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Incentive Pay, Teams and Earnings: Evidence from Toronto Firms

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1. Introduction

The use of 'high-performance' workplace practices has received considerable attention from researchers. The strong majority of this literature has focused on the impact on establishment outcomes such as productivity. Until the mid to late 1990s, much of this literature was qualitative or anecdotal. Several key contributions in the late 1990s – of particular note, Ichniowski, Shaw and Prennushi (1997) – provided more convincing evidence that organizational practices such as teams and incentive pay may lead to substantial productivity gains. While this literature has led to novel implications for human resource management strategy, it has largely focused on manufacturing settings. Moreover, most studies have been on a single firm.

Overall, little is known about human resource practices in non-manufacturing and non-case study settings. Moreover, for incentive pay, few studies have actually observed compensation contracts. This paper examines the relationship between several workplace practices (including teams and incentive pay) and earnings using unique employee-employer linked personnel data where the explicit nature of compensation contracts is observed.

A key contribution of the paper is that the data allows for a different style of methodological approach than what has typically been done in the literature. Most previous research on workplace reorganization on the management side of the literature, and compensation policy in labour economics have consisted of empirical case studies – either a single firm or multiple plants (or assembly lines) of a single firm in a manufacturing setting where researchers observe the production process. This approach is attractive for two key reasons: 1) actual productivity can be observed, and 2) longitudinal data can be created such that the researcher observes productivity before and after the adoption of a new workplace practice. In some cases, one plant is used as a comparison group for another so that the empirical strategy is not simply a before-and-after methodology, but a difference-in-difference approach. As noted, the disadvantage of the above methodology is that the results are confined to a single firm (or narrow industry), and thus may not be representative of other situations. Perhaps more importantly, one must always question why one plant adopted the workplace innovation while another plant did not. With the exception of the piece-rate study of Shearer (2004), random assignment has not been used in the human resource management literature.

This paper uses data that combines personnel records with survey-based information, and where the entire firm is observed: that is, the position and earnings of every employee is observed, and workplace practices including incentive pay contracts at the business unit level are observed. Seven unit levels are observed in the data: top executives, lower executives, middle management / supervisory professionals, information technology managers, non-management / non-supervisory professionals, IT staff, and clerical / support staff. This type of data allows for a multi-level empirical methodology (sometimes referred to as hierarchical model) where the econometric framework specifically allows for variables measured at different levels (individual-level, business unit-level, and establishment-level) of the firm to affect the dependent variable — combined with different options for addressing unobserved heterogeneity. For instance, my preferred approach uses establishment-level fixed effects, absorbing all firm-level variation. Most key human resource management variables are measured at the business unit level, and thus identification does not come from establishment-level variation as in cross-sectional establishment-level data — nor variation from firms adopting (or abandoning) a certain practice as in longitudinal data — but variation across business units. While most variation in the human resource practices examined is across-firms, a substantial amount of within-firm variation exists from which to work with. The central finding is that team-based organizational structures — particularly when teams are combined with team-based incentive contracts — as well as long-term, stock-based incentive pay programs are associated with substantial wage premiums. Short-term, annual bonus incentive plans along with other compensation policies such as merit-based salary progression, formal salary structures and profit-sharing have no impact on earnings.

2. Previous literature

The ‘high-performance’ literature is vast, and cannot be reviewed here. Appelbaum and Batt (1994) provide a review of the early literature. In this section, I emphasize a) studies that have focused on teams and / or incentive pay — as these are the two key workplace practices examined, and b) studies that help illustrate the different methodological approach used in the paper. In general, this review involves two, often distinct literatures: research on teams from the management / organizational behaviour literature and research on incentive pay from the economics literature.

Until the mid-to late-1990s most research on teams could be described as qualitative or anecdotal. The few rigorous studies tended to be ‘quasi-experiments’ involving a very small number of employees. For instance, Griffen (1988) compares a group of 73

workers from one manufacturing plant who were organized into quality circles and followed over a period of time with a comparison group drawn from a different plant belonging to the same firm.[1] However, no random assignment was done — the managers at one plant decided to implement the quality circle while the mangers at the other plant decided not to. Unobserved plant-specific factors can contaminate the results of such a study. More recently, Banker, Field, Schroeder, and Sinha (1996) examine four motor assembly lines of a single firm over a 21-month period where all four lines adopted semi-autonomous teams. This study uses monthly and weekly productivity data, but in essence is a before-and-after approach since all four lines adopted teams at the same time and so identification is driven by that one change. Most of this literature finds productivity gains, although there is also evidence that these gains are temporary.

