Wages and Labour Productivity: the role of Performance-Related Pay in Italian firms

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Abstract

This paper analyses the role of Performance Related Pay (PRP) agreements on labour productivity and wages. Its main contribution is thus to investigate the effects of PRP on both dimensions, i.e. productivity and distribution, whereas most of the studies of related literature are restricted to one of those aspects.

All estimates are performed for a large sample of manufacturing and service Italian firms with more than five employees and a restricted sample including only unionised firms. It allows us to focus on a relevant feature of industrial relations represented by worker representation and its role in local wage setting in the Italian economy.

The expected positive link between PRP and firm performance has been confirmed in all estimates, also controlling for a rich set of covariates. Furthermore, the comparison of productivity estimates with those for wages allows us to ascertain that payments by results might be not only rent-sharing devices, but schemes that substantially lead to efficiency enhancements. These findings have been validated by a number of robustness checks, also taking into account endogeneity by using instrumental variables and the treatments of 3SLS.

The paper argues that well designed policies, that circumvent the limited implementation of PRP practices, would guarantee productivity improvement. The real effectiveness of these measures would not be weakened under union governance.

JEL Classification: D24, J31; J33; J51.

Keywords: Efficiency, Wages, Performance–related pay, unions.

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1.Introduction[1]

During the last years, the efficiency performance of the Italian economy has been disappointing, even in comparison to other European economies (Daveri and Jona-Lasinio 2005; Damiani, Pompei and Ricci, 2011). In the same years, the share of national income accruing to employees has recorded large falls, as documented by OECD (2012, ch. 3). This paper examines the drivers of both evidence by testing whether the insufficient room given to performance related payments (PRP) in decentralised bargaining has a say on efficiency and distributive patterns recorded in the Italian economy.

As known, in the last few years, "the centre of gravity in decision-making on employment contracting, wages and human resources has moved – to a smaller or larger extent – closer to the firm (European Commission, 2011, p. 9). This trend towards decentralisation of wage setting has been associated with the increasing use of variable pays, such as Performance Related Pay, to provide an important element of flexibility and more closely links to individual or collective performance. However, this trend has shown great variability across EU economies and appears limited in the Italian economy, thus insufficient to foster adequate efficiency gains and not capable to offer bonuses linked to firm performance.

This paper is the first to investigate for the Italian economy the effects of PRP on both these dimensions, i.e. productivity and distributive implications, whereas most of the studies of related literature are restricted to one of those aspects (Gielen, Kerkhofs and Van Ours, 2009). With our empirical strategy, comparing estimates for impacts of PRP on productivity and wages, we verify whether PRP schemes have lead to efficiency enhancements or broaden the space for local rent-sharing.

The paper also focuses on a relevant feature of quality of industrial relations, represented by the presence of unions. The impact exerted by unions, as summarised in Bryson and Forth (2010), depends on their influence in promoting more efficient management, through their 'voice' function, but also on extracting union wage premiums, as predicted by monopoly union bargaining models. This seems relevant in a highly unionised economy, such as the Italian case and particularly valuable because, up to now, international evidence shows contradictory findings, and the effects of unions on pay settings and productivity are still ambiguous. Thus our case study commands attention to researchers interested to further verify the role of workers' representation and PRP.

We use a unique dataset for the Italian economy obtained from the ISFOL Employer and Employee Surveys (2005, 2007, 2010) which collect information at firm level for both manufacturing and services sectors and for enterprises with more than five employees, whereas other studies on Italy are more limited in scope, because restricted to large size firms or focused on specific sectors. This rich dataset permits to explore the relationship between PRP and efficiency (labour productivity and total factor productivity growth), and to provide estimates for the effects of PRP on wages, also controlling for an ample set of covariates[2].

In the econometric analysis, various robustness checks have been performed and the main results have been validated by instrumental variable estimates. Furthermore, additional checks have been carried out by the treatments of Three- Stage Least Square (3SLS), assuming that the same instrument is valid for both labour productivity and wages. This method can be more efficient and its relative advantage increases when the interrelations among the error terms are higher.

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[1] A preliminary version of this paper has been presented at the Workshop, Industrial Relations, Productivity and Growth in Italy, organized by AISRI and AIEL, University of Rome, La Sapienza, 18October 2013. We especially thank the discussant, Enrico Saltari. We also thank Nicola Acocella and Riccardo Leoni and participants to the workshop for their useful comments.

[2]The determinants of decentralised bargaining and of bargaining covering PRP have been estimated on the basis of the ISFOL surveys for 2005 and 2007 by Damiani and Ricci (forthcoming).

The paper is organised as follows. Section 2 briefly discusses related literature. Section 3 presents data and offers descriptive statistics. Section 4 illustrates the econometric framework and estimation results. Section 5 concludes.

2. Related literature

One of the key characteristics of compensation systems concerns fixed or variable payments, i.e. payments linked to worker input or to worker performance. (Lazear, 1995). The properties of these alternative options are still under debate since up to now neither these payment types produces universally superior results (Belfield and Marsden 2003). We offer additional evidence by focussing on output- based pay, such as PRP, that may be individual or collective.

PRP, that is output-based (performance-based) pay, by linking wages to individual performance, is expected to increase productivity through higher motivation and innovation. Indeed, individual performance pay is held to generate beneficial effects in the form of higher effort and work quality, higher commitment and incentives to firm-specific human capital (Prendergast, 1999). In addition, pay settings that change from rewards based on input measures to payments related to output outcomes may induce dramatic improvements in production, which may be explained by two factors that have equal impacts. The first is that this policy attracts workers of greater ability (Lazear, 2000). The second is that contingent contracts are effective in contexts in which output (but not effort) is observable by the employer because such contracts encourage more effort and mitigate the agency problem.

However, controversial aspects of individual incentives are conceivable. For instance, Bandiera et al. (2005) show that employees underperform when wages are linked to relative performance, since workers whose efforts impose negative externalities on their fellows internalize fear retaliation. In another study, Bandiera et al. (2010) examine the importance of social ties across workers and find positive spill-over effects where social ties exist, as a given worker's productivity is significantly higher when that person works together with friends, especially those who are more able. In order to motivate workers, firms may therefore choose to exploit social incentives as an alternative to monetary incentives.

Another controversial aspect arises from the possible trade-off between extrinsic and intrinsic motivations, since contingent rewards may conflict with intrinsic motivation, so impairing performance (Benabou and Tirole, 2003).

