Performance-related pay and firm performance in Finland

Hannu Piekkola
The Research Institute of the Finnish Economy, Helsinki, Finland

Abstract

Purpose – To analyse productivity effects of performance-related pay (PRP).

Design/methodology/approach – Fixed effect analysis of the productivity effects of the introduction of PRP scheme using linked employer-employee data from Finland in 1996-2002 and controlling for the skill structure of the employees.

Findings – PRP improves both productivity and profitability by the same magnitude of around 6 per cent, but only if the compensations are substantial enough and exceeding on average 3.6 per cent of salaries for those who receive it. Incentive effects relate to the introduction of PRP, usually accompanied by new human resource management. PRP in Finland cannot, however, be directly linked to an increase in participation of employees in decision-making. PRP schemes have substantially improved firm performance without creating much wage pressures.

Practical implications – Useful information for the implementation and design of incentive-based wage schemes.

Originality/value – Very few papers using large data sets have information on exact PRP payments that are separate from bonus pay or piece wages.

Keywords Performance related pay, Company profit sharing schemes, Company performance, Finland

Paper type Research paper

1. Introduction

Performance-related pay (PRP) has become increasingly popular in Finland since the late-1990s. This can be explained by the rapid and substantial change in the business environment of firms. Ruigrok *et al.* (1999) find that changes in the business environment in Northern Europe have caused corporate restructuring that has led to organisational delayering and the decentralisation of strategic and operational decision-making. Whitfield and Poole (1997) argue that the new way of organising employment not only includes team-working and employee involvement in decision-making but also contingency pay. On the financial side, the business system in Finland has experienced a transition from a credit-based to a capital-market-based financial system and the liberalisation of foreign ownership in 1993. The domestic market is open to more intense foreign competition as a result of EU membership in 1995. All these changes have influenced corporate governance and the incentive schemes used.

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This paper studies PRP in the Finnish labour market in 1996-2002 using detailed data on employees in manufacturing from the Confederation of Finnish Industry and Employers that have been linked to the financial statements of the respective firms. PRP keenly relates to new human resource management (HRM), which has large impact on employer-employee work relations (Ichniowski and Shaw, 2003). PRPs in Finland are also by definition tied more or less to the economic performance of individual/unit/firm. PRP has become a prominent part of firm-level wage determination in the Finnish system of highly centralized wage negotiations[1]. The PRP scheme system is also well defined since in other countries the new kinds of PRPs often also cover bonus pays not tied to economic performance (e.g. in Sweden).

There are at least three reasons for using PRP. Kruse (1996) considers PRP as a way to align the incentives of employees and employers when output is difficult to measure or ascribe to an individual. This is more typical for highly educated and for R&D employees with complex tasks difficult to supervise. Piekkola and Kauhanen (2003) examine, in a linked employer-employee data rent sharing as one component of firm-level compensation, which is determined by quasi rents. It is also shown by use of this approach that skilled workers are the main targets of rent sharing.

Under capital-intensive production technology, aligning company and employee interests is important, as the misuse of capital is a concern. Firm size can also increase monitoring costs. However, it is well-known that group incentives do not necessarily work well in large organisations owing to free rider effects (Kandel and Lazear, 1992). Reorganisation of work may thus be needed ensuring horizontal monitoring (FitzRoy and Kraft 1987) or peer pressure (Kandel and Lazear 1992).

The desire to have some stability in the workforce participating in PRP is also an argument for its use. Chelius and Smith (1990) find evidence that those employees whose compensation is partly in the form of PRP experience higher employment stability. However, their results are only marginally significant. Kraft (1991) finds that PRP decreases the dismissals made by firms. The data presented in Azfar and Danninger (2001, Figure 1 on p. 624) support the view that separations and quits are lower in profit sharing firms especially when tenure is seven years or more. The job mobility of younger employees, on the other hand, remains high.

The introduction of PRP is usually associated with other reforms in firm-level wage setting and HRM. Firms with new HRM are less hierarchical. Conyon *et al.* (2001) argue that there is greater need to use PRP since employees are less motivated by the chance of a promotion. We believe that the productivity effects are linked to the simultaneous adoption of new management or personnel policy. Firms should benefit from simultaneous reorganisation of labour and team work under PRP.

Some of the productivity effects may also relate to co-operation between employees and employers. Conte and Svejnar (1988) find that the productivity effect of PRP might be linked to employee participation in decision-making. After controlling for this factor, the productivity effects of PRP that they find disappear. Doucouliagos' (1995) findings, which are based on numerous studies, support this view. In Finland the employers are, however, relatively free to set the targets of PRP, according to a recent survey (Alho *et al.* 2003). Employees did not participate at all in the setting of profit-sharing objectives in 29 per cent of firms and they were only entitled to give a non-binding opinion on the profit-sharing scheme in 35 per cent of firms. Profit sharing was agreed together only in 14 per cent of firms. The non-involvement of employees is

also accepted by labour unions when profit-sharing is mainly based on profit targets, as in half of the firms with a profit-sharing scheme.

