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PERFORMANCE PAY AND ENTERPRISE PRODUCTIVITY: The Details Matter*

By

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Abstract

Much of the empirical literature on PRP (Performance Related Pay) focuses on a question of whether the firm can increase firm performance in general and enterprise productivity in particular by introducing PRP and if so, how much. However, not all PRP programs are created equal and PRP programs vary significantly in a variety of attributes. This paper provides novel and rigorous evidence on the productivity effect of varying attributes of PRP and shows that the details of PRP indeed matter. In so doing we exploit the panel nature of our Finnish Linked Employer-Employee Data on the details of PRP. We first establish that the omitted variable bias is serious, makes the cross-sectional estimates on the productivity effect of the details of PRP biased upward substantially. Relying on the fixed effect estimates that account for such bias, we find: (i) group incentive PRP is more potent in boosting enterprise productivity than individual incentive PRP; (ii) group incentive PRP with profitability as a performance measure is especially powerful in raising firm productivity; (iii) when a narrow measure (such as cost reduction) is already used, adding another narrow measure (such as quality improvement) yields no additional productivity gain; and (iv) PRP with greater Power of Incentive (the share of PRP in total compensation) results in greater productivity gains yet returns to Power of Incentive diminishes very slowly.

JEL M52, J33, J24, J53, O53.

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PERFORMANCE PAY AND ENTERPRISE PRODUCTIVITY: The Details Matter

I. Introduction

Compensation systems have been shifting away rapidly from a fixed wage contractual payment basis in many nations around the world (Ben-Ner and Jones 1995) . Particularly prominent is the explosion in the use and interest in Performance Related Pay (PRP) (see, for instance, Lemieux et al. 2009, Bryson 2012.). There are two types of PRP, group incentive pay which ties pay to group performance and individual incentive pay which links pay to individual performance.

Group incentive pay is often called employee financial participation schemes which include profit sharing, employee stock ownership, stock option, and team incentive (or gainsharing) plans. With the rising use and interest in such employee financial participation schemes, many studies have examined their effects on enterprise performance in industrialized countries.[1] Most prior studies consider either Profit Sharing Plans (PSPs) in which at least part of the compensation for no executive employees is dependent on firm performance (typically profit)[2] or Employee Stock Ownership Plans (ESOPs) through which the firm forms an ESOP trust consisting of its non-executive employees and promotes ownership of its own shares by the trust.[3] Moreover, an increasing number of firms (in particular "New Economy" firms) are extending the use of Stock Option Plans (SOPs) to include non-executive employees in recent years.[4] Finally, with the rising popularity of "High Performance Workplace Practices (notably

[1] For a survey of the literature on financial participation schemes, see for instance Kruse (1997 on employee stock ownership and Jones, Kato and Pliskin (1997) on profit sharing, gain sharing/team incentives. For a Meta-analysis of the literature, see Doucouliagos (1995). For a more theoretical survey of the literature, see (Gibbons 1997, Prendergast 1999). For more recent works, see the shared capitalism literature (Bryson and Freeman 2008, Kruse et al. 2008).

[2] For detailed discussion on the definition of PSPs, see Kruse (1993) and Jones et al. (1997).

[3] See, for instance, Jones and Kato (1995), Blasi et al. (1996) and Kruse and Blasi (1997).

[4] See, for instance Sesil et al. (2002) and Conyon and Freeman (2004).

self-directed teams)", more firms are introducing TIPs (Team Incentive Plans) which makes at least part of the compensation for employees dependent on performance of the team or work group to which they belong.[5]

The literature on individual incentive pay is equally rich, including a variety of econometric case studies, field experiments, and laboratory experiments (see, for instance, Lazear 2000, Shearer 2004, Dohmen and Falk 2011).

One of the most frequently addressed questions in the literature is whether the introduction of PRP leads to an increase in enterprise productivity and if so, how much. By now we have a rich body of evidence on this question. However, there is a disproportionate dearth of evidence on whether various attributes of PRP or the details of PRP matter for its productivity effect. For instance, it is of great interest and importance to discern whether group incentive pay or individual incentive pay yields a greater enterprise productivity gain. As discussed below, neither the behavioral perspective nor the worker sorting perspective offers an unambiguous answer to the question. Hence it is an empirical matter. In short, we know a lot about whether the incidence of PRP matter for enterprise productivity yet we know very little about whether the details of PRP matter. It is this gaping hole in the literature that this paper tries to fill.