Economic theory is also ambiguous as to the expected impact of PRP in the form of collective bonuses on productivity. These bonuses, such as profit sharing, favour better teamwork, greater workforce cooperation in facing new technology and organizational changes and these collective incentive schemes are more likely to be offered when total output is the result of the efforts of many agents and individual contributions cannot easily be identified (Holmstrom, 1979; Fitzroy and Kraft, 1992). In such cases, the absence of group incentives may lead to inferior Nash equilibria, associated with low levels of productivity due to limited cooperation. By contrast, employees who participate to enterprise results "will become more committed to the goals of that enterprise, leading to improvements in individual and organisational performance. At a wider societal level, financial participation may be seen as a tool for redistribution of income and wealth, and may therefore serve as a broader instrument for social integration" (Pendleton et al. 2001, p.1).

However, collective bonuses may induce employees to free ride on the efforts of others and cut productivity. In such circumstances, group incentives may lead to decentralised monitoring due to peer pressure and shame norms (Kandel and Lazear, 1992; Mas and Moretti, 2009), thus mitigating opportunistic behaviour. More generally, the promotion of team culture and employee participation in decision-making, reveals a policy which contributes, like financial participation, to increasing commitment (Blinder, ed., 1990).

On empirical grounds, the summary paper of Pérotin and Robinson reported 'very solid international evidence' that employee financial participation has a positive or neutral effect on productivity. In more recent works, productivity effects of collective PRP have been tested in a number of studies (Kruse, Blasi and Park, 2008; Bryson and Freeman; 2008; Gielen, Kerkhofs

and Van Ours, 2009; Kato, Lee and Ryu, 2012,). However, the number of contribution that estimate productivity effects by using representative firm surveys are still smaller. Particularly valuable is to highlight the incentive experience in Italy, because prior works for this country have been restricted to large companies, selected sectors or particular areas in the north of the country (Origo, 2009; Lucifora and Origo, 2012).

In addition, what deserve closer attention are the main impacts of PRP on wage setting. In decentralised wage-bargaining, workers, through PRP, can appropriate a large part of the rents generated by their firms. One interpretation of the positive wage premium negotiated in firm-level contracts is that of rent-sharing. This may be relevant when specific human capital is important and there is "a match-specific surplus (rent), created by the costs of finding new partners, and this surplus will have to be shared by bargaining" (Acemoglu and Piscke, 1999, p. F121). Some authors, by using firm-level data, show a robust positive association between wages and profitability (see, among others, Abowd and Lemieux, 1993; Blanchflower, Oswald, and Sanfey, 1996). This evidence has been confirmed by introducing controls for unobserved worker heterogeneities (Gurtzen, 2008; Martins, 2009).

However, how much of these wage effects are due to the presence of unions is still uncertain. On one hand, trade unions have sufficient bargaining power to obtain high wage premiums with firm-level agreements and favourable conditions from local contracts. One potential result is to strengthen the pay-performance link, as in rent-sharing models (Blanchflower, Oswald, and Sanfey 1996). On the other hand, unionised plants are more likely to utilise incentive payments accompanied by joint decision-making, leading to better results in terms of firm performance (Black and Lynch, 2001). In unionised firms, constructive institutional responses overcome free rider problems of group incentives, increase workers' commitment and reduce voluntary labour turnover (Booth and Chatterji, 1998). Accordingly, the two impacts, on efficiency and wages, may reveal to a large extent, inseparable, as shown by Addison and Belfield (2007). Furthermore, as signalled by incentive contract literature, clusters of complementary human resource management (HRM) practices may exert significant effects on productivity. For the Italian case, Leoni (2012) has shown that also skill improvements and workers' skill competence, that result in more efficient production, can be obtained from specific high performance work practices, especially when adopted in a bundled form.

Other studies have shown that the set of HRM variables includes union relations, as tested in the representative study of Ichniowsky, Shaw and Prennushi, 1997). Even in low unionised economies, such as the UK, there is also new evidence that worker representatives are perceived by employers as institutions capable of improving firm performance (Bryson and Forth, 2010). We will address these issues in the econometric section.

3. Data and descriptive statistics

3.1 Data

Our empirical analysis is based on information obtained by the Employer and Employee Surveys (RIL) that were conducted by ISFOL in 2005, 2007 and 2010 on a representative sample of partnerships and limited firms that operated in the non-agricultural private sector.

The ISFOL-RIL surveys collect a rich set of information about employment composition, personnel organization, industrial relations and other workplace characteristics. In particular, the RIL questionnaire provides information about the adoption of decentralised bargaining and PRP, as well as the presence of unions (see the Appendix, Table A1, for detailed definitions of all variables). Each RIL cross-section for the years 2005, 2007 and 2010 counts about 25000 firms, whereas its longitudinal component over the period 2005-2007-2010 counts about 12000 firms.

As far as PRP is concerned, each firm is asked whether or not such a scheme is adopted. Unfortunately, we do not know whether the different types of schemes are based on firm-, group- or individual- performance (this information is available only for 2010). Besides, the dataset does not provide statistics on how many workers in the firm receive PRP. Therefore, our

PRP-variable is a dummy variable simply indicating the existence or not of a PRP scheme of some kind.

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 information from the AIDA archive. Then the longitudinal RIL-AIDA merged sample is restricted to those limited liability companies which operated in the Italian private sector over the period 2005-2010. Further, we excluded firms with less than five employees to retain only those firms characterized by a minimum level of organizational structure. The final sample is given by a no-balanced panel of about 9000 firms during the period 2005-2010.

3.2 Descriptive statistics

In this section, we perform a descriptive analysis of the RIL-AIDA merged sample for the years 2005, 2007 and 2010. Table 1 reports the means and standard deviations for the key variables used in the econometric analysis. The number of sampled firms increases from 8064 to 10136 over the period analysed. This time variability suggests to be cautious in discussing summary statistics, even though the variability is not so important and the composition effects should be limited. The results show that in 2005, 2007 and 2010, only 15%, 12% and 14% of firms, respectively, have PRP schemes, thus confirming the limited spread of PRP agreements and no significant changes over the observed period[3].

The RIL AIDA merged sample also reveals a rather slight increase in the two dependent variables (labour productivity and wages), and in the physical capital per employees between 2005 and 2010.