Thus PRP schemes may rather be advocated on the grounds giving employers more self-determination in wage policies. There is strong demand, especially among Finnish employers, for boosting the role of locally flexible elements in the Finnish wage bargaining system (for evidence for the desire for local bargaining and description of Finnish bargaining system, see Heikkilä and Piekkola, 2005). In Finland the union participation rate is also close to 90 per cent and firms do not largely differ in this respect. Finnish labour market is highly organised covering manufacturing, private services, local and regional government and the State. Wages are centrally negotiated, although increasing share of contract wages encompass also firm-level decision-making.

We consider the introduction of PRP scheme as once and for all change also in order to tackle the problem of endogeneity of PRP. We use here information both by the level of PRP and the productivity before and after the implementation of the scheme. The novelty of the data is that it also includes information on the total amount paid and we can set some minimum threshold level for PRP to have incentive effects. Marsden and Richardson (1992) and Harris (2001) also report survey results showing that the size of compensation is a critical factor and incentive effects are decreased if PRP forms only a small proportion of the total compensation, i.e. are in place but only to a low degree implemented. In the studies comparing productivity before and after implementation, PRP has been show to be positively related to productivity as for many other studies (Bhargava, 1994; Conyon and Freeman, 2001; Blasi *et al.*, 1996). Two studies from France and Italy have also information on firms observed before they adopt the schemes and find that in both countries profit-sharing firms are more productive than non-profit-sharing firms once the schemes are in place (Estrin *et al.*, 1999; Biagioli and Curatolo, 1999). The main results here are that the introduction of PRP as part of firm's new HRM increases productivity and profitability if the compensations are high enough. The simultaneous smaller positive wage effects can explain the wide acceptance for its adoption by both employers and employees.

The paper is organized as follows. Section 2 provides a description of the data and the methods used. Section 3 first briefly looks into the reasons for the use of profit-sharing adoption. Section 4 examines the effects of PRP on wages, productivity and financial performance. Section 5 concludes.

2. Data

We use data on individual employees from the Confederation of Finnish Industry and Employers in 1996-2002 linked to the financial data of the respective firm. Member firms of the Confederation cover around 420,000 employees, which is nearly one-third of the employment in private sector in Finland. The manufacturing sector is entirely and construction sector largely covered, while 25 per cent of firms and employees are from non-manufacturing industries. Data enable calculation of hourly wages based on hours worked. Manufacturing sector can be considered as forerunner in the implementation of PRP. Non-manufacturing private service sector and public sector have followed in the implementation of new incentive-based schemes. The data include information on actual PRP, separately reported in all firms since 1996. Profit sharing based mainly on the firms accounting profits and decided on annual meeting of shareholders are separately reported and excluded here. PRP schemes are not

supported by the government with any tax incentives. Data is explained in greater detail including the summary statistics in the appendix. Now we turn to summary figures of the extent of PRP shown in Table I.

Table I shows that the share of firms paying profit shares has substantially increased in recent years. In 2002, 28 per cent of the firms applied it and 31 per cent of the employees received profit shares. Table I shows that only 17 per cent of the employees in smaller firms with fewer than 150 employees enter the scheme, compared with nearly 35 per cent in firms with over 150 employees.

It is seen from the row indicated by the share of blue-collar employees that about 14 per cent of the blue-collar workers do actually obtain PRP in firms where the scheme is applied. The comparable figure for white-collar employees has risen from 23 to 32 per cent. PRP also varies largely over industries, although the industries have been converging. The construction sector exhibits a smaller share of companies with PRP, but has been catching up with the other industries. IT sector (includes manufacturing and business services) have the most companies with PRP scheme. The need for group incentives in this industry can be associated with the most extensive evolution of skill-biased technical change, e.g. related to computer use (Autor *et al.*, 1998).

The logit models are used to describe the probability of PRP as a function of the independent variables. This is given formally in equation (1).

$$Pr\{y_{it} = 1\} = F(\beta' x_{it}), \tag{1}$$

where

$$F = \frac{e^{\beta' x_{it}}}{1 + e^{\beta' x_{it}}}.$$

The estimated function is non-linear and thus the maximum likelihood estimation is used. In F β is a vector of the coefficients to be estimated and x is a vector of

	1996	1998	2000	2002	Average
Employees (per cent)	*22.3*	*30.9*	*33.0*	*37.7*	*31.0*
Vocational or lower (per cent)	21.0	28.9	30.8	34.5	28.8
Vocational college or higher (per cent)	31.7	44.1	48.0	57.7	45.4
Firm size<150 (per cent)	12.3	18.1	17.4	18.8	16.6
150<firm size (per cent)	24.5	33.4	37.3	43.7	34.7
Observations	340,535	374,591	422,706	415,954	388,447
Firms (per cent)	*23.1*	*29.7*	*28.9*	*30.1*	*27.9*
Share of blue-collar (per cent)	8.8	17.6	18.6	10.8	13.9
Share of white-collar (per cent)	22.9	31.5	33.8	39.0	31.8
Manufacturing (per cent)	25.5	33.7	36.2	35.6	32.7
IT sector (per cent)	36.4	52.0	48.7	46.3	45.8
Construction (per cent)	9.2	16.9	18.8	21.9	16.7
Business services (per cent)	40.0	12.5	46.7	20.0	29.8
Observations	1,114	1,255	1,826	1,693	1,472

