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ABSTRACT

Performance Pay and Enterprise Productivity: The Details Matter*

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 incentives (the share of PRP in total compensation) results in greater productivity gains, and returns to Power of incentives diminishes very slowly.

JEL Classification: 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, Bryson, et al., 2012, Lemieux, MacLeod and Parent, 2009). 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 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 (See, for instance, Jones and Kato, 1995, Blasi, Conte and Kruse, 1996 and Kruse and Blasi, 1997). Moreover, an increasing number of firms (in particular "New Economy" firms) are

[1] For a survey of the literature on financial participation schemes, see for instance Blasi, Conte and Kruse (1996) 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) and Prendergast (1999). For more recent works, see the shared capitalism literature (see, for instance, Bryson and Freeman, 2008, and Kruse, Blasi and Park, 2008).

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

extending the use of Stock Option Plans (SOPs) to include non-executive employees in recent years (See, for instance, Sesil, Kroumova, Blasi and Kruse, 2002) and Conyon and Freeman, 2004).

Finally, with the rising popularity of "High Performance Workplace Practices (notably 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 (See, for example, Hamilton, Nickerson and Owan, 2003, Jones and Kato, 2011 and Jones, Kalmi and Kauhanen, 2010 for teams and TIPs). The literature on individual incentive pay is equally rich, including a variety of econometric case studies, field experiments, and laboratory experiments (see, for instance, Dohmen and Falk, 2011, Lazear, 2000, and Shearer, 2004).

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. Nevertheless, 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 will be of great interest and importance to discern which of the two kinds of PRP, group or individual incentive pay, yields a greater enterprise productivity gain. As discussed by a recent survey of the literature by Bloom and Van Reenen (2011), theoretically group incentive pay and individual incentive pay affect worker behavior and organizational performance differently. For instance, on one hand, group incentive pay promotes teamwork and collaboration among workers, whereas individual incentive pay does not. On the other hand, group incentive pay is subject to the free-rider problem, which may negate its positive productivity effect, while individual incentive pay does not suffer from the free-rider problem.

Group incentive pay and individual incentive pay may also have differing effects on worker sorting. The introduction of individual incentive pay may encourage low-productivity workers to leave the firm and attract high-productivity workers to join it (see, for instance, Dohmen and Falk, 2011, Lazear, 2000). Group incentive pay if the free-rider problem is serious may lead to the opposite worker sorting---attracting low-productivity workers to the firm due to an opportunity to free-ride on their high-productivity coworkers and induce high-productivity workers to leave the firm.[3]

In sum, theory makes it amply clear that group incentive pay and individual incentive pay are likely to have very different effects on worker behavior and organizational outcomes. Yet many existing data, such as the Panel Study of Income Dynamics (PSID) which was used by one of the most influential studies on PRP in recent years (Lemieux, MacLeod and Parent, 2008), does not distinguish group incentive pay from individual incentive pay, and hence does not allow researchers to estimate the productivity effect of group incentive pay separate from that of individual incentive pay.

Furthermore, even within each of the two types of PRP (individual and group), there is considerable heterogeneity. Some PRP schemes apply equally to the large majority of employees and some only to a small subset of employees. PRP also differs in the use of specific performance measures. Even if the same performance measure is used, the power of incentives (how sensitive pay is to performance) may vary.

In short, we know a lot about whether the incidence of PRP matter for enterprise productivity yet we know relatively little about whether the details of PRP matter. It is this

[3] Kato and Morishima (2002) provide evidence that group incentive pay combined with joint labor-management committees at the top as well as at the grassroots can overcome the free-rider problem of group incentive pay, leading to a positive productivity gain.

important gap 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 (Kruse, 1993 and Pendleton and Robinson, 2017). Such exceptions are, however, subject to potentially serious bias due to unobserved firm heterogeneity that is correlated with the varying attributes of PRP.[4] Unlike the rich literature on the productivity effect of the incidence of PRP, panel data on the varying attributes 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 caused by unobserved firm heterogeneity. 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 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 which 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 2,676 to 3,204 firms and the response rates have been

[4] Those studies do use a rich range of firm or workplace level variables to limit the bias.

between 31% and 55%.[5] More details of the sample and respondents are given in Table 1.