With respect to workforce composition, Table 1 shows that the share of blue-collar workers increases over time, from 46% in 2005 to 55% in 2010, while, symmetrically, the proportion of white collars decreases from 45% in 2005 to 39% in 2010.

Concerning the percentage of women, workers with fixed-term contracts and immigrants (workers coming from other countries), a slight decrease over time is recorded, indicating a tendency in our sample towards the reduction of 'peripheral' employment: on average, the proportion of women decreases from 39% to 35% from 2005 to 2010; analogously, the stock of workers with fixed-term contracts over the total employment is declining from 11% in 2005 to 10% in 2010, and the share of immigrants, on total employees, declines from 9% to 5%. The overall weakness in productivity and wage growth of sampled firms may be explained by the lowering of both innovative and exporting units over the period considered .Firms that originate new products decline from 55% to 45%, whereas the proportion of exporters slumps from 41% to 31%, between 2005 and 2010.

As we will discuss in the next section, sale volatility recorded in two different previous periods will be used as instruments, supporting in the econometric analysis our robustness check. What matters here, is that this average previous volatility of sales is remarkable over the sample (the log of the standard deviation ranges from 12.55 to 12.90). This information, available only for a restricted sub-sampled firms (about 4.000 observations per year), allows us to control for endogeneity and lead us to confirm all our main results.

According to expectations, in our sample small-size firms prevail and the largest share of firms is mainly located in Northern Italy. In particular, firms with less than 50 employees are more than 80% while those with more than 250 employees are about 5% of the total sample in each year considered. Finally the RIL-AIDA data indicate that firms are mainly specialised in manufacturing sectors and less present in services, with the exception of the trade sector.

These differentials in territorial localisation and sectors of the Italian firms, as well as in various characteristics of workforce composition, show the importance of our data for analysing

[3] For critical analyses of the Italian bargaining model and the reforms adopted in the last years see Acocella and Leoni (2010) and Tronti (2010).

the use of PRP, whereas other (few) studies using firm level data are very often limited to smaller samples, restricted by sector, geographical localisation and size (Origo, 2009; Lucifora and Origo, 2012)..

[Insert Table 1]

Finally notice that PRP firms, that are scarcely widespread, exhibit better performances and pay higher wages, at least according to the key indicators used in our empirical analysis The Kernel density estimations, calculated on the pooled sample, show that there is higher probability to find PRP firms among firms with higher values of labour productivity and wages. As shown by Figure 1, the distribution referring to PRP firms is slightly placed to the right of that concerning other firms. This difference is recorded in the whole sample and is confirmed in the restricted sample that includes only unionised firms.

These first comparisons of firms that have a PRP scheme with respect those that have not, encourage us to further explore the existence of possible causal relations between PRP schemes and enterprise performance.

[Insert Figure 1]

4. Estimates

4.1 The econometric strategy

In this section we present the empirical strategy aimed at estimating the effect of PRP on labour productivity and wages.

In particular, the relationship between labour productivity and PRP may be formalized by a production function augmented by a dummy variable capturing the incidence of PRP and inserting a set of other controls for firm characteristics and workforce composition. The following equation is then estimated:

$$(1) \qquad \ln\left(\frac{P}{L}\right)_{it} = \alpha \cdot \ln\left(\frac{K}{L}\right)_{it} + \beta \cdot PRP_{it} + \delta \cdot X_{it} + \mu_s + \gamma_j + \eta_t + +\varepsilon_{it} \quad \text{t=2005,2007, 2010}$$

where $ln\left(\frac{P}{L}\right)_{i,t}$ is the (log of) valued added per employee, $\ln\left(\frac{K}{L}\right)_{it}$ is the (log of) physical capital per employee, PRP represents a dummy variable indicating the presence of PRP and the vector X_{it} denotes other controls for workforce composition and firm characteristics. Finally, the parameter m_s denotes sector specific fixed effects, g_j regional (NUTS1_level) fixed effects for macro-areas, η_t represents year fixed effects and ε_{it} is the error term capturing the idiosyncratic component of labour productivity.

The wage equation parallels the productivity equation (1). Thus, estimate the following equation:

$$(2) \quad \ln\left(\frac{W}{L}\right)_{it} = \alpha \cdot \ln\left(\frac{K}{L}\right)_{it} + \beta \cdot PRP_{it} + \delta \cdot X_{it} + \mu_s + \gamma_j + \eta_t + \varepsilon_{it} \qquad \text{t=2005,2007, 2010}$$

where the dependent variable represents the (log of) the average annual wages (W) per employee (L), while the explanatory variables are the same included in equation (1): $\ln\left(\frac{K}{L}\right)_{it}$

is the (log of) physical capital per employee, PRP represent a dummy variable indicating the presence of PRP and the vector X_{it} denotes the controls for workforce composition and firm characteristics discussed in the previous section. The parameter m_s denotes sector specific fixed effects, g_j the regional (NUTS1_level) fixed effects for macro-areas, η_t represents the year fixed effect and ε_{it} is the error term.

Afterwards, the econometric strategy tackles the question of endogeneity of PRP on productivity and wages. We started with a pooled cross section analysis of equations (1) and (2), controlling for time dummies fixed effects. However, pooled regressions do not allow us to distinguish between incentive or distributive effects of PRP *and* spurious correlation between PRP and productivity (or wages), that will typically arise if more productive firms and firms that pay higher wages more likely adopt PRP schemes. As a result of this potential endogeneity of PRP variable, the estimated effect of PRP would be biased.

To deal with endogeneity, we use *the feasible two step IV-GMM estimator* on the pooled data 2005-2007-2010 for equation (1) and (2). Baum et al. (2003 and 2007), demonstrated that when the disturbance covariance matrix is affected by heteroskedasticity and observations are clustered (we have firms in three different time periods) this GMM estimator is more efficient and emerges as useful alternative to the standard fixed IV estimators[4]. As instruments, we use firm-level values of the volatility of sales recorded in two past periods: i) the three years 1999, 2000, 2001, and ii) the three years 2002, 2003, 2004. Lagged values of volatility of sales is a proxy of uncertainty faced by firms, and it is expected to be correlated with the probability that firms introduce PRP schemes as incentive -sharing devices over the period 2005-2007-2010, as explained below (see the sub-section 4.3). At the same time, lagged values of sale volatility are supposed to be not correlated with current values of labour productivity and wages[5]. Unfortunately, the volatility of sales is not available for all firms used in the baseline estimation, hence the robustness checks are performed on a restricted sample. For that reason there will be a variation in the magnitude of coefficients of main interest, but not in sign and significance, but our main results are confirmed.