Table I.
Share of employees with PRP

Note: The average share of employees with PRP is somewhat larger 36 per cent instead of 31 per cent in the data linked to financial statements of firms and used in the subsequent analysis with 639,113 fewer observations mainly from small firms

independent variables. As the data have a time dimension, the standard errors are corrected for dependence within individuals. In the estimation of earnings, productivity and performance effects we rely especially on estimates using the fixed effects models as given in equation (2).

$$z_{it} = \beta x_{it} + \upsilon_i + \varepsilon_{it}, \tag{2}$$

where in addition to the notation introduced previously, z_{it} is earnings for individual i or productivity or performance for firm i, ε_{it} is a classical error term and υ_i is the individual/firm effect. In the fixed effects model the individual/firm effect is allowed to be correlated with the regressors, whereas in the random effects model, it is not. Many of the explanatory factors such as profitability may be linked to some variables unobservable to us, creating an omitted variables bias. These variables might include managerial talent and other organisational issues. These effects can also be controlled for, to the extent that they are time-invariant, by using fixed-effects panel regression. The variables that tend to be quite stable might be better estimated through the random effects model, which also takes the cross-section nature of the data into account. For these variables measurement error might also be a large component of the variation (Johnston and DiNardo 1997, pp. 391-401).

The major difficulty in the analysis is the possible endogeneity of the profit-sharing variables. This follows from two sources: first, there might be selection, and second, our data do not reveal whether a firm has a profit-sharing plan, but they reveal whether they have paid profit shares. The figures of the share of firms paying profit shares in Table I are indeed lower than the share of the firms with a profit-sharing plan in the survey conducted by the Confederation of Finnish Industry and Employers (2001, 2002) (54 per cent in 1998 and 62 per cent in 2001). Thus, they are likely to be companies that have a PRP (profit-sharing) plan but have not paid profit shares, probably because the goals have not been met. To tackle the problem of endogeneity arising from the data issue we construct a new variable as follows: the profit-sharing dummy is set to unity for all the years after it has first been observed to be unity. The introduction of profit sharing is often part of new HRM. Hence, part of the productivity effects can also be explained by other changes in HRM. Profit-sharing schemes are also not abandoned very often. In this way we can decrease the bias arising from the fact that zero PRP some year may be an indicator of bad performance.

We also use the information on the magnitude of the profit shares paid out. The variable used is the mean of the profit share payments divided by the mean of the base wage over all employees (if any profit share is paid). Thus this variable captures both the magnitude of profit-sharing payments and the extent of their use in firms with profit shares. The 25 per cent of the firms with lowest PRP have the average profit share payments below 0.6 per cent of the average wage level. Such casual profit shares may be insufficient to change managerial behaviour. Thus our preferred profit-sharing dummy is one which is set to unity only after the total PRP has hit the level of 0.6 per cent of the total wage bill (for those who receive profit share the average PRP is then 3.6 per cent of the wage bill). We also report comparative results when this restriction is not made.

3. The determinants of PRP

The dependent variable in the logit model, the PRP dummy in year t, is based on the profit shares paid out in the year $t + 1$. This is because the profit shares are generally

paid out once a year at the beginning of the year based on the profits of the previous year. The decision to use PRP has thus actually been made in the previous year (modelling this way also reduced the endogeneity of the PRP). The fixed effect method uses about 13.5 per cent of the sample, where the PRP dummy variable changes over time, which is 76,725 out of 564,688 person-year observations with no PRP at first year in data, firm uses PRP at the first observation year in 520,636 person-year observations. It is noteworthy that firms are not on average more profitable after the implementation of PRP scheme using the 0.6 per cent criterion (or even less profitable if no restriction on the level of PRP is made). Thus, fixed effects estimates that control firm effects are most reliable, since on average increased profitability cannot explain the introduction of PRP. On the other hand, on average, profits per employee are 60,000 euros for firms with PRP and double higher than for firms not using PRP.

Admittedly, conditional logit relies heavily on the distribution for identification. However, the random effects models were not numerically stable so they cannot be used. The analysis includes estimation of the share of the profit-sharing payments in relation to the base wage. This is estimated using the Tobit model because of the large share of zeros (Maddala, 1983, Chapter 6). The results of the regressions explaining the incidence of PRP are shown in Table II. The number of observations is quite large and thus the confidence level is fixed at 0.1 per cent.