Ichnioswski et al (1997) is one of the few 'economics' studies to examine teams, and is also one of the few studies to examine interactions between teams (and similar high performance workplace practices) and incentive pay. The authors make a significant step forward methodologically by following a much larger number of firms — 36 steel finishing lines belonging to 17 establishments — over a longer period (around 60 months), giving them enough variation over time and across lines for a fixed-effects approach where line-specific unobserved heterogeneity can be differenced out. They also examine a larger number of human resource practices including incentive pay, teams and flexible job assignment and find that, in general, bundles of alternative workplace practices yield large productivity gains. Their findings, of course, are still restricted to a very narrow industry, but few other disadvantages are present (other than the cost in conducting such a study).

For incentive pay, a different trend occurred in the literature. Some studies such as Seiler (1984), Brown (1992) and Parent (1999) use survey-based individual-level data to compare the wages of piece rate workers and fixed-rate workers. These studies tend to find wage premiums for piece rates that are consistent with enhanced incentives: if incentive pay raises productivity then employees on incentive pay contracts will be paid more. The natural problem is individual-specific unobserved heterogeneity: piece rate workers may be systematically different from fixed-rate workers in a manner unobserved to the researcher and correlated with wages. Parent (1999) improves upon the Seiler and Brown studies by using panel data so the individual-specific unobserved term is differenced out. A problem remains with this style of longitudinal study;

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[1] The degree of autonomy and decision-making ability in teams varies across cases. Banker et al (1996) define the continuum of teams, which ranges from quality circles—where membership is voluntary and decision-making is essentially restricted to making suggestions for improvements to the production process—to self-managing or self-directing teams—where work groups are a necessary part of the production process and have complete autonomy over the management and execution of their tasks (which may include hiring). Between these two extremes are semi-autonomous work groups, who manage and execute core production activities, but still rely on separate departments for functions related to the production process such as purchasing, recruiting and hiring, quality controls, and distribution functions.

namely, the *change* in contract that occurs over time (and is the source of identification) must be exogenous. On the other hand, the Parent study has the advantage of coming from nationally representative data.

More recent studies have gone the field-based case study approach typically used in management. For incentive pay, this approach has the important advantage of observing incentive pay contracts at the establishment-level. For instance, Lazear (2000) examines the case of a windshield installer firm that adopted piece rates and finds large productivity gains. This study is similar in spirit to Banker et al and other comparable papers from the management literature in that it is a before-and-after study of a single firm. However, a key advantage of Lazear relative to most previous work is that there is exogenous variation in when individual workers were allocated to piece rates giving a much more convincing source of variation from which to identify incentive effects. Other notable examples of individual-level productivity where contracts are observed at the firm-level include Paarsch and Shearer (1999 and 2000). A key contribution is Shearer (2004) where tree-planters from a single firm are randomly assigned to different contracts. Other than the case of random assignment, there is still a selection problem in these studies since contracts are a firm decision, and firms that use incentive pay may differ systematically from those that do not in a way that is unobserved and correlated with firm-level outcomes such as productivity / profitability — or individual-level outcomes such as productivity / wages through hiring 'better' workers.

Overall, the case-study / field research style papers have three key advantages: 1) excellent productivity information; 2) plants / firms are typically only chosen if a single, clear-cut workplace practice was introduced with no other change in human resource strategy, technology, and so forth; and 3) longitudinal information on productivity is typically available to see if the identified effects persist. The disadvantages of such studies are twofold: 1) the results are restricted to a very narrowly defined industry or occupational group (tree-planters, windshield installers, or assembly line manufacturing); and 2) unless random assignment has been used, there is always the question of why the firm made the workplace innovation, and whether that choice was related with unobserved factors that are correlated with characteristics of interest.

There is a scarcity of studies from multiple firms that represent a wide variety of industries. Three notable examples that use national survey data are Huselid (1995), Huselid and Becker (1996) and Cappelli and Neumark (2001). The advantage of these papers over field studies is that they can analyze the effects of a full array of organizational practices, and are much more representative. Huselid and Huselid and Becker use data only on publicly traded companies with more than 100 employees as has been common in the executive compensation literature (for instance, Jensen and Murphy, 1990). The cross-sectional case of Huselid found, in general, substantial productivity gains from certain bundles of workplace practices, but Huselid and

Becker found that — using the same data but with two years of observations so, to some extent, the firm-specific unobserved heterogeneity could be differenced out — that these effects vanished. Of course, with only a two-year panel, one must question how much variation in workplace practices over time exists. Cappelli and Neumark make a major contribution by examining a reasonably large, nationally representative sample of firms from all manufacturing sectors over a substantial number of years. They find that workplace practices which increase autonomy for workers raise employee compensation (labour cost per workers), but little evidence in favor of productivity gains. With the exception of profit-sharing plans, most of these establishment-level survey-based studies have had no or very limited information on incentive pay.

This paper provides evidence based on a methodology that lies between the two branches of the previous literature. In particular, I use unique data on firms where actual contracts and team-based work structures are observed for different business units within the firm, and earnings are observed at the individual level. This data allows for a multi-level framework where unobserved firm-specific heterogeneity can be controlled for, and identification of teams and incentive pay effects is driven by variation across business units within firms.