Furthermore, we use a 3SLS estimation in which the two dependent variables (labour productivity and wages) are explicitly taken to be endogenous to the system and treated as correlated with disturbances in the system of equations.

In this context, also our key variable PRP is treated as endogenous and correlated with disturbances, while other control variables included in the right-hand side of the system of equations (1)-(2) are considered to be exogenous. Then we perform a 3SLS-IV regression to estimate a SUR model of equations (1) and (2) using as instruments for PRP the (lagged) values of sale volatility for each firm. In this empirical framework, the estimated coefficient of PRP in the wage equation (2) may be compared to that estimated in productivity equation (1). It allows us to verify if the relative bargaining power of firms and workers affects the division of the social surplus obtained from the employment relationship.

4.2 Effects of PRP: OLS estimates

In this section we estimate the effect of PRP on productivity and wages of Italian firms. The OLS estimates are presented in Table 2 and are obtained by including time, regional (NUTS, the Nomenclature of Territorial Units for Statistics, Level-1) and sector dummies, to control for time-varying, geographical disparities and highly sector-specific factors which probably influenced the dependent variables and which cannot be captured by means of controls included in our analysis.

Due to multicollinearity problems we could not introduce the firm size as regressor. However, both literature concerning Italian firms (Hall et al., 2009) and our own calculations report a good correlation between export and innovation propensities, on one side , and firm size on the other. This evidence led us to consider these propensities as good proxies of the firm size[6].

[Insert Table 2]

[4] To save space we do not show the results of tests proving the presence of heteroskedasticity in our estimated equations. These results are available upon request.

[5] Among rationales behind the choice of our instrument, one may recall some results of the strategic management and sales management literatures. For instance, the use of an incentive plan is positively related to a dimension of organizational performance, such as sales volatility, as found by Menguc and Barkers (2003). Other arguments for the correlation between variable pay and profit volatility are offered by Burke and Hsieh (2006).

[6] Results concerning these correlations, found in our sample, are available upon request.

The first two columns report the results obtained for the whole sample of firms, unionised and not, and the remaining columns those for the sub-sample of unionised firms. Thus, the comparison among these different results indicates productivity and wage differences between firms that have unions and all sampled firms[7].

The findings obtained indicate that the effect of PRP is positive and significant on labour productivity (column *a*). An analogous results has been obtained by replicating our estimation strategy for wages, (column *b).* These findings are confirmed also for unionised firms (columns c and d), even though differences in the magnitude of some effects deserve a short discussion. As regards wages, the lower coefficient on PRP for unionised firms might indicate that other actors, not only managers and employees, considerably influence the use of performance related pays and that productivity gains are not fully appropriated by workers. Indeed, under unions, PRP schemes represent 'shared capitalist plans' of compensation, that enable employers to secure benefits, as documented for other countries by the employee financial participation literature (see, among others, Poutsma, Blasi and Kruse, 2012). Our result may also be interpreted as a confirmation that in years of progressive decline in trade union membership and diffusion of precarious working conditions, unions' objective function has been more oriented to wage moderation to preserve job positions. Thus employees' representatives have exerted their bargaining power to moderate wage demands, as also shown for other country experiences (Dumont et al. 2005).

Most of the control variables show the expected sign. We find the significant and positive role of the capital stock per capita in both labour productivity and wage equations, whereas concerning workforce characteristics we obtain the strong negative coefficient associated with the percentage of women. A cautionary interpretation is necessary, since the percentage of women is very likely to be correlated with unobserved (or omitted) firm characteristics. In addition, the negative coefficient associated with the female component is likely to be related to the gender wage gap. Indeed, our wage estimates (columns *b* and *d*) seem to confirm that lower productivity increases, obtained when the proportion of women is higher, is at least partially related to less generous remunerations offered to women. It is in line with other studies that find that female employees, on average, prefer activities that allow a larger flexibility between job and family, have lower interdependence with other workers, are less involved in participative work forms (Zwick, 2004), and appear less respondent to incentives.

Another interesting finding is the negative coefficient of fixed-term workers on labour productivity (columns *a* and *c*), accompanied by a parallel segmentation of these precarious workers in wage setting (column *b* and *d*). Other workers' characteristics, such as employment positions, play a role: the coefficient associated to white- and blue-collar workers are negative and significant, with respect to the omitted category, the executives. A plausible explanation is that managerial employees have a positive and significant influence on productivity,. This may be due to their providing better-designed pay schemes to induce optimal effort from their subordinates.

Finally, the propensity to export has a positive and significant influence on both productivity and wages, and probably it also works as a good proxy of medium and large sized firms.

4.3 IV and 3SLS *estimates*

The possible endogeneity of PRP deserves further attention. The exogeneity assumption of PRP might be violated if firms adopt this reward system on the basis of productivity performance, as said above. In other terms, enterprises with PRP might be more efficient in advance (and may offer higher rewards) than firms that don't have a scheme. This problem, due to the fact that better managed firms tend to adopt PRP, is taken into account carrying out instrumental variable estimates and implementing some tests to validate the choice of these instruments.

[7] It must be remarked that the comparison of coefficients of PRP on productivity and wages has only an approximate value and are not totally reliable because the results shown in columns (a), (b) and (c), (d) are obtained by estimating different equations. Only in the 3SLS model they are obtained from a unique system of equations and in this case the comparison has a full validity.

This method requires finding instruments that can predict PRP, without directly affecting our dependent variables, labour productivity and wages. The volatility of sales, recorded in past years before 2005, may be a valid instrument because it is not correlated with our dependent variables, but at the same time, may influence our key regressor PRP.

Notice that Italy is characterized by a two-tiered bargaining regime: at the first level there is an industry-wide bargaining; at the second level there is a firm level (or territorial) bargaining, that may distribute PRP wage premiums linked to productivity or firm results. In this wage setting, the design of the PRP wage component means that it can only improve the wage set in the first level, or be zero when targets on productivity or firm results are not met. In other words, wage negotiations at the firm level mostly concern production bonuses that employers pays to workers when the firm experiences upturns; on the contrary, no penalisation is envisaged for workers' rewards during downturns. Thus, it is plausible to assume that Italian firms and workers, that underwent higher sales volatility in the past, are more willing to adopt a PRP scheme, because PRP can lead to an increase in motivation, employee performances and wages. By contrast, no losses are associated with high volatility of sales because employees do not take extra-risks, and when the volatility of sales is high also risk-averse employees will be no reluctant to accept PRP agreements.