Though the literature on the productivity effect of the details of PRP is limited, there are a number of notable exceptions, such as Kruse (1993). Such exceptions are, however, subject to potentially serious bias due to unobserved firm heterogeneity that is correlated with PRP. Unlike the rich literature on the productivity effect of the incidence of PRP, panel data on the detail of PRP are seldom available. Our Finnish LEED (Linked Employer Employee Data) provide such unusual data and thereby allow us to provide fixed effect estimates on the productivity effect of PRP details which are relatively free from bias due to unobserved firm heterogeneity that is correlated with PRP. In fact, our analysis confirms that when estimating the productivity effect of PRP details, unobserved firm heterogeneity appears to be indeed correlated with PRP details, causing serious upward bias for the cross-sectional estimates (as opposed to the fixed effect estimates) on the productivity effect of PRP details.

The paper is organized as follows. In the next section, we describe the data in

[5] See, for example Hamilton et al. (2003), Jones and Kato (2011) and Jones et al. (2010)for teams and TIPs.

some detail. Section III provides the empirical strategy and presents the results. The concluding section follows.

II. Data

We combine several data sources. At the core of the dataset are three waves of the Confederation of Finnish Industries (EK) compensation surveys. EK is the central organization of employer associations and it has over 16,000 member firms, most of which are small and medium-sized enterprises. The member firms represent over 70% of the Finnish GDP and over 90% of exports. The survey has been carried out three times, 2005, 2008 and 2011. The sample size has varied from 2676 to 3204 firms and the response rates have been between 31% and 55%[6]. More details of the sample and respondents are given in the Appendix.

The survey deals mainly with the prevalence and characteristics of PRP systems. Each question concerning the PRP plans asks separate answers for blue-collars, clerical employees and white-collars. The top management, e.g., CEOs and equivalents, were not included in the survey. The survey allows us to characterize the PRP plans in terms of the performance measures, organizational levels of performance measurement, and coverage of the plans. For the productivity estimations we need measures of value added and capital, which are available from balance sheet data (Asiakastieto) that can be linked to the compensation surveys.

In the estimations we also control for the average level of education, work experience and tenure of the firms' employees. These data are available from EK's wage statistics. These data are a linked employer-employee data with a rich content of information about the employees (for more details see e.g. Kauhanen and Napari 2012a). We also control for foreign ownership, which was an important determinant of PRP in Finnish firms in the 1990s with influence even today. This information is linked from Statistics Finland's business register.

[6] The response rates are good for this type of survey. For example, in the European Company Survey, which considers inter alia payment systems, carried out by the European Foundation for the Improvement of Living and Working Conditions had a response rate of 42 % in its management interview module (Eurofound 2010) The survey used by Ittner and Larcker (2002)had a response rate of roughly 34%.

III. Econometric Specifications and Results

We begin with a standard dummy variable approach commonly used in the literature (see for instance, Jones and Kato (1995)). Specifically we estimate Cobb-Douglas production functions, augmented by a dummy variable capturing the productivity effect of the incidence of PRP:

(1) CS (Cross Section): $\ln Q_{it} = \beta_K \ln K_{it} + \beta_L \ln L_{it} + \beta_1 \text{incidence}_{it} + \boldsymbol{\beta_x X_{it}}$ + (year effects) + u_{it}

(2) FE (fixed effects): $\ln Q_{it} = \beta_K \ln K_{it} + \beta_L \ln L_{it} + \beta_1 \text{incidence}_{it} + \boldsymbol{\beta_x X_{it}}$

+ (firm specific fixed effects) + (year effects) + u_{it}

where Q_{it} is output of firm i in year t, measured by value added; K_{it} is the capital stock; L_{it} is labor; incidence_{it} is a dummy variable which takes the value of 1 if PRP is used for at least one employee group (blue-collar, white-collar, upper white-collar) in firm i in year t, and the value of zero otherwise; and β's are slope coefficients. In addition, our data allow for a set of other controls, $\boldsymbol{X_{it}}$. First, since we have employee-level data on every worker for each firm in our sample, unlike earlier works, we can add a set of time-varying control variables capturing labor force characteristics of firm i in year t (education, general labor market experience, and tenure). As shown in the summary statistics in Table 1, the average employee has about 12 years of formal education; 22 years of general labor market experience; and 10 years of tenure in the current firm. Second, we control for firm i's foreign ownership in year t by constructing a dummy variable indicating whether or not the firm is majority foreign-controlled in year t. Again, as shown in Table 1, twenty percent of firms is majority foreign-controlled.