It is seen from the first and second columns that the explanatory factors for substantial PRP (second column) or for any PRP (first column) are similar. Profit shares relative to average earnings are explained in the last column. The average profit share is 4.4 per cent of the annual income and 3.2 per cent for blue-collar and 5.4 per cent for white-collar workers (for those who receive it). It is seen that the share is higher for the highly educated also after controls. These figures are consistent with the survey of the Confederation of Finnish Industry and Employers (2001).

We argued earlier that PRP relates to the use of skilled workforce especially when it is difficult to measure or ascribe output to individuals. From earlier Table I, it was seen that 45.4 per cent of employees with skills obtained through vocational college or higher education are covered by the PRP scheme. The last column in Table II shows that PRP is more extensive for white-collar workers and for the highly educated. Firms with a higher share of educated workers in the firm (not necessarily with higher share of white collar workers) have a greater likelihood of PRP, and the profit share is higher (last column). The employee R&D dummy and the firm R&D dummy have instead a negative effect (R&D dummy equals one when the share of white-collar workers in R&D-related work exceeds 5 per cent of all employees). This is largely explained by this effect being captured by the inclusion of dummy for IT industry. From Table I PRPs are much more common than in other industries (after controls PRPs are 198 per cent more common than in the reference industries: mineral, food, textile and clothing, not reported).

The difference between the 80 and 20th percentiles of regular hourly earnings is used as a proxy for the possibilities of promotion in a given firm. Firms with a larger wage variation measured in this way exhibit a more hierarchical structure. It is seen that the specifications here do not support the hypothesis of substitution PRP for hierarchical payments, since large wage variance increases the likelihood of PRP.

PRP may also improve firm performance by increasing job stability. Churning is equal to separations when jobs are created and to hirings when jobs are lost. It is thus a measure of excess worker mobility. It is seen that the excess mobility of the blue-collar

Table II.
Estimates of the determinants of PRP

Variable	Logit Coefficient	Logit SE	Logit PRP/wage bill > 0.6 per cent Coefficient	Logit PRP/wage bill > 0.6 per cent SE	Tobit PRP/salary Coefficient	Tobit PRP/salary SE
Within firm 80th-20th wage	0.521	(0.004)*	0.572	(0.004)*	0.226	(0.003)*
Hourly wage	2.149	(0.026)*	2.092	(0.026)*		
Seniority^2 (years)/100	0.198	(0.004)*	0.172	(0.005)*	0.112	(0.001)*
Vocational and voc. college					0.294	(0.017)*
University degree					0.107	(0.018)*
White-collar worker	2.361	(0.045)*	2.439	(0.047)*	3.350	(0.016)*
R&D related work	−0.142	(0.029)*	−0.173	(0.029)*	−0.541	(0.02)*
Share of white-collar workers	−3.147	(0.071)*	−2.745	(0.074)*	−5.158	(0.035)*
Mean seniority (years)	0.148	(0.002)*	0.113	(0.002)*	0.115	(0.001)*
Firm R&D dummy	−0.274	(0.02)*	−0.090	(0.02)*	0.643	(0.018)*
Share of highly educated	1.298	(0.026)*	1.090	(0.027)*	1.923	(0.012)*
Churning low educated	−0.959	(0.047)*	−0.954	(0.047)*	−2.143	(0.055)*
Churning highly educated	1.846	(0.067)*	1.512	(0.067)*	2.485	(0.077)*
Capital intensity	0.288	(0.008)*	0.199	(0.008)*	0.099	(0.004)*
Net profits per capita[a]	0.046	(0.0000002)*	0.078	(0.0000002)*	0.061	(0.0000001)*
Equity ratio fair	0.043	(0.018)	0.067	(0.017)*	−0.980	(0.017)*
Equity ratio good	0.071	(0.02)*	0.257	(0.02)*	−0.451	(0.017)*
150 < firm size < 700	0.543	(0.027)*	0.659	(0.027)*	1.233	(0.018)*
Firm size > 700	1.560	(0.03)*	1.682	(0.031)*	1.857	(0.017)*
No. observations	542,683		530,390		2,031,294	
LR χ^2/DF	114,910	22	112,370	22	323,238	23
Predicted right per cent/pseudo R^2	45.1		41.0		0.06	

Notes: [a]in €10,000; the dependent variable is the individual profit sharing dummy at date t-based on actual payments at date t+1 (respectively, for the profit share/wage in the last column). This is set to one after first observed in the firm. In second column profit-sharing dummy is set to one only after the total PRP of those who receive it has hit the level of 0.6 per cent of the total wage bill for all. Regressions include five industry dummies. The base for employment size is plants with fewer than 150 employees; *significant at 99.9 per cent confidence level

workforce decreases the probability of PRP. It is also seen that long-term employment relations as indicated by seniority squared are positively related to the adoption of PRP. Our results suggest that especially the stability of the low-educated workforce is an important reason for the adoption of profit sharing for blue-collar workers. PRPs appear to be instead popular in firms, where white-collar workforce has high level of churning.