The conjecture above seems to be confirmed: we performed the *IV-GMM* regression by introducing in the first stage, as external instruments of PRP, the volatility of sales recorded at firm level over the period 1999-2001, and 2002-2004 (see Table A.2, in the Appendix, for the first-stage results). We obtain that both our instruments positively influence the adoption of the PRP scheme.

In the second stage, we obtain the results reported in Table 3. Similarly as done in Table 2, for each dependent variable we ran two specifications, the first for the whole sample (first two columns) and the second for the unionised firms (remaining columns).

[Insert Table 3]

By using the *IV-GMM* estimates, the coefficients of PRP, instrumented with the volatility of sales, show the expected sign and are significantly different from 0. The validity of the external instruments is signalled by three different tests: under-identification, weak-identification and over-identification (Baum, 2003; 2007). The only exception is the productivity equation for the sample of unionised firms (Table 3, column *c*), where the tests of joint validity of the chosen instruments is at the limit (see the p-value for the Hansen J Statistic). In any case, the instrumentation of PRP is validated by the productivity estimation concerning the whole sample (column *a*).

To have a confirmation of our results, an additional robustness check has been performed in Table 4, by the treatment of Three-Stage Least Squares estimator (3SLS), that is a combination of multivariate regression (Sur estimation, see Zellner and Theil, 1962 for its properties) and Two-Stage Least Squares method. Indeed, if the dependent variables are somehow correlated each other, as in our case, one has to control for the variance-covariance matrix of error terms by means of simultaneous equations.

In the first stage we use the instruments of PRP, shown above: i) volatility of sales at firm level over the period 1999-2001; ii) volatility of sales at firm level over the period 2002-2004. In the Second-Stage, a consistent estimate for the covariance matrix of the equation disturbances is obtained; whereas in the Third-Stage a GLS-type estimation is performed by using the covariance matrix estimated in the second stage and with the instrumented values in place of the right-hand-side endogenous variables.

[Insert Table 4]

The last row shows the total correlation between each pair of equations that justifies the use of the covariance matrix of the disturbances, performed with the Seemingly Unrelated Regression Method. In addition, we can make a proper comparison of the PRP coefficients of the productivity and wage equations, respectively. The Wald test tells us that these coefficients are statistically different in both

samples (All Firms and Unionised Firms). We obtain that the coefficient of PRP on wages is still slight lower in unionised firms with respect to all firms (0.838 versus 0.864), even though unions play a role in limiting the extraction of surplus accruing to employers via the adoption of PRP. Indeed, the positive difference between the PRP coefficients of productivity and wage equations is only 0.330 in unionised firms, whereas it goes up to 0.425 in all firms.

In any case, what is worth noting in Table 4 is that our previous findings still hold and suggest the positive link of PRP with pays and performances.

Conclusions

This paper has analysed the role of the implementation of decentralised bargaining in explaining the recent slow-down of the Italian efficiency growth, with a particular focus on the role played by the (limited) diffusion of Performance Related Pay (PRP) agreements on labour productivity. We obtained that PRP may significantly stimulate efficiency gains and thus the limited implementation of these wage practices has played a role in explaining the Italian disappointing results.

The paper has also addressed distributive concerns exploring how PRP schemes bargained in local wage setting contributed to explain wages, and thus have a say on distributive patterns recorded in the Italian economy in the last few years.

All estimates are performed for a large sample of manufacturing and service Italian firms that employ more than 5 workers and controlling for a rich set of covariates. Furthermore, to validate our OLS results, various robustness checks have been performed, by *IV-GMM* estimates and the treatments of 3SLS, assuming that the same instrument is valid for every equation, labour productivity and wages. In addition, we focused on a relevant feature of industrial relations, represented by unionization. The results indicate that unions, not only extract wage premiums for their workers, as predicted by monopoly union bargaining models, but through their 'voice' function, may counter-balanced negative side-effects of collective PRP, such as free-riding. Overall, the estimates suggest that workers' organisations play a redistributive function that reveals not detrimental to an efficiency-enhancing role.

Concerning policy implications, the adoption of measures that circumvent the limited implementation of PRP practices may be recommended, since payments by results, rather than being only distributive devices, may substantially lead to efficiency enhancements. The effectiveness of this strategy is not weakened under union governance.

The main limitation of our findings concerns PRP data. Unfortunately, we know whether the different types of schemes are based on firm-, group- or individual- performance only for 2010, but this information is not available for previous years[8] and the dataset does not provide statistics on how many workers in the firm receive PRP, nor for indicators chosen to link pays to performance. Furthermore, we only investigated the average effect of PRP on productivity and wages, by considering the standard conditional mean econometric techniques. We expect that additional results could be obtained taking into account the heterogeneity of firms along the productivity and wage distributions by means of quantile regression techniques.

Future research, made available also by additional statistical information, will permit to explore the role of individual and collective variable payment schemes on the basis of a richer dataset and to thoroughly evaluate their different influence on efficiency gains and redistribution inside heterogeneous Italian firms.

[8] The availability of data concerning the diffusion of PRP schemes offered at the individual, team, or establishment level has been exploited by Damiani and Ricci (2013), with a specific focus on the role played by of the quality of managers, captured by their educational profile.

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Table 1: Descriptive statistics: RIL-AIDA merged sample