Finally, we consider a set of industry dummy variables.[7] As a robustness check, we also consider translog production functions and find that our results change little when we consider translog production functions.[8] Furthermore, to account for possible endogeneity of labor input, we also consider a method proposed by Levinsohn and Petrin (2003)and simplified by Wooldridge (2009). Reassuringly there is no discernible change in the results.

The CS specification is subject to a well-known problem of unobserved firm

[7] Industry dummy variables are time-invariant and hence are dropped in our fixed effect estimations.

[8] These, and other, unreported regression results are available from the corresponding author at tkato@colgate.edu upon request.

heterogeneity that affects firm productivity as well as the firm's decision to introduce PRP. For instance, it is plausible that the firm with overall high-quality management is more likely to introduce a PRP scheme as an innovative and smart payment system. It is also quite plausible that overall high-quality management leads to higher enterprise productivity. Since we cannot reliably measure a variable such as high-quality management, the CS estimates are likely to be biased upward. A standard solution is the fixed effect (FE) estimation which controls for unobserved firm heterogeneity by exploiting the fact that much of unobserved firm heterogeneity tends to be stable over time.

Table 2 reports the CS and FE estimates of our baseline production function, Eq. (1) and Eq. (2). The estimated coefficients on incidence for both specifications are positive and statistically significant at the 1 percent level, pointing to the positive productivity effect of PRP. Furthermore, as expected, the estimated productivity effects are much larger for the CS specification than for the FE specification, suggesting that the CS estimation may be indeed biased upward due to the possibility that unobserved firm heterogeneity (such as managerial ability and corporate culture) is correlated with the use of PRP. When such unobserved firm heterogeneity is accounted for by fixed effects, the magnitude of the estimated productivity effect of PRP is about 9 percent which is quite plausible and comparable to what similar earlier studies found (e.g. Jones and Kato 1995 for Japan, Gielen et al. 2010 for Holland, Kato et al. 2010 for Korea).

Having established that the incidence of PRP is indeed positively correlated with productivity, conditional on a variety of covariates (including firm fixed effects), we now turn to the main question of the paper—Do the details of PRP matter? First, we explore the most frequently studied detail—the penetration of PRP (the proportion of the labor force covered by PRP or coverage). Table 3 summarizes the estimates of Eq. (1) and Eq. (2) with coverage used instead of incidence. As in the case of incidence, both CS and FE yield positive estimated coefficients on coverage that are significant at the 1 percent level, confirming prior studies pointing to the importance of coverage in the productivity effect of PRP (Jones and Kato 1993, Kruse 1993). The size of the estimated productivity effect of coverage in the FE specification is again plausible—a ten-percentage-point increase in coverage (which constitutes roughly a 20 percent increase in coverage for the average firm with 49 percent coverage) will lead to a one-percent increase in

productivity.

Note that the CS estimate on the coefficient on coverage turns out to be considerably larger than the FE estimate, again pointing to the substantial upward bias of the CS estimates due to unobserved firm heterogeneity that is positively correlated with coverage. As such, accounting for unobserved firm heterogeneity by using fixed effects is important when we study the productivity effect of incidence as well as that of coverage.

Our data are unusually rich in other details of PRP that have not been investigated by prior studies. Perhaps most importantly our data provide longitudinal information on the extent to which the firm's PRP is based on individual performance or group performance. Specifically our data enable us to create the following two variables: (i) group incentive is defined as the share of employees whose PRP plans are based on group performance only (not on individual performance); and (ii) individual incentive is defined as the share of employees whose PRP plans are based on at least individual performance (including PRP based on both individual and group performance). Reassuringly we find that there are comforting within-firm variations in individual incentive and group incentive over time, which allow for fixed effect estimations.