The survey's primary objective is to collect firm-level information on the prevalence and characteristics of PRP systems. Each question concerning the PRP plans in the survey asks separate answers for blue-collar employees, clerical employees and white-collar employees. The survey further asks if PRP is used and if so, which performance measures are used and at which hierarchical level. Thus it enables us to characterize the PRP plans in various ways. We then merge the EK compensation data with Asiakastieto, firm-level balance sheet data, which will allow us to calculate each firm's value added and capital.

The merged data are further combined with the EK's wage statistics database which contain employee-level data (such as education, work experience, and firm tenure). As such, the resulting database is Linked Employer-Employee Data (LEED) augmented by unusual panel data on the attributes of PRPs (for more details see Kauhanen and Napari, 2012a). Finally, we use Statistics Finland's business register and add data on foreign ownership to the PRP-augmented LEED, using firm IDs. We have 1135 to 1659 observations with all of the necessary data. Note that unlike many studies using LEED which use individual employees as the unit of analysis, our unit of analysis is individual employers and construct individual employer-level data from data on their employees.

III. Econometric Specifications and Results

We begin with a standard dummy variable approach commonly used in the literature (see

[5] 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%.

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, clerical, and white-collar) in firm i in year t, and the value of zero otherwise; and β's are slopes. In addition, our data allow for a set of other controls, $\mathbf{X_{it}}$. 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 (average education level, general labor market experience, and tenure of all employees at the firm). As shown in the summary statistics in Table 2, 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 2, twenty percent of firms are majority foreign-controlled. Finally, we consider a set of industry dummy variables.[6]

As a robustness check, we also consider translog production functions and find that our

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

results change little when we consider translog production functions.[7] 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 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 or progressive corporate culture/history 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 or progressive corporate culture/history leads to higher enterprise productivity. Since we cannot reliably measure a variable such as high-quality management and progressive corporate culture/history, 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 such as overall management quality/progressive corporate culture and history tends to be stable over time.

Table 3 reports the CS and FE estimates of our baseline production function, Eq. (1) and Eq. (2). The estimated coefficients on log $capital_{it}$ and log $employment_{it}$ are positive and statistically significant at the 1 percent level, and the size of each coefficient is reasonable.[8]

The estimated coefficients on $incidence_{it}$ for both specifications are positive and statistically

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

[8] As explained in Hsiao (1986; 26-28), the use of panel data in production function estimation leads to a smaller sum of estimated output elasticities. The sums of estimated output elasticities for the FE specification reported above are close to those cited in Hsiao (1986; 27). We also estimated all of our FE models with constant returns to scale imposed, and reassuringly we found no appreciable difference in the results.

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 (for instance, Gielen, Kerkhofs and Van Ours, 2010 for Holland, Jones and Kato, 1995 for Japan, and Kato, Lee and Ryu, 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? We begin with exploring the most frequently studied detail—the penetration of PRP (the proportion of the labor force covered by PRP or coverage[9]). Table 4 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 $coverage_{it}$ turns out to be considerably larger than the FE estimate, again pointing to the substantial upward bias of the CS estimates due to

[9] Coverage does not mean receipt of a recent pay-out. It is possible that employees participating in PRP receive no pay-out for certain years.

unobserved firm heterogeneity that is positively correlated with 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. It turns out that PRP used by Finnish firms almost always contain some group incentive. As such, PRP used by Finnish firms can be meaningfully grouped into two categories: (i) group PRP defined as PRP which contains group incentive but no individual incentive pay; and (ii) individual PRP defined as PRP which contains individual incentive (most of them also contain group incentive). Specifically, building on our last analysis of $coverage_{it}$, we create the following two variables: (i) group $coverage_{it}$ is defined as the proportion of the labor force for which firm i uses group PRP in year t; and (ii) individual $coverage_{it}$ is defined as the proportion of the labor force for which firm i uses individual PRP in year t. Note that if firm i does not use any PRP in year t, both variables are zero. Reassuringly we find that there are comforting within-firm variations in group $coverage_{it}$ and individual $coverage_{it}$ over time, which allow for fixed effect estimations.