	Year 2005			Year 2007			Year 2010		
	N.	**Mean**	***Std. Dev.***	**N.**	**Mean**	***Std. Dev.***	**N.**	**Mean**	***Std. Dev***
Performance Related Pay	8064	0.15		8362	0.12		10136	0.14	
Accounting variables									
ln (value added per capita)	5291	10.66	*0.77*	7512	10.73	*0.62*	9069	10.69	*0.61*
ln (wage per capita)	5241	9.93	*0.66*	7451	9.99	*0.42*	9060	10.01	*0.43*
ln (physical capital per capita)	5294	9.80	*1.6*	7507	9.85	*1.58*	9054	9.90	*1.76*
Workforce characteristics									
% executives	8064	0.09	*0.13*	8551	0.05	*0.1*	10136	0.05	*0.1*
% white collar workers	8064	0.45	*0.32*	8551	0.38	*0.31*	10136	0.39	*0.31*
% blue-collar workers	8064	0.46	*0.32*	8551	0.57	*0.33*	10136	0.55	*0.33*
% women	8064	0.39	*0.28*	8580	0.34	*0.28*	10136	0.35	*0.28*
% fixed-term contracts	8064	0.11	*0.16*	8580	0.1	*0.17*	10136	0.10	*0.17*
% immigrant workers	8064	0.09	0.18	8301	0.06	0.12	9955	0.05	0.11
Firm characteristics									
Age	5261	22.45	16.83	6585	24.13	16.90	4870	26.70	17.23
Process Innovation	7775	0.47	0.50	8169	0.43	0.50	9920	0.39	0.49
Product Innovation	7820	0.55	0.50	8184	0.56	0.50	9926	0.45	0.50
Export	8064	0.41	0.49	8360	0.30	0.39	9944	0.31	0.46
ln (Sales volatility)_1999-2001	3924	12.63	1.65	4940	12.56	1.65	3431	12.55	1.64
ln (Sales volatility)_2002-2004	2887	12.87	1.47	3600	12.82	1.47	2416	12.90	1.43
Firm Size									
5 < n of employees<15	8064	0.38		8551	0.42		10136	0.43	
15 ≦n employees < 50	8064	0.35		8551	0.34		10136	0.33	
50 ≦ n employees < 250	8064	0.21		8551	0.19		10136	0.19	
n of employees ≧250	8064	0.07		8551	0.05		10136	0.05	
NUTS1_Macro-regions	8064						10136		
North- West	8064	0.35		8580	0.34		10136	0.33	
North-East	8064	0.25		8580	0.26		10136	0.25	
Centre	8064	0.2		8580	0.2		10136	0.21	
South	8064	0.21		8580	0.21		10136	0.21	
Sectors	8064						10136		
Textile, Wearing Apparel, Food Industry	8064	0.14		8580	0.14		10136	0.14	
Other Manufacturing, Mining, Utilities	8064	0.28		8580	0.31		10136	0.31	
Constructions	8064	0.11		8580	0.1		10136	0.1	
Trade, hotels, restaurants	8064	0.13		8580	0.16		10136	0.16	
Transportation and communication	8064	0.07		8580	0.05		10136	0.05	
Intermediation and other business service	8064	0.14		8580	0.1		10136	0.1	
Education, health and private social services	8064	0.12		8580	0.14		10136	0.14	

Notes: for binary variables and dummies the mean corresponds to the relative frequency.

Figure 1: Distributions of Wages, Labour Productivity and Total Factor Productivity

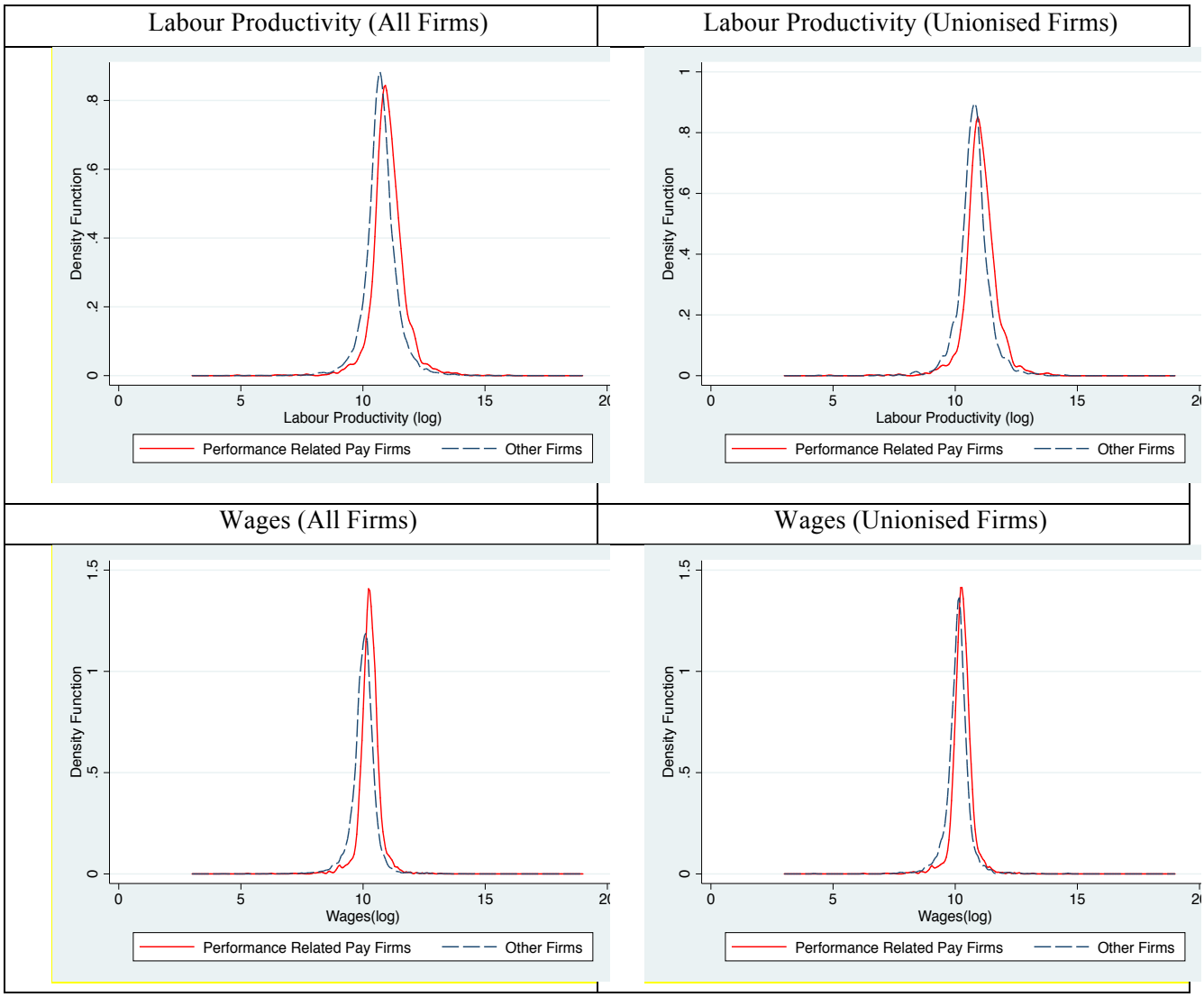

Table 2: Effects of Performance Related Pay on Labour Productivity, Wages and TFP (OLS Estimates)