4. The wage and firm performance effects

The productivity effects and the required risk premium when employees' earnings are more risky may affect the wage level. The wage estimations include a fixed effects model. Fixed effects are analysed separately for each person-firm relation thus ignoring the effects of job switches. Only coefficients related to PRP are shown, while other explanatory variables used are the same as in Table II.

The effect of PRP on average hourly wages (which include all non-regular pay such as PRP) is significant but not very large (Table III). Booth and Frank (1999) explain that the wage effect describes the productivity effect, net of monitoring costs. The fixed effect estimation shows that the earnings of employees receiving PRP are, on average, 4.1 per cent higher than those not receiving it in firms that have paid profit shares. Without controls: the share of educated, the share of white-collar workers and R&D-related workers and churning, the wage effect would be 7 per cent for substantial profit-sharing. The wage effects are not far away from those obtained by Booth and Frank (1999), who studied PRP using survey data, and Lazear (2000), who used plant data. Booth and Frank's results show that PRP increases wages by 9 per cent for men and 6 per cent for women (we find only a small difference between genders, which is not reported) and Lazear finds a 9 per cent increase in wages following the adoption of a PRP scheme. It is then interesting to investigate how PRP affects productivity at the firm level. The translog equation estimated in the productivity analysis is:

$$\ln(\mathrm{VA}_{it}) = \alpha_1 + \beta_1 k_{it} + \beta_2 l_{it} + \beta_3 k_{it}^2 + \beta_4 l_{it}^2 + \beta_5 k_{it} * l_{it} + \boldsymbol{\gamma x} + \varphi \mathrm{PS}_{it} + \upsilon_i + \varepsilon_{it}, \quad (3)$$

where VA_{it} is value added, K_{it} is natural logarithm of capital, l_{it} is natural logarithm of average employment and the vector $\mathbf{x}$ contains variables controlling for the composition of the workforce and other firm characteristics and PS_{it} is the profit-sharing dummy. We are able to control for all the major characteristics of the employment structure. These include the share of highly educated workers, average tenure, R&D-related work and the wage hierarchy, captured by the difference in the earnings level between the 8th and 2nd deciles.

Endogeneity is also analysed by the use of instrumental variable estimation, where variables relevant in personnel policy are used as instruments. The lagged value of profits per capital and profit share per salary are our primary instruments, whereas the lagged value of turnover did not pass the test of over-identifying restriction of Davidson and MacKinnon (1993). It was discussed before that PRP where complements rather than substitutes for hierarchical payments. We include lagged values of wage dispersion (firm 80th-20th log wage) in the instruments. Profit share per capital is also interacted with the share of white-collar workers and wage dispersion. Instruments pass the test of over-identifying restriction test (Sargan test has p-value 0.5721.)[2]. Table IV shows the productivity effects of PRP using equation (3). The dependent variable is the natural logarithm of the value added.

Table III. Hourly wage effects of PRP

Fixed effects Variable	Coefficient	SE	Coefficient	SE	Blue-collar Coefficient	SE	White-collar Coefficient	SE
PRP dummy	0.041	(0.001)*						
PRP dummy (PRP/wage bill > 0.6 per cent)			0.040	(0.001)*				
PRP dummy white-collar (PRP/wage bill > 1.2 per cent)					0.048	(0.001)*		
PRP dummy blue-collar (PRP/wage bill > 0.5 per cent)							0.035	(0.0004)*
No. observations/groups	1,486,620	458,498	1,486,620	458,498	837,355	260,464	648,995	202,054
R^2: overall	0.13		0.13		0.16		0.01	

Notes: The dependent variable is the average hourly wage that includes all taxable compensations per actual working time. The table reports coefficients and standard errors; *meaning significance at 99.9 per cent confidence level. Explanatory variables are the same as in Table II including five industry dummies