Individual incentive pay and group incentive pay have distinctly different implications for the effect of PRP on enterprise performance. 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, however, 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 (see, for instance, Dohmen and Falk, 2011, Lazear, 2000). In contrast, group incentive pay may result 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 5. The discrepancy between the CS and FE estimates here is large, and thereby not accounting for unobserved firm heterogeneity will result in a highly misleading conclusion. 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, while the estimated coefficient on individual incentive is not at all significantly different from zero.[10] The aforementioned overestimation of the productivity effect of PRP due to unobserved heterogeneity appears to be particularly acute for individual incentive pay for Finnish firms. It suggests that Finnish firms experimenting with individual incentive pay may be those firms with superior unobserved managerial quality or progressive corporate culture.

The FE estimates on the coefficient on group coverage_{it} and individual coverage_{it} suggest 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 point to the efficacy of group incentive pay in boosting enterprise

[10] A t-test shows that the coefficients are statistically significantly different from each other ($p=0.03$)

productivity while failing to find such evidence for individual incentive pay.

We now turn to the details of group 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$_{it}$, which takes a value of one if firm i in year t uses only profitability as a performance measure for its PRP, zero otherwise. We contrast the profit sharing plans with all other types of PRP plans. We define other measures$_{it}$, taking a value of one if firm i in year t has any other type of PRP plan than profit share$_{it}$, and zero otherwise. Note that if profit share$_{it}$=0 and other measures$_{it}$=0, firm i in year t does not use PRP.

As shown in Table 6, the estimated coefficients on both profit share$_{it}$ and other measures$_{it}$ are positive and statistically significant for both the CS and FE specifications. In our preferred FE specification, 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, pointing to a possible advantage of the use of profitability as a performance measure in PRP over other performance measures.[11] Note that in the CS specification that fails to account for unobserved heterogeneity, the estimated coefficient on other measures$_{it}$ 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$_{it}$.

The next set of variables are borrowed from Kauhanen and Napari (2012) 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).

[11] However, the coefficients are not statistically significantly different from each other at the conventional levels.

Specifically, as shown in Table 7, (i) single-broad$_{it}$ takes a value of one if firm i in year t uses PRP with a single performance measure which is profitability, zero otherwise; (ii) single-narrow$_{it}$ takes a value of one if firm i in year t uses PRP with a single performance measure which is NOT profitability, zero otherwise; (iii) multiple-broad$_{it}$ takes a value of one if firm i in year t uses PRP with multiple performance measures which include both profitability and one other measure, zero otherwise; (iv) multiple-narrow$_{it}$ takes a value of one if firm i in year t uses PRP with multiple measures which do not include profitability, zero otherwise. The omitted reference category is no-PRP$_{it}$ =1 if firm i in year t uses no PRP, 0 otherwise.

This classification is based on recent theories which suggest that broad and narrow measures should be combined to manage the trade-off between risk and distortion (Baker, 2002) or the trade-off between risk and incentives to utilize specific knowledge (Raith, 2008).

For those firms with PRP used only for one of the three employee groups, assigning one of these PRP classifications to the firm's PRP plans is straightforward. For those firms with PRP used for multiple employee groups, we use the following procedure. If the firm uses a PRP plan for the white-collar group, we consider the white-collar plan as a representative plan of the firm, for cross tabulations reveal that for firms with PRP plans used for the white-collar group, it is rare that plan details for the other employee groups differ from those for the white-collar group. If the firm does not use a PRP plan for the white-collar group but uses for the clerical group, we will use the clerical plan as the representative plan of the firm.

The results are highlighted in Table 8. Our preferred FE specification that account for unobserved heterogeneity provides two noteworthy insights. First, the estimated coefficient on multiple-narrow$_{it}$ 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 multiple-broad$_{it}$ is not greater than the estimated coefficients on either single-broad$_{it}$ or single-narrow$_{it}$. 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 we measure the power of incentives as the ratio of maximum amount of PRP that the plan allows to regular earnings, power of incentives$_{it}$. Thus this measure shows how large role PRP plays in the compensation of the employees. For those firms with PRP plans used for multiple employee groups, it is possible that the maximum amount of PRP payment as a share of regular earnings differ from one employee group to another. For such firms, we use a weighted average with the number of employees as a weight. It is quite plausible that the relationship between power of incentives$_{it}$ and productivity may be nonlinear, and thereby we consider power of incentives$_{it}$ and its squared term. Table 9 confirms that productivity gains from PRP are indeed greater when the power of incentives is stronger. The estimated coefficients on the squared term of power of incentives$_{it}$ are statistically significant yet 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$_{it}$ between the CS specification and the FE specification, pointing to the presence of endogeneity bias caused by unobserved firm heterogeneity correlated with the power of incentives.