	All Firms		Unionised Firms	
Dependent Variable	ln (value added per capita)	ln (wage per capita)	ln (value added per capita)	ln (wage per capita)
Explanatory Variables	*a*	*b*	*c*	*d*
Performance Related Pay	**0.069*** **	**0.088*** **	**0.072*** **	**0.049*** **
	(0.017)	(0.011)	(0.021)	(0.014)
ln (physical capital per capita)	0.144***	0.061***	0.133***	0.059***
	(0.005)	(0.003)	(0.008)	(0.007)
Fixed-term contracts_Share	-0.416***	-0.430***	-0.239***	-0.410***
	(0.039)	(0.035)	(0.083)	(0.085)
White Collars_share	-0.452***	-0.390***	-1.027***	-0.903***
	(0.087)	(0.077)	(0.206)	(0.158)
Blue Collars_share	-0.756***	-0.626***	-1.329***	-1.141***
	(0.086)	(0.075)	(0.199)	(0.148)
Women_share	-0.374***	-0.378***	-0.462***	-0.371***
	(0.026)	(0.021)	(0.055)	(0.039)
Immigrants	-0.128***	-0.131***	0.125	0.033
	(0.045)	(0.040)	(0.098)	(0.084)
Firm's Age	0.001	0.002***	0.000	0.001*
	(0.000)	(0.000)	(0.001)	(0.000)
Process Innovation	0.005	-0.014	0.016	-0.023
	(0.012)	(0.009)	(0.022)	(0.017)
Product Innovation	0.002	0.014	0.011	0.016
	(0.012)	(0.009)	(0.025)	(0.018)
Export	0.071***	0.061***	0.074***	0.059***
	(0.012)	(0.009)	(0.025)	(0.016)
Constant	9.974***	9.952***	10.598***	10.482***
	(0.098)	(0.086)	(0.222)	(0.169)
Time Dummies	Yes	Yes	Yes	Yes
Sector Dummies	Yes	Yes	Yes	Yes
NUTS1_level Dummies	Yes	Yes	Yes	Yes
R_Squared	0.250	0.230	0.263	0.252
Obs	13178	13186	3304	3284

*** significant at 1% level; ** significant at 5% level; *significant at 10% level. Note: *OLS estimates. Robust standard errors in parentheses are clustered at firm level*

Table 3: Effects of Performance Related Pay on Labour Productivity, Wages, and TFP (IV Estimates)

Dependent Variable	ln (value added per capita)	ln (wage per capita)	ln (value added per capita)	ln (wage per capita)
Explanatory Variables	*a*	*b*	*d*	*e*
Performance Related Pay	**1.231*** **	**0.830*** **	**1.088*** **	**0.797*** **
	(0.158)	(0.106)	(0.232)	(0.181)
ln (physical capital per capita)	0.135***	0.050***	0.123***	0.052***
	(0.008)	(0.005)	(0.014)	(0.011)
Fixed-term contracts_Share	-0.134*	-0.171***	-0.269	-0.372***
	(0.077)	(0.061)	(0.176)	(0.140)
Executives_share	-0.863***	-0.848***	-0.747**	-0.696***
	(0.164)	(0.128)	(0.292)	(0.223)
White Collars_share	-1.225***	-1.120***	-1.048***	-0.926***
	(0.159)	(0.124)	(0.282)	(0.210)
Women_share	-0.151***	-0.223***	-0.255**	-0.201***
	(0.053)	(0.038)	(0.102)	(0.077)
Immigrants	-0.001	0.001	0.436**	0.283**
	(0.089)	(0.071)	(0.189)	(0.144)
Firm's Age	-0.004***	-0.001**	-0.002*	0.000
	(0.001)	(0.001)	(0.001)	(0.001)
Process Innov.	-0.051	-0.060***	-0.051	-0.073**
	(0.044)	(0.016)	(0.040)	(0.030)
Product Innov.	-0.021	-0.007	0.004	-0.003
	(0.022)	(0.014)	(0.042)	(0.029)
Export	-0.055	-0.022	-0.037	-0.011
	(0.051)	(0.015)	(0.041)	(0.031)
Constant	10.485***	10.525***	10.077***	10.095***
	(0.177)	(0.140)	(0.366)	(0.277)
Time Dummies	Yes	Yes	Yes	Yes
Sector Dummies	Yes	Yes	Yes	Yes
NUTS1_level Dummies	Yes	Yes	Yes	Yes
Underidentification Test _ p value (Kleibergen-Paap rk LM Statistic)	0.000	0.000	0.000	0.000
Weak Identification Test _ Wald F Stat. (Kleibergen-Paap rk Wald F Satistic)	76.105	74.695	18.172	17.382
Overidentification Test _ p value (Hansen J Statistic)	0.256	0.165	0.070	0.778
Obs.	6579	6570	2340	2329

*** significant at 1% level; ** significant at 5% level; *significant at 10% level. Note: All IV estimations are based on the two-step efficient GMM estimator and a variance-covariance estimator that is robust to heteroskedasticity (robust standard errors in parentheses). The external instruments of the Performance Related Pay that have been used in the first stage are: i) volatility of sales at firm level over period 1999-2001; ii) volatility of sales at firm level over the period 2002-2004.

Table 4: Effects of Performance Related Pay on Labour Productivity, Wages and TFP (Three-Stage Estimation for Systems of Simultaneous Equations)