3. Data

The data used in this study come from the 2001 Incentive Pay Survey, conducted on behalf of the Toronto Board of Trade by a major consulting firm. The data is unique in several respects. First, the data was collected in seven modules which can be thought of as business units: top executives, lower executives, middle management, IT managers, non-supervisory professionals, IT workers, and support staff. Thus, a variety of human resource management practices — particularly compensation policies — are available at the business unit level for a homogenous group of employees. Second, it contains complete compensation information (salary, bonus, bonus plan, and job title) on all individuals in each firm for the modules that are relevant for a given firm, and that they agreed to report. However, at this point, I am only considering short-term incentive pay (i.e., bonus plans) at the business unit level. Third, the data contains information on the specific nature of compensation contracts within the firm including the structure of the contract, eligibility, performance measure, formula for computing amount and so forth. The most senior human resource staff member was contacted by the consulting company; apparently, in almost all cases, this was the individual who participated in the data collection. In addition, analysts from the consulting company followed-up with participants to ensure the company's compensation contracts were fully understood. Finally, the data merges this rich information from personnel records and contracts with relatively standard survey-based information – which contains many establishment-level and unit-level

characteristics researchers typically wish to control for. The principal disadvantages of the data are that a) it is only representative of firms in Toronto and therefore, may not reflect the nature of firms across Canada or elsewhere, and b) the cost of such rich information is that only a small number of firms can be surveyed. The number of establishments varies by module, but 415 firms reported information for at least two modules. Of course, we do not expect firms to respond to all modules. For instance, many firms in the data are subsidiaries or small divisions and so do not have any executives. As well, some firms simply do not have an IT department. An additional disadvantage of the data from the perspective of this paper is that I do not observe specifically which employees are members of teams. Fortunately, the data does contain information on teams at the module level, and thus I can distinguish between teams at the management level from the various non-management levels and so forth.

Table 1 provides descriptive statistics on the establishments in the data. As the table indicates, the data appears to be fairly representative with a wide variety of establishments present. Gross revenues vary from under $20 million to over $1 billion in a relatively even manner — although the distribution is slightly skewed towards lower revenue firms. Firm size is evenly distributed with around 20% of firms employing less than 100 employees, about 40% between 100 and 500 employees, and 40% over 500 employees. Manufacturing dominates the industry distribution at 25% of the sample, but all other major industry groups are represented. High-technology includes aerospace, electronics and precision instrument manufacturing, and software manufacturing, and is separated from other industries given the focus on IT workers that surveyors had at the time the data was collected. The public sector and related group includes the public sector, quasi-public sector such as hospitals, as well as charities and non-profits. Finally, I also present descriptive statistics on ownership and organizational structure. Many previous studies on teams – indeed, the human resource management literature in general — are based on large U.S. publicly traded companies such as the Fortune 500 companies, and one must question whether the results are applicable to private companies. In this data, about 38% of the firms are publicly traded and 44% are private, with the remainder being government, quasi-government (hospitals etc.) or not-for-profit establishments. As well, 40% of firms are parent companies with 46% being subsidiaries; the remainder consists of a mix of partnerships, government and related, and non-subsidiary divisions / units of a parent company.

Table 1
Establishment characteristics in 2001 Incentive Pay Survey

Characteristic	Proportion in data (%)
Industry:	
Manufacturing	25.2
High Technology	9.2
Trade	16.8
Finance and insurance	11.6
Transportation, communication, utilities	6.0
Public administration and social services	6.0
Business services, professional associations	4.0
Other private sector services	16.0
Not for profit organizations	4.8
Firm Size:	
Less than 50 employees	13.1
50 to 99 employees	13.4
100 to 249 employees	20.1
250 to 499 employees	19.4
500 to 999 employees	12.0
1000 + employees	22.1
Gross revenues for FY2000:	
Less than $5 million	11.7
$5.1 to $10 million	6.1
$10.1 to $20 million	11.7
$20.1 to $50 million	16.5
$50.1 to $100 million	14.2
$100.1 to $300 million	19.0
$300.1 to $1 billion	13.2
Over $1 billion	7.9
Organizational structure:	
Parent company or independent	41.4
Subsidiary	43.9
Other	14.7
Ownership:	
Publicly traded	37.6
Privately held	44.7
Other	17.7

Note: The number of firms is 415.

Table 2 reports summary statistics on all key human resource characteristics examined by business unit. The unit of analysis is position-firm cells so if you divide the sample size for each business unit by the number of firms you have the average number of distinct job titles per firm. There are a total of 192 job titles in the data, and these are based on information given by the firms in the study (as opposed to being a set of pre-determined job titles that firms had to try to fit their people into). In some cases, groupings were made in the data preparation stage; for instance, labour relations managers are grouped with human resource managers because there were only a smaller number of the former and the two functions were viewed as highly comparable. That said, the job positions are very homogenous in terms of job functions performed.