Table IV.
Productivity effects of PRP

Variable	Fixed effects Coefficient	SE	Fixed effects Coefficient	SE	Fixed effects Coefficient	SE	IV Fixed effects Coefficient	SE	Random effects Coefficient	SE
Firm PRP dummy	0.024	(0.016)								
Firm PRP dummy (PRP/wage bill > 0.6 per cent)			0.062	(0.017)***			0.065	(0.019)***	0.121	(0.014)***
Firm PRP dummy white-collar (PRP/wage bill > 1.2 per cent)					0.036	(0.017)**				
Firm PRP dummy blue-collar (PRP/wage bill > 0.5 per cent)					0.036	(0.019)*				
Log capital	−0.124	(0.062)**	−0.134	(0.062)**	−0.166	(0.065)**	−0.066	(0.074)	−0.374	(0.041)***
Log average employment	0.844	(0.082)***	0.851	(0.083)***	0.878	(0.091)***	0.756	(0.094)***	1.495	(0.051)***
Log capital^2	0.017	(0.003)***	0.018	(0.003)***	0.018	(0.003)***	0.013	(0.003)***	0.032	(0.002)***
Log average employment^2	0.072	(0.007)***	0.072	(0.007)***	0.059	(0.009)***	0.059	(0.009)***	0.056	(0.005)***
Log capital *log average employment	−0.062	(0.008)***	−0.063	(0.008)***	−0.055	(0.009)***	−0.050	(0.009)***	−0.083	(0.006)***
Within firm 80th-20th wage	0.006	(0.002)***	0.006	(0.002)***	0.006	(0.002)***	0.005	(0.003)*	0.012	(0.002)***
Share of female	0.040	(0.061)	0.044	(0.061)	0.031	(0.063)	0.056	(0.071)	−0.094	(0.037)**
Share of highly educated	0.007	(0.015)	0.009	(0.015)	0.003	(0.015)	0.004	(0.017)	0.057	(0.011)***
Share of white-collar	−0.017	(0.039)	−0.020	(0.039)	−0.002	(0.04)	0.008	(0.045)	−0.028	(0.031)
Firm R&D dummy	−0.009	(0.018)	−0.010	(0.018)	−0.017	(0.019)	−0.034	(0.018)*	−0.003	(0.016)
No. observations/groups	7,290	1,709	7,220	1,709	6,974	1,707	5,667	1,511	7,220	1,709
R^2: overall	0.924		0.925		0.929		0.928		0.938	

Notes: The table reports coefficients and standard errors with year dummies. The dependent variable is logarithmic value added and random effects estimations include industry dummies. Instruments include lagged values of profits per capita, wage dispersion, profit shares per capita and interaction of profit shares per capital with share of white collar workers and wage dispersion; *significant at 90 per cent confidence level; **significant at 95 per cent confidence level; ***significant at 99 per cent confidence level

We would expect that the production function is increasing and that the isoquants are convex, i.e. the function is quasi-concave. All the estimated functions satisfy these conditions when evaluated at sample means. Table IV shows that PRP increases productivity, but not necessarily when it is not substantial enough. Using the fixed effects estimation the first column shows no statistically significant productivity effects when the firm is classified as paying profit share even when profit shares are a very small proportion of the total compensations. However, if we concentrate on the 75 per cent of the profit-sharing firms where total profit shares paid in subsequent year exceeded 0.6 per cent of the total wage bill we get positive productivity effects. The effects are reasonable, being around 6 per cent. Thus, the critical point is whether compensations are very small or not. We also report productivity effect when the introduction of PRP is instrumented in column 4, see discussion above. It is seen that the productivity effect is close the same as using no instrumenting. Finally, we also report random effect estimation in last column. Productivity effects are in line with previous studies (Conte and Svejnar, 1988; FitzRoy and Kraft, 1987; Kruse, 1992; Uusitalo, 2002) for Finnish data, but exceeds the results obtained here by using the fixed effect estimation.

The compensations for general human capital of individual worker or the wage effects are also lower than productivity effects. The average wage effects in the sample of firms used in productivity analysis is lower of around 2 per cent (using firm-average values of variables in Table II, not reported).

Looking into other significant explanatory variables it seems that wage dispersion within the firm has a positive effect on productivity. Lazear (2000) similarly finds that variable pay increases productivity and wage dispersion. It seems that the composition of the workforce such as the share of female, the share of highly educated and the share of white-collar workers does not affect productivity. One explanation is relatively low variation. In the random effects estimation the productivity effects are positive. The impact of R&D activity on productivity also seems to be insignificant. Finally, the coefficient of capital is not reasonable given that it is negative (also in random effects estimation). In general, the low coefficient on capital intensity might be due to the measurement error in the variable. It is not rare to find such low values for the coefficient of capital (Griliches and Regev, 1995).

Following table analyses operating income effects. The firm performance effects are also assessed by the return on assets. The arbitrary values are omitted by dropping 5 per cent of the firm-year observations with lowest and highest values of return on asset. Moreover, market value effects are assessed in firms listed on the Helsinki Stock Exchange. Market values per net profits yield the price-earnings ratio (PE). The PE exceeds 100 in almost 25 per cent of the cases, which is explained by the very low value of net profits. The estimations exclude these observations, where PE would fluctuate arbitrarily. Only the profit-sharing variables are reported. Table V shows the results.