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 such bias.

First, the comparison between the cross-sectional estimates and the fixed-effect estimates suggests that the omitted variable bias may be serious—making the cross-sectional estimates on the productivity effect of the details of PRP biased upward substantially. Any future attempt to estimate the effects of PRP will need to be mindful of the potentially serious upward bias of cross-sectional estimates, and try to collect panel data and estimate fixed effect models or at least use a very rich set of controls for firm characteristics.

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. Most prior studies examine individual incentive pay or group incentive pay but rarely study both simultaneously, in particular in fixed effect estimations (for individual incentive pay, see for example Lazear, 2000; Shearer, 2004; Freeman and Kleiner, 2005; and Bandiera et al., 2005, and for group incentive pay, see for instance Jones and Kato, 1995; Lavy, 2002; Hamilton et al., 2003; Boning et al., 2007; Burgess et al., 2007; Baiker and Jacobson, 2007; Bloom et al., 2009; Bryson, et al., 2010). Fortunately our longitudinal data have comforting with-firm variations in various attributes of PRP over time, which has allowed us for the first time to compare and contrast the effect on productivity of group incentive pay and individual incentive pay consistently in the fixed effect framework.

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.[12]

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

[12] Pendleton and Robinson (2017) obtain similar evidence from their analysis of cross-sectional data from the British Workplace Employment Relations Survey.

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 incentives do not diminish rapidly.

References

Baicker, Katherine and Mireille Jacobson. 2007. "Finders Keepers: Forfeiture Laws, Policing Incentives, and Local Budgets." Journal of Public Economics, Vol. 91, No. 11-12, pp. 2113-2136.

Baker, George. 2002. "Distortion and Risk in Optimal Incentive Contracts." Journal of Human Resources, Vol. 37, No. 4, pp. 728-751.

Bandiera, Oriana, Iwan Barankay and Imran Rasul. 2005. "Social Preferences and the Response to Incentives: Evidence from Personnel Data." Quarterly Journal of Economics, Vol. 120, No. 3, pp. 917-962.

Ben-Ner, Avner and Derek C. Jones. 1995. "Employee Participation, Ownership, and Productivity: A Theoretical Framework." Industrial Relations, Vol. 34, No. 4, pp. 532-54.

Blasi, Joseph, Michael Conte and Douglas Kruse. 1996. "Employee Stock Ownership and Corporate Performance among Public Companies." Industrial and Labor Relations Review, Vol. 50, No. 1, pp. 60-79.

Bloom, Nicholas and John Van Reenen. 2011. Human Resource Management and Productivity. In Orley Ashenfelter and David Card. Handbook of Labor Economics, pp 1697 - 1767: Elsevier.

Boning, Brent, Casey Ichniowski and Kathryn Shaw. 2007. "Opportunity Counts: Teams and the Effectiveness of Production Incentives." Journal of Labor Economics, Vol. 25, No. 4, pp. 613-650.

Bryson, Alex and Richard Freeman. 2008. "How Does Shared Capitalism Affect Economic Performance in the Uk?". National Bureau of Economic Research, Inc, NBER Working Papers: 14235.

Bryson, Alex, Richard B. Freeman, Douglas L. Kruse, Richard B. Freeman and Joseph R. Blasi. 2010. How Does Shared Capitalism Affect Economic Performance in the United Kingdom? In., Shared Capitalism at Work: Employee Ownership, Profit and Gain Sharing, and Broad-Based Stock Options, pp 201-224: NBER Conference Report series. Chicago and London: University of Chicago Press.