	All Firms		Unionised Firms	
Dependent Variable	ln (value added per capita)	ln (wage per capita)	ln (value added per capita)	ln (wage per capita)
Explanatory Variables	*a*	*b*	*c*	*d*
Performance Related Pay	**1.289*** **	**0.864*** **	**1.168*** **	**0.838*** **
	(0.119)	(0.081)	(0.215)	(0.157)
ln (physical capital per capita)	0.137***	0.049***	0.125***	0.053***
	(0.006)	(0.004)	(0.011)	(0.008)
Fixed-term contracts_Share	-0.125**	-0.154***	-0.316**	-0.343***
	(0.064)	(0.043)	(0.137)	(0.100)
White Collars_share	-0.890***	-0.814***	-0.698***	-0.615***
	(0.111)	(0.075)	(0.232)	(0.169)
Blue Collars_share	-1.241***	-1.101***	-0.968***	-0.856***
	(0.105)	(0.072)	(0.222)	(0.162)
Women_share	-0.134***	-0.219***	-0.207**	-0.181***
	(0.041)	(0.028)	(0.084)	(0.062)
Immigrants	-0.002	0	0.461***	0.285**
	(0.074)	(0.051)	(0.163)	(0.118)
Firm's Age	-0.005***	-0.002***	-0.002**	-0.001
	(0.001)	(0.000)	(0.001)	(0.001)
Process Innov.	-0.055	-0.062***	-0.053	-0.070***
	(0.051)	(0.014)	(0.037)	(0.027)
Product Innov.	-0.026	-0.007	-0.011	-0.002
	(0.020)	(0.013)	(0.035)	(0.026)
Export	-0.053	-0.025	-0.031	-0.019
	(0.050)	(0.020)	(0.037)	(0.027)
Constant	10.488***	10.509***	9.983***	10.007***
	(0.127)	(0.087)	(0.284)	(0.207)
Time Dummies	Yes	Yes	Yes	Yes
Sector Dummies	Yes	Yes	Yes	Yes
NUTS1_level Dummies	Yes	Yes	Yes	Yes
Obs	6531		2321	
Correlation between equations	Corr(a,b)=0.806		Corr(c,d)=0.866	
Wald Test for the coefficient of Performance Related Pay	H_0: ln (va per capita) -ln(wage per capita)=0 Diff.=0.425 p_value = 0.000		Diff.=0.330 p_value = 0.000	

*** significant at 1% level; ** significant at 5% level; *significant at 10% level. H_0 in Wald Test assumes that the differences between the coefficients of Performance Related Pay in the productivity and wage equations (0.425 and 0.330 in All firms and Unionised Firms, respectively) are not significantly different from zero. The p_value of this test shows that this H_0 is rejected.

APPENDIX

Table A1: Variable definition

Variable	Definition
Performance Related Pay	Dummy variable that equals 1 if the firm adopts PRP payments of any kind, 0 otherwise.
ln (value added per capita)	Log of value-added per employee (source AIDA) deflated by the value added deflator (source ISTAT)
ln (wage per capita)	Log of wage bill per employee (source AIDA) deflated by the consumer price index for blue and white collar workers (source ISTAT)
ln (physical capital per capita)	Log of capital stock per employee (source AIDA) deflated by the investment deflator (source ISTAT)
% executives	Percentage of managers and supervisors
% white collar workers	Percentage of white collar workers
% blue-collar workers	Percentage of manual workers
% women	Percentage of women among total workers
% fixed-term contracts	Percentage of fixed-term workers
% immigrant workers	Percentage of workers coming from other countries
Unions	Dummy variable that equals 1 if there is a worker representation of any kind in the firm, 0 otherwise
Age	Age of firms
Process Innovation	Dummy variable that equals 1 if the firm adopted process innovations in the last three years, 0 otherwise
Product Innovation	Dummy variable that equals 1 if the firm originated new products in the last three years, 0 otherwise
Export	Dummy variable that equals 1 if the firm exported in the last three years, 0 otherwise
ln (Sales volatility)_1999-2001	Logarithm of the standard deviation of sales over the period 1999-2001
ln (Sales volatility)_2002-2004	Logarithm of the standard deviation of sales over the period 2002-2004
Firm Size	Logarithm of the number of employees at firm level
North- West	Dummy variable that equals 1 if the firm is localised in North-Western regions, 0 otherwise
North-East	Dummy variable that equals 1 if the firm is localised in North-Eastern regions, 0 otherwise
Centre	Dummy variable that equals 1 if the firm is localised in Central regions, 0 otherwise
South	Dummy variable that equals 1 if the firm is localised in Southern regions, 0 otherwise
Sectors	Dummy variable that equals 1 if the firm is localised in sector shown in table1, 0 otherwise

Source: RIL Survey, ISFOL

Table A.2 Effects of Performance Related Pay on Labour Productivity, Wages and TFP (IV Estimates, First Stage)

	All Firms		Unionised Firms	
Dependent Variable 2d Stage	ln (value added per capita)	ln (wage per capita)	ln (value added per capita)	ln (wage per capita)
Dependent variable 1st Stage	**Performance Related Pay**		**Performance Related Pay**	
Explanatory Variables	*a*	*b*	*c*	*d*
Sales Volatility 2002_2004	**0.023*** **	**0.019*** **	**0.024*** **	**0.023*** **
	(0.009)	(0.004)	(0.009)	(0.009)
Sales Volatility 1999_2001	**0.033*** **	**0.037*** **	**0.034*** **	**0.033*** **
	(0.010)	(0.004)	(0.010)	(0.010)
ln (physical capital per capita)	0.003	-0.002	0.004	0.003
	(0.009)	(0.003)	(0.009)	(0.009)
Fixed-term contracts_Share	0.052	-0.052	0.037	0.052
	(0.111)	(0.033)	(0.112)	(0.111)
White Collars_share	-0.316*	-0.134**	-0.309*	-0.316*
	(0.174)	(0.062)	(0.177)	(0.174)
Blue Collars_share	-0.273	-0.061	-0.264	-0.273
	(0.169)	(0.061)	(0.173)	(0.169)
Women_share	-0.193***	-0.100***	-0.188***	-0.193***
	(0.056)	(0.023)	(0.056)	(0.056)
Immigrants	-0.293*	-0.082**	-0.298*	-0.293*
	(0.103)	(0.038)	(0.102)	(0.103)
Firm's Age	0.002**	0.003***	0.002**	0.002**
	(0.001)	(0.000)	(0.001)	(0.001)
Process Innov.	0.050**	0.043***	0.052**	0.050**
	(0.025)	(0.011)	(0.025)	(0.025)
Product Innov.	0.022	0.018*	0.018	0.022
	(0.025)	(0.011)	(0.025)	(0.025)
Export	0.061**	0.033***	0.060**	0.061**
	(0.025)	(0.011)	(0.025)	(0.025)
Constant	-0.136	-0.517***	-0.161	-0.136
	(0.234)	(0.092)	(0.237)	(0.234)
Time Dummies	Yes	Yes	Yes	Yes
Sector Dummies	Yes	Yes	Yes	Yes
NUTS1_level Dummies	Yes	Yes	Yes	Yes
Obs	6579	6570	2340	2329

*** significant at 1% level; ** significant at 5% level; *significant at 10% level.