Let us first look at the effects on the return on assets and earnings. The firm PRP dummy shows the effect of PRP on financial performance. It is seen that firms with PRP (in the 75 per cent of firms on average exceeding 0.6 per cent of the wage bill) have approximately 1.8 per cent-points higher return on assets and 6.7 per cent-points higher operating profits. The lower panel of Table V reports the PE and productivity effects (in the same firms). As discussed, these are only assessed for firm-years with a

Table V.
Return on Assets, profits and market value effects of PRP

Fixed effects Variable	Coefficient	SE	Return on asset (ROA) Coefficient	SE	Coefficient	SE
Firm PRP dummy	0.924	(0.6)				
Firm PRP dummy (PRP/wage bill > 0.6 per cent)			1.837	(0.619)***		
Firm PRP dummy white-collar (PRP/wage bill > 1.2 per cent)					2.284	(0.665)***
Firm PRP dummy blue-collar (PRP/wage bill > 0.5 per cent)					0.781	(0.736)
No. observations	6,220		6,155		5,941	
R^2	0.012		0.013		0.013	
			Log operating revenues			
Firm PRP dummy	0.053	(0.051)				
Firm PRP dummy (PRP/wage bill > 0.6 per cent)			0.067	(0.052)		
Firm PRP dummy white-collar (PRP/wage bill > 1.2 per cent)					0.109	(0.054)**
Firm PRP dummy blue-collar (PRP/wage bill > 0.5 per cent)					0.090	(0.061)
No. observations	6,364		6,305		6,105	
R^2	0.547		0.552		0.574	
			Market value per net profits (PE) if PE < 100			
Firm PRP dummy	0.008	(0.023)				
Firm PRP dummy (PRP/wage bill > 0.6 per cent)			−0.011	(0.023)		
Firm PRP dummy white-collar (PRP/wage bill > 1.2 per cent)					−0.036	(0.023)
Firm PRP dummy blue-collar (PRP/wage bill > 0.5 per cent)					−0.013	(0.023)
Foreign ownership per cent	0.000	(0.001)	0.000	(0.001)	0.000	(0.001)
No. observations	114		114		114	
R^2	0.008		0.010		0.043	

Notes: Explanatory variables are the same as in Table IV including year dummies and in price-earning (PE) estimation also including the share of stocks owned by foreigners. In ROA 5 per cent of observations with lowest and highest values are dropped; *significant at 90 per cent confidence level; **significant at 95 per cent confidence level; ***significant at 99 per cent confidence level

positive PE value below 100, reducing the number of observations from 143 to around 100 or below. It is seen from Table V that we do not find PRP to increase the PE.

5. Conclusions

Following earlier results the use of PRP can be explained by incentive effects and by the aims to decrease the mobility of workers. Such firms are likely to be characterised by use of skilled workers and are large and typically located in IT-industry. White-collar workers receive substantially higher share of the profit share compared to wages. Productivity effects are not lower for blue-collar workers, when it has been seen desirable to extent PRP to cover all workers by its popularity in firms with long tenures and low churning.

It is shown that PRP raises productivity and profitability to the same degree of around 6 per cent, but only if high enough. Introduction of PRP schemes have statistically significant effect on productivity if PRP is at least 0.6 per cent of the total wage bill so that profit share is 3.6 per cent for those who receive it. Profit-sharing firms have also on the average around 1.8 point higher return on assets. It is seen that PRP schemes have substantially improved firm performance without creating much wage pressures. PRP has also distinct effects of its own, and is not substitute for hierarchical payments. PRP did not instead seem to raise the share price and PE ratio in firms listed on the Helsinki Stock Exchange.

Notes

1. Besides incentive-pay schemes new human resource management includes problem-solving teams, blue-collar participation, information exchange, extensive employee screening, broad job definitions, rotation of workers, employment security guarantees and professional education.
2. We also tried the following procedure (Wooldridge, 2002, pp. 623-4). First, we obtained the fitted values for the profit-sharing dummy from a logit regression. These values were then used as an instrument in 2SLS regressions concerning productivity and profitability. However, these estimates turned out to be high and extremely volatile, too. Similar findings are reported in Blasi *et al.* (1996).

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Appendix. The linked employee-employer data

The data are linked employer-employee data. The two parts of the data are separate and were grouped for this study. The data form an unbalanced panel with a relatively short time dimension 1996-2002. The financial data come from Balance Consulting Oy and Suomen Asiakastieto and include 93,559 Finnish firms. The financial data include detailed income statements, full balance sheets and numerous key ratios for corporate analysis. The labour data are from the Confederation of Finnish Industry and Employers. The data cover the years 1996-2002 and include both blue- and white-collar employees. The white-collar employees receive salaries and the blue-collar workers are remunerated on an hourly basis. There are approximately 3.09 million person-year observations of which 1.87 million are blue-collar and 1.23 million white-collar employees. The data include a rich set of variables covering compensation, education and profession.

The number of observations drops to 2.08 million after calculating regular hourly earnings, as explained later. The large reduction in the number of observations is due to no information on education (91,000), no seniority (3,000), inconsistent hourly wages (118,000, see below), no firm-code (373,000) or missing financial data (640,000, but included in summary Table I for employee figures). In a wage regression a person was dropped if the observed wage is not within five standard deviations of the predicted value, using work experience up to the fourth power, 23 education-educational field dummies and gender as explanatory variables. These reductions mean that smaller companies are under-represented in the final data. The firm-level data include about 10,480 observations, which means that there are approximately 2,351 companies.