Bryson, Alex, Richard Freeman, Claudio Lucifora, Michele Pellizzari and Virginie Perotin. 2012. "Paying for Performance: Incentive Pay Schemes and Employees' Financial Participation". Centre for Economic Performance, LSE, CEP Discussion Paper 1112.

Burgess, Simon, Carol Propper, Marisa Ratto, Stephanie von Hinke, Kessler Scholder and Emma Tominey. 2010. "Smarter Task Assignment or Greater Effort: The Impact of Incentives on Team Performance." Economic Journal, Vol. 120, No. 547, pp. 968-989.

Conyon, Martin J. and Richard B. Freeman. 2004. Shared Modes of Compensation and Firm Performance: U.K. Evidence. In David Card, Richard Blundell and Richard B. Freeman. Seeking a Premier Economy: The Economic Effects of British Economic Reforms, 1980-2000, pp 109-146. Chicago and London: University of Chicago Press.

Dohmen, Thomas and Armin Falk. 2011. "Performance Pay and Multidimensional Sorting: Productivity, Preferences, and Gender." American Economic Review, Vol. 101, No. 2, pp. 556-590.

Doucouliagos, Chris. 1995. "Worker Participation and Productivity in Labor-Managed and Participatory Capitalist Firms: A Meta-Analysis." Industrial and Labor Relations Review, Vol. 49, No. 1, pp. 58-77.

Eurofound. 2010. European Company Survey 2009: Overview. Luxembourg: Office for Official

Publications of the European Communities.
Freeman, Richard B. and Morris M. Kleiner. 2005. "The Last American Shoe Manufacturers: Decreasing Productivity and Increasing Profits in the Shift from Piece Rates to Continuous Flow Production." Industrial Relations, Vol. 44, No. 2, pp. 307-330.
Gibbons, Robert. 1997. Incentives and Careers in Organizations. In., Advances in Economics and Econometrics: Theory and Applications: Seventh World Congress. Volume 2, pp 1-37. Cambridge; New York and Melbourne: Cambridge University Press.
Gielen, Anne C., Marcel J. M. Kerkhofs and Jan C. van Ours. 2010. "How Performance Related Pay Affects Productivity and Employment." Journal of Population Economics, Vol. 23, No. 1, pp. 291-301.
Hamilton, Barton H., Jack A. Nickerson and Hideo Owan. 2003. "Team Incentives and Worker Heterogeneity: An Empirical Analysis of the Impact of Teams on Productivity and Participation." Journal of Political Economy, Vol. 111, No. 3, pp. 465-98.
Ittner, Christopher D. and David F. Larcker. 2002. "Determinants of Performance Measure Choices in Worker Incentive Plans." Journal of Labor Economics, Vol. 20, No. 2, pp. S58-S90.
Jones, Derek C., Panu Kalmi and Antti Kauhanen. 2010. "Teams, Incentive Pay, and Productive Efficiency: Evidence from a Food-Processing Plant." Industrial and Labor Relations Review, Vol. 63, No. 4, pp. 606-626.
Jones, Derek C. and Takao Kato. 1993. "Employee Stock Ownership Plans and Productivity in Japanese Manufacturing Firms." British Journal of Industrial Relations, Vol. 31, No. 3, pp. 331-46.
Jones, Derek C. and Takao Kato. 1995. "The Productivity Effects of Employee Stock-Ownership Plans and Bonuses: Evidence from Japanese Panel Data." American Economic Review, Vol. 85, No. 3, pp. 391-414.
Jones, Derek C. and Takao Kato. 2011. "The Impact of Teams on Output, Quality, and Downtime: An Empirical Analysis Using Individual Panel Data." Industrial and Labor Relations Review, Vol. 64, No. 2, pp. 215-240.
Jones, Derek C., Takao Kato and Jeffrey Pliskin. 1997. Profit Sharing and Gainsharing: A Review of Theory, Incidence and Effects. In D. Lewin, D. Mitchell and M. Zaidi. The Human Resource Management Handbook Part I, pp pp. 153-174. Greenwich, CT: JAI Press.
Kato, Takao, Ju Ho Lee and Jang-Soo Ryu. 2010. The Productivity Effects of Profit Sharing, Employee Ownership, Stock Option and Team Incentive Plans: Evidence from Korean Panel Data. In Tor Eriksson. Advances in the Economic Analysis of Participatory and Labor-Managed Firms, pp 111-135: Advances in the Economic Analysis of Participatory and Labor-Managed Firms, vol. 11. Bingley, U.K.: Emerald.
Kato, Takao and Motohiro Morishima. 2002. "The Productivity Effects of Participatory Employment Practices: Evidence from New Japanese Panel Data." Industrial Relations, Vol. 41, No. 4, pp. 487-520.
Kauhanen, Antti and Sami Napari. 2012. Career and Wage Dynamics: Evidence from Linked Employer-Employee Data. In Solomon W. Polachek and Konstantinos Tatsiramos. Research in Labor Economics, pp 35-76: Emerald Group Publishing Limited.
Kauhanen, Antti and Sami Napari. 2012. "Performance Measurement and Incentive Plans." Industrial Relations, Vol. 51, No. 3, pp. 645-669.
Kruse, Douglas and Joseph R. Blasi. 1997. Employee Ownership, Employee Attitudes, and Firm

