st. er	coeff	st.er.	coef	st.er.	coef	err.	coef.	st.er	coef.	st.er.
Log(fixed capital)	0,116 *	0,007												
Log (employees)	0,208 *	0,009												
Year dummies	(Yes)													
Constant	7,768 *	0,062	-1,19 *	0,16	-2,74 *	0,36	-1,65 *	0,18	-1,16 *	0,16	-0,46 ***	0,24	0,65 ***	0,37
PRP			0,12 **	0,05	0,12	0,08	0,17 *	0,05	0,13 *	0,05	0,04	0,05	0,08	0,10
Union			0,25 *	0,04	0,25 *	0,05	0,24 *	0,05	0,24 *	0,04	0,31 *	0,04	0,30 *	0,08
% females			-0,39 *	0,04	-0,51 *	0,07	-0,49 *	0,05	-0,36 *	0,04	-0,25 *	0,06	-0,24 *	0,09
% White-collar workers			-0,24 ***	0,13	0,98 *	0,28	0,17	0,15	-0,22 ***	0,14	-0,70 *	0,20	-1,46 *	0,33
% Blue-collar workers			-0,28 **	0,13	0,96 *	0,27	0,12	0,15	-0,25 ***	0,14	-0,77 *	0,19	-1,52 *	0,32
% Trained workers			-0,01	0,04	0,07	0,07	-0,02	0,04	0,03	0,04	0,03	0,04	-0,02	0,07
% Fixed-term contracts			-0,53 *	0,09	-1,06 *	0,21	-0,62 *	0,09	-0,45 *	0,09	-0,26 **	0,11	-0,11	0,16
Foreign			0,12 *	0,03	0,13 *	0,05	0,03	0,03	0,12 *	0,03	0,12 *	0,04	0,21 *	0,06
Unempl. 2004			0,02 *	0,01	0,00	0,01	0,01	0,01	0,02 *	0,01	0,02 *	0,01	0,02 ***	0,01
Vacancy rate			-0,66 *	0,13	-0,94 *	0,30	-0,71 *	0,19	-0,58 *	0,11	-0,53 *	0,17	-0,54 *	0,22
North-West			0,59 *	0,07	0,39 *	0,15	0,46 *	0,08	0,55 *	0,07	0,55 *	0,10	0,56 *	0,14
North.East			0,50 *	0,08	0,43 *	0,15	0,40 *	0,09	0,44 *	0,08	0,44 *	0,11	0,37 *	0,14
Centre			0,48 *	0,07	0,35 *	0,13	0,36 *	0,07	0,41 *	0,07	0,43 *	0,09	0,44 *	0,11
10-49 employees			0,64 *	0,03	0,61 *	0,07	0,58 *	0,04	0,59 *	0,03	0,66 *	0,05	0,67 *	0,06
50-249 employees			1,65 *	0,05	1,57 *	0,07	1,53 *	0,06	1,58 *	0,05	1,66 *	0,06	1,70 *	0,09
> 250 employees			2,42 *	0,07	2,14 *	0,13	2,37 *	0,11	2,53 *	0,07	2,51 *	0,08	2,41 *	0,12
N. of obs.	12756													
N. of firms	4748		3276											
Pseudo R-squared			0,6365		0,286		0,3197		0,3647		0,3922		0,3851	

Note: omitted category: managers, firms with less than 10 employees, South; * significant at 1%, ** significant at 5%, *** significant at 10%
In quantile regression , bootstrapped errors with 200 replications

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