Individual incentive pay and group incentive pay have distinctly different implications for the effect on enterprise productivity of PRP. From the behavioral perspective, group incentive pay promotes teamwork and collaboration among workers, whereas individual incentive pay motivates workers to focus on their own effort and performance (sometimes even at the cost of teamwork). From the worker sorting perspective, individual incentive pay leads to positive worker sorting (high-productivity workers self-select into firms with such individual incentive pay and low-productivity workers self-select out). In contrast, group incentive pay results in negative worker sorting unless free-riding is effectively mediated. In other words, low-productivity workers are attracted to such firms with group incentive pay for the opportunity to free-ride on high-ability workers. High-productivity workers try to exit from such firms in order to avoid being free-ridden.

The results are summarized in Table 4. The discrepancy between the CS and FE estimates here is large, and not accounting for unobserved firm heterogeneity will result in a highly misleading conclusion. Thus, on the one hand, the estimated coefficients on group incentive and individual incentive in the CS specification without accounting for unobserved firm heterogeneity

are positive and statistically significant at the 1 percent level, indicating that both group incentive pay and individual incentive pay yield positive and significant productivity gains. On the other hand, for the FE specification which does account for such unobserved firm heterogeneity, the estimated coefficient on group incentive is positive and statistically significant at the 5 percent level yet the estimated coefficient on individual incentive is not at all significantly different from zero. It suggests that when the share of employees whose PRP plans are based on group performance only (or the proportion of employees under pure group incentive) rise by 10 percentage points, productivity will increase by 0.7 percent, while the same 10-percentage point increase in the proportion of employees whose PRP plans are based on at least individual incentive will lead to no significant productivity improvement. As such, when properly accounting for unobserved firm heterogeneity, our data suggests group incentive pay may be more potent in boosting enterprise productivity than individual incentive pay.

Not all group incentive pay is created equal. Some ties pay to profit (profit sharing), while some links pay to other measures such as cost savings. Thus, we create a dummy variable, profit share, which takes a value of one if the firm uses profitability as a performance measure for its PRP, zero otherwise, and other measures, which takes a value of one if the firm uses any other measure as a performance measure for its PRP, zero otherwise. Note that if profit share=1 and other measures=1, the firm uses profitability as well as any other measure, and that if profit share=0 and other measures=0, the firm does not use PRP.

As shown in Table 5, the estimated coefficients on both profit share and other measures are positive and statistically significant for both the CS and FE specifications. In our preferred FE specification that accounts for unobserved firm heterogeneity, the use of PRP with profitability as a performance measure is found to yield a 15-percent productivity gain, while the use of PRP with any other measure is found to lead to an increase in productivity by 7 percent, suggesting the advantage of the use of profitability as a performance measure in PRP over other performance measures. Note that in the CS specification that fails to account for unobserved heterogeneity, the estimated coefficient on other measures is found to be much larger and that the advantage of profit share over other measures is no longer evident. We interpret the rather sharp discrepancy between the FE and CS results as an indication of a large upward bias of the

productivity effect of PRP due to unobserved firm heterogeneity that is correlated with other measures.

The next set of variables are borrowed from Kauhanen and Napari (2012b), who classify PRP plans according to the number of measures used (one or multiple) and breadth of the performance measures (broad referring to profitability and narrow to other measures). *Narrow only* refers to PRP plans that use a single performance measure which is not profitability, *Broad only* refers to PRP plans where performance measurement is solely based on profitability, *Multiple narrow measures* is self-evident by now, and *Broad and narrow* refer to plans that have multiple measures and profitability is among them. In the data, the performance measures are given for each of the employee groups. To assign a firm to one of these categories we used the category of the upper white-collars for the whole firm if the upper-white collars had a PRP plan. The rationale for this was that cross tabulations show that the plans tend to be quite similar for the different employee groups according to this classification. If the upper-white collars did not have a plan, we used the category of the white collars, and if only blue-collar had a plan we naturally used their category.