Performance. In D. Lewis, D. Mitchell and M. Zaidi. The Human Resource Management Handbook Part I, pp pp. 113-152. Greenwich, CT: JAI Press.
Kruse, Douglas L. 1993. Profit Sharing: Does It Make a Difference? Kalamazoo, Michigan: W.E. Upjohn Institute for Employment Research.
Kruse, Douglas L., Joseph R. Blasi and Rhokeun Park. 2008. "Shared Capitalism in the U.S. Economy? Prevalence, Characteristics, and Employee Views of Financial Participation in Enterprises". National Bureau of Economic Research, Inc, NBER Working Papers: 14225.
Lavy, Victor. 2002. "Evaluating the Effect of Teachers' Group Performance Incentives on Pupil Achievement." Journal of Political Economy, Vol. 110, No. 6, pp. 1286-1317.
Lazear, Edward P. 2000. "Performance Pay and Productivity." American Economic Review, Vol. 90, No. 5, pp. 1346-61.
Lemieux, Thomas, W. Bentley MacLeod and Daniel Parent. 2009. "Performance Pay and Wage Inequality." Quarterly Journal of Economics, Vol. 124, No. 1, pp. 1-49.
Levinsohn, James and Amil Petrin. 2003. "Estimating Production Functions Using Inputs to Control for Unobservables." Review of Economic Studies, Vol. 70, No. 243, pp. 317-341.
Pendleton, Andrew and Andrew Robinson. 2017. "The Productivity Effects of Multiple Pay Incentives." Economic and Industrial Democracy, Vol. 38, No. 4, pp. 588-608.
Prendergast, Canice. 1999. "The Provision of Incentives in Firms." Journal of Economic Literature, Vol. 37, No. 1, pp. 7-63.
Raith, Michael. 2008. "Specific Knowledge and Performance Measurement." RAND Journal of Economics Vol. 39, No. 4, pp. 1059-1079.
Sesil, James C., Maya K. Kroumova, Joseph R. Blasi and Douglas L. Kruse. 2002. "Broad-Based Employee Stock Options in Us 'New Economy' Firms." British Journal of Industrial Relations, Vol. 40, No. 2, pp. 273-94.
Shearer, Bruce. 2004. "Piece Rates, Fixed Wages and Incentives: Evidence from a Field Experiment." Review of Economic Studies, Vol. 71, No. 2, pp. 513-534.
Wooldridge, Jeffrey M. 2009. "On Estimating Firm-Level Production Functions Using Proxy Variables to Control for Unobservables." Economics Letters, Vol. 104, No. 3, pp. 112-114.

Table 1: Sample and Respondents in the EK compensation survey

	Sample		Respondents		Respondents share	
	Firms	Employees	Firms	Employees	Firms	Employees
2005	3 204	681 000	958	434 000	30 %	64 %
2008	3180	722 637	1738	529 417	55 %	73 %
2011	2676	729 097	1204	501 080	45 %	69 %

Sampling: 2005 firm size 6-9: 10%; 10-49: 20%; 50-99: 50%; >100:100%. In 2008 and 2011 firm size 10-99: 25%; >100: 100%.