The variables

Firm-level variables. *The firm PRP dummy.* Tells whether the firm has a PRP plan in the year t. It is based on the PRPs paid out in the year $t + 1$. This measure does not provide any information on the nature of the PRP plan.

The firm PRP dummy modified. Based on the PRP dummy, but set equal to unity for the following years after first having taken this value. This is done to diminish the effect of profit level fluctuations on the profit-sharing measure.

The firm R&D dummy. If the share of white-collar employees with R&D related work exceeds five per cent of all employees then the firm is classified as an R&D company.

Within Firm 80th-20th log wage. A measure of the wage dispersion within the firm. It is the difference between the 80th and 20th percentile of the log average wage.

Capital intensity. The natural logarithm of the ratio of capital to labour, where the capital is measured by the accounting values of the land, machinery and buildings. The accumulation method is not used owing to the shortness of the time dimension of the data.

Employment. Average employment during the year obtained from the financial data.

Highly educated employees/employees. The share of employees with a bachelor's degree (lower university and non-university degrees) or higher.

Net profits. Profit before extraordinary items and appropriations and after taxes in real terms.

Equity ratio. is used to measure the firm's ability to answer for its commitments in the long run. The equity ratio is used as an indicator variable with three classes. The classes are suggested by the Committee for Corporate Analysis in Finland. It is classed as good if it exceeds 35 per cent, fair if it is between 20 and 35 per cent and bad if it is below 20 per cent.

Churning. measures excess employee mobility, equal to separations when jobs are created and to hirings when jobs are lost (See Davis *et al.* (1996), for evaluation of churning.).

IT-industry. It includes the manufacturing of computers, telecommunications, and software engineering and database management.

Foreign ownership per cent. The percentage of the firm's stock that is held by foreigners at the end of the year.

Return on assets per cent. profit before extraordinary items and appropriations and after taxes + financial expenses + taxes divided by total assets.

Employee-level variables. *PRP dummy.* Tells whether an employee is included in a PRP plan in the year t. It is based on the profit shares paid out in the year $t + 1$. This is set to unity after first observing it to be unity, with the possibility that if one changes the employer, the employee's PRP status may change. It is also set to unity from 1996 if the person has received profit-shares. Like the firm PRP dummy it does not provide any information on the nature of the profit-sharing plan.

Hourly earnings. This includes all taxable compensations per actual working time, which includes overtime hours. Regular hourly earnings are the sum of PRP, time and piece wages per actual working time for the blue-collar employees. For the white-collar employees it is the sum of regular monthly earnings and PRP divided by the regular working time.

The person R&D status. This is obtained from the data and is available for the white-collar employees.

Seniority. Duration of a job measured in years.

Key figures of the data. The variables mostly concerning the firm-level are obtained from the firm data and variables concerning employees are calculated from the employee data. As seen from Table I, about 3/4 of the companies are in manufacturing, the average number of personnel being a little over 420. However, the range is quite large, from 2 to 44,808. The average turnover is €97 million. The companies are thus fairly large by Finnish standards. R&D activity is found in 33.1 per cent of the companies and on the average 19.9 per cent of personnel work in R&D. White-collar employees form 41.2 per cent of the work force. The average age is 39.6 and seniority 13 years (Table A1).

Variable	Observation	Mean	Std deviation	Min.	Max.
Employee level variables					
PRP	2,084,854	31.1 per cent	0.46		
PRP (1 once observed)	2,084,854	37.6 per cent	0.48		
PRP (PRP/wage bill > 0.6 per cent, 1 once observed)	2,084,854	35.7 per cent	0.48		
PRP (PRP/salaries)	2,084,854	452.3	1,344		
Salaries	2,084,854	25,281	12,735	0	1
Age	2,084,854	39.6	11.32	1.320	4.278
Women	2,084,854	27.9 per cent	0.45	1.827	5.446
Seniority	2,084,854	13.1	10.69	0	1
Employee R&D dummy	2,084,854	8.5 per cent	0.28		
White-collar share	2,084,854	41.2 per cent	0.32		
Firm R&D dummy	2,084,854	33.1 per cent	0.47		
Churning low educated	2,084,854	0.082	0.13		
Churning highly educated	1,766,295	0.046	0.08	0	49
Net profits per capita	2,067,440	14,484	48,513	0	1
Equity ratio	2,084,854	39.7	31.05		
Firm-level variables					
Sales[a]	10,480	9,764	79,505	129	13,800,000
Value added[a]	10,479	3,006	23,725	2.216	15.147
Net profits per capita[a]	10,096	17	86	−505.895	1224.501
Operating profits[a]	10,480	859	−10,924	2	44,808
Personnel	10,104	432	2,187	−3.680	9.263
Capital[a]	10,480	3,271	24,961	0	1
Firm R&D dummy	10,480	19.9 per cent	0.40	0	1

Note: [a]in €10,000. In estimations the churning of highly educated set at zero if missing

Table AI.
Summary statistics