The results are highlighted in Table 6. Our preferred FE specification that account for unobserved heterogeneity provides two noteworthy insights. First, the estimated coefficient on Multiple narrow measures is small and insignificant even at the 10 percent level, pointing to the rapidly diminishing returns to the use of narrow measures in PRP—adding another narrow performance measure to PRP that already links pay to a narrow performance measure will yield little additional productivity gain. Second, somewhat surprisingly the estimated coefficient on Combination of broad and narrow is not greater than the estimated coefficients on either Narrow only or Broad only. It follows that a mixing strategy that links pay to both profitability and any other measure is no more productivity-enhancing than a non-mixing strategy (use profitability only or any other measure only).

Finally most PRP plans specify maximum PRP payments as share of regular earnings. *The power of incentives* is measured as the maximum amount that PRP payments can be of the base salary. It is calculated as the weighted average of the three employee groups. We use this variable as a proxy for the power of incentives. The relationship between Power of Incentives and

productivity may be nonlinear, and thereby we consider Power of Incentives squared on top of Power of Incentive. Table 7 confirms that productivity gains from PRP are indeed greater when the power of incentives is stronger. The estimated coefficients on Power of Incentives squared are statistically significant yet very small, indicating that the relationship between Power of Incentives and productivity is only very mildly concave.

Also, again we find a sizable gap in the estimated coefficients on Power of Incentives between the CS specification and the FE specification, suggesting the presence of endogeneity bias caused by unobserved firm heterogeneity correlated with the power of incentive.

IV. Conclusions

Much of the empirical literature on PRP focuses on a question of whether the firm can increase firm performance in general and enterprise productivity in particular by introducing PRP and if so, how much. However, not all PRP programs are created equal and PRP programs vary significantly in various attributes. Do the details of PRP matter? Economic theory tends to suggest that they may. For instance, some PRP programs link pay to individual worker performance, while some tie worker compensation to group performance. Economic theory predicts that individual incentive PRP and group incentive PRP have different behavioral effects on workers and imply contrasting worker sorting outcomes. The empirical literature on PRP tends to be relatively silent on the question of whether the details of PRP matter, and a disproportionately small number of prior studies which address the question are often subject to potentially serious omitted variable bias due to likely correlations between unobserved firm heterogeneity and the details of PRP.

This paper has filled this important gap in the literature by providing novel and rigorous evidence on the productivity effect of varying attributes of PRP. Most notably we have been able to exploit the availability of panel data on the details of PRP and show not only the cross-sectional estimates that are subject to the aforementioned omitted variable bias but also the fixed-effect estimates that account for the omitted variable bias.

First, the comparison between the cross-sectional estimates and the fixed-effect estimates suggests that the omitted variable bias is indeed serious—making the cross-sectional estimates on the productivity effect of the details of PRP biased upward substantially. Second,

the fixed-effect estimates that account for the omitted variable bias show that the details of PRP matter indeed. Specifically, we have found that group incentive PRP is more potent in boosting enterprise productivity than individual incentive PRP. From the behavioral perspective, the result suggests that overall, collaboration and teamwork may play an important role in enhancing enterprise productivity in the workplace in many Finnish firms. From the worker sorting perspective, it implies that negative sorting caused by group incentive pay—high-productivity workers leave the firm with group incentive pay in order to avoid being free-ridden by low-productivity coworkers may be of limited relevance to many firms in Finland. Furthermore, we have found that group incentive PRP with profitability as a performance measure is especially powerful in raising firm productivity, pointing to the use of profit sharing as a particularly attractive option.

Our fixed effect estimates have also shed some new light on the value of using multiple performance measures in PRP. When a narrow measure (such as cost reduction) is already used, adding another narrow measure (such as quality improvement) has been found to yield no additional productivity gain. Furthermore, somewhat unexpectedly adding a broad measure (profitability) has been also found to have no productivity advantage.

Lastly, as expected, we have found that PRP with greater Power of Incentives (the share of PRP in total compensation) results in greater productivity gains, and that returns to Power of Incentive do not diminish rapidly.