Sources: EK Compensation Survey, 2005, 2008, and 2011

Table 2 Summary Statistics

Variable	Obs	Mean	Std. Dev.
log value added$_{it}$	1,659	15.99	1.63
log capital$_{it}$	1,659	14.54	2.50
log employment$_{it}$	1,659	4.97	1.47
Mean experience$_{it}$ (years)	1,659	21.89	4.33
Mean seniority$_{it}$ (years)	1,659	10.39	5.23
Mean education$_{it}$ (years)	1,659	12.33	1.07
Foreign owned$_{it}$	1,659	0.20	0.40
Incidence$_{it}$	1,659	0.70	0.46
Coverage$_{it}$	1,659	0.49	0.46
Group coverage$_{it}$	1,654	0.44	0.47
Individual coverage$_{it}$	1,659	0.22	0.39
Profit share$_{it}$	1,659	0.08	0.28
Other measures$_{it}$	1,659	0.62	0.49
Narrow only$_{it}$	1,556	0.03	0.17
Broad only$_{it}$	1,556	0.11	0.31
Multiple narrow measures$_{it}$	1,556	0.05	0.22
Broad and narrow$_{it}$	1,556	0.50	0.50
Power of incentives$_{it}$	1,135	0.057	0.095

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

Table 3 Productivity effects of PRP: Incidence

	(1)	(2)
VARIABLES	OLS	FE
log capital$_{it}$	0.131***	0.069***
	(13.054)	(2.843)
log employment$_{it}$	0.866***	0.821***
	(65.860)	(12.102)
Incidence$_{it}$	0.189***	0.087**
	(6.782)	(2.238)
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 4 Productivity effects of PRP: coverage

	(1)	(2)
VARIABLES	OLS	FE
log $capital_{it}$	0.127***	0.068***
	(12.671)	(2.877)
log $employment_{it}$	0.877***	0.821***
	(68.556)	(12.078)
$Coverage_{it}$	0.172***	0.110***
	(6.169)	(2.933)
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 5 Productivity effects of PRP: group vs. individual

	(1)	(2)
VARIABLES	OLS	FE
log $capital_{it}$	0.132***	0.072***
	(13.157)	(2.965)
log $employment_{it}$	0.865***	0.824***
	(64.729)	(12.110)
Group $coverage_{it}$	0.145***	0.074**
	(5.255)	(2.009)
Individual $coverage_{it}$	0.209***	-0.004
	(5.468)	(-0.082)
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 6 Productivity effects of PRP: profit sharing vs. others

	(1)	(2)
VARIABLES	OLS	FE
log $capital_{it}$	0.131***	0.070***
	(13.077)	(2.909)
log $employment_{it}$	0.865***	0.814***
	(65.632)	(12.061)
Profit $share_{it}$	0.151***	0.145**
	(3.631)	(2.558)
Other $measures_{it}$	0.196***	0.073*
	(6.857)	(1.823)
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 7 Four types of PRP

	Single performance measure	Multiple performance measure
Broad (profitability)	Single-broad	Multiple-broad
Narrow (other measures)	Single-narrow	Multiple-narrow

Table 8 Productivity effects of four types of PRP

VARIABLES	(1) OLS	(2) FE
log $capital_{it}$	0.133***	0.076***
	(13.027)	(3.219)
log $employment_{it}$	0.855***	0.820***
	(62.023)	(11.979)
Broad-$single_{it}$	0.143***	0.159***
	(3.823)	(2.669)
Narrow-$single_{it}$	0.120*	0.137**
	(1.934)	(2.112)
Broad-$multiple_{it}$	0.219***	0.103**
	(7.074)	(2.002)
Narrow-$multiple_{it}$	0.196***	0.009
	(2.596)	(0.073)
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 9 Productivity effects of PRP: Power of incentives

	(1)	(2)
VARIABLES	OLS	FE
log capital$_{it}$	0.132***	0.084**
	(10.750)	(2.166)
log employment$_{it}$	0.876***	0.788***
	(55.330)	(6.594)
Power of incentives$_{it}$	1.842***	0.940*
	(6.779)	(1.673)
Power of incentives$_{it}^2$	-0.965***	-0.561**
	(-6.100)	(-2.045)
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