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Table 1 Summary Statistics

Variable	Obs	Mean	Std. Dev.
log value added	1659	15.986	1.630
log capital	1659	14.540	2.498
log employment	1659	4.972	1.466
Mean experience (years)	1659	21.887	4.333
Mean tenure (years)	1659	10.393	5.230
Mean education (years)	1659	12.329	1.074
Foreign owned	1659	0.203	0.402
incidence	1659	0.704	0.457
coverage	1659	0.488	0.457
group incentive	1654	0.437	0.475
individual incentive	1659	0.217	0.388
profit measure	1659	0.084	0.277
other measures	1659	0.620	0.485
Narrow only	1556	0.029	0.168
Broad only	1556	0.107	0.309
Multiple narrow measures	1556	0.049	0.217
broad and narrow	1556	0.499	0.500
power of Incentive	1135	5.695	9.506

Sources: EK Compensation Survey and EK Linked Employer-Employee Data

Table 2 Productivity effects of PRP: Incidence

	(1)	(2)
VARIABLES	CS	FE
log capital	0.131***	0.069***
	(13.055)	(2.843)
log employment	0.866***	0.821***
	(65.868)	(12.106)
Incidence	0.189***	0.087**
	(6.782)	(2.239)
Observations	1,659	1,659
R-squared	0.933	0.538

Sources: EK Compensation Survey and EK Linked Employer-Employee Data
Notes: Robust t-statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 3 Productivity effects of PRP: coverage

	(1)	(2)
VARIABLES	CS	FE
log capital	0.127***	0.068***
	(12.672)	(2.878)
log employment	0.877***	0.821***
	(68.565)	(12.083)
coverage	0.172***	0.110***
	(6.169)	(2.934)
Observations	1,659	1,659
R-squared	0.933	0.540

Sources: EK Compensation Survey and EK Linked Employer-Employee Data
Notes: Robust t-statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 4 Productivity effects of PRP: group vs. individual

	(1)	(2)
VARIABLES	CS	FE
log capital	0.132***	0.072***
	(13.158)	(2.966)
log employment	0.865***	0.824***
	(64.732)	(12.115)
group incentive	0.145***	0.074**
	(5.254)	(2.011)
individual incentive	0.209***	-0.004
	(5.468)	(-0.081)
Observations	1,654	1,654
R-squared	0.933	0.538

Sources: EK Compensation Survey and EK Linked Employer-Employee Data
Notes: Robust t-statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 5 Productivity effects of PRP: profit sharing vs. others

	(1)	(2)
VARIABLES	CS	FE
log capital	0.131***	0.070***
	(13.078)	(2.909)
log employment	0.865***	0.814***
	(65.640)	(12.066)
profit share	0.151***	0.145**
	(3.631)	(2.559)
other measures	0.196***	0.074*
	(6.857)	(1.825)
Observations	1,659	1,659
R-squared	0.933	0.540

Sources: EK Compensation Survey and EK Linked Employer-Employee Data
Notes: Robust t-statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 6 Productivity effects of PRP: Broad vs. Narrow

	(1)	(2)
VARIABLES	CS	FE
log capital	0.133***	0.076***
	(13.028)	(3.219)
log employment	0.855***	0.820***
	(62.024)	(11.983)
Narrow only	0.120*	0.137**
	(1.936)	(2.115)
Broad only	0.143***	0.159***
	(3.825)	(2.671)
Multiple narrow measures	0.196***	0.010
	(2.596)	(0.075)
Combination of broad and narrow	0.219***	0.103**
	(7.073)	(2.005)
Observations	1,556	1,556
R-squared	0.934	0.562

Sources: EK Compensation Survey and EK Linked Employer-Employee Data
Notes: Robust t-statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 7 Productivity effects of PRP: Power of Incentive

VARIABLES	(1) CS	(2) FE
log capital	0.132***	0.084**
	(10.750)	(2.166)
log employment	0.876***	0.788***
	(55.331)	(6.594)
Power of incentive	0.018***	0.009*
	(6.780)	(1.673)
Power of incentive^2	-0.000***	-0.000**
	(-6.100)	(-2.046)
Observations	1,135	1,135
R-squared	0.938	0.484

Sources: EK Compensation Survey and EK Linked Employer-Employee Data
Notes: Robust t-statistics in parentheses
*** p<0.01, ** p<0.05, * p<0.1