Short-term incentive pay refers to annual bonus plans, and long-term incentive pay refers to stock-based plans. A wide variety of types of short and long-term incentive plans exist in the data, but these differences are ignored at present with the exception of team-based plans (see below). Strictly speaking, the summary statistics are not comparable across business units since the number of underlying firms changes. In general, the incentive pay incidences are as expected with the use of incentive contracts — both short- and long-term — increasing with the level of position. Perhaps one surprise is the extent to which incentive pay is used among support staff. It is important to note that part-time, contract, and non-permanent workers are excluded from the data and so the support staff module (and IT staff which are often contracted out) only reflects full-time, permanent employees.

There are three team-related variables; two are survey-based and one is from the contract information. The first is referred to as ‘teams’ in Table 2 and indicates that employees in the relevant business unit *require* team or group input as part of their job function. This characteristic may be different from the various team definitions in the literature (see footnote 1 in section 2), which have been limited to assembly line-type manufacturing processes. The nature of teams may be very different across industries. For instance, there are several business / management consulting firms in the data which largely operate on a group project basis where group members have almost complete autonomy over the production process. Such a situation would be analogous to self-managing work teams in the manufacturing literature. All of these firms responded yes to the ‘teams’ question for their non-support staff. The nature of group-work and the extent of autonomy in other settings may be very different, however. It is, again, useful to stress that the analysis does not use cross-firm variation specifically for exactly this type of reason. We also observe whether business units use peer evaluation as part of the performance management process. The performance management literature recommends that firms use peer evaluation in cases where teams or group-based project work are an integral part of the production process. Indeed, the bivariate correlation between teams and peer evaluation is very high and statistically significant. The final team-related variable is team or group-based

Table 2
Summary statistics on human resource policies by business unit

Variable	Upper executives	Lower executives	Middle managers	IT managers	Non-supervisory professional	IT non-managers	Support staff
Total compensation ($)	186,113.60 (99,428.59)	141,913.40 (62,156.59)	72,626.35 (18,709.64)	83,507.67 (21,947.41)	55,863.40 (15,042.51)	54,987.93 (390.96)	36,935.65 (8,486.65)
Short-term incentive pay	.627 (.022)	.517 (.018)	.546 (.010)	.497 (.023)	.379 (.010)	.350 (.013)	.362 (.013)
Long-term incentive pay	.300 (.021)	.236 (.015)	.182 (.007)	.174 (.018)	.143 (.008)	.130 (.009)	.113 (.009)
Formal salary structure	-	-	.611 (.009)	.579 (.023)	.605 (.019)	.622 (.013)	.600 (.013)
Merit-based pay inceases	-	-	.446 (.010)	.521 (.023)	.490 (.010)	.493 (.013)	.458 (.013)
Team or group incentive pay	.125 (.015)	.079 (.010)	.124 (.006)	.068 (.012)	.096 (.006)	.055 (.006)	.141 (.009)
Teams	.135 (.015)	.164 (.013)	.150 (.007)	.118 (.015)	.142 (.007)	.115 (.008)	.169 (.010)
Peer-based perform. review	.077 (.012)	.103 (.011)	.110 (.006)	.122 (.015)	.088 (.007)	.113 (.008)	.076 (.007)
Profit-sharing plan	.203 (.018)	.155 (.013)	.159 (.007)	.126 (.016)	.159 (.007)	.111 (.008)	.181 (.010)
Gain-sharing plan	.027 (.007)	.022 (.005)	.041 (.004)	.028 (.008)	.049 (.004)	.026 (.004)	.051 (.006)
Number of observations	488	770	2699	459	2628	1441	1466
Number of firms	275	275	339	293	331	293	388

NOTES: Standard errors (deviation for total compensation) are in parentheses.

incentive pay. This variable indicates that the business units who responded yes to the 'teams' question *also* have group or team-based short-term incentive contracts (i.e., where the performance measure is a function of group or team-based components). It is useful to stress for econometric purposes that the team-based incentive pay variable is sub-category of the teams variable (all business units that equal one for team incentive pay also equal one for teams).

4. Analysis

This paper uses a multi-level (or hierarchical) model to estimate the effect of incentive pay, team-based structures and other workplace practices on total compensation. These types of models are useful when the data has a clustered or nested structure to it (e.g., Rabe-Hesketh et al., 2005). For instance, in our case, the data is nested from the individual-level, to positions or job titles, to business units (the module level), and finally into firms. Because no information besides bonus plans, compensation amount and job title is available at the individual-level, I use job titles as the first level. There are, in theory, a total of 192 job titles nested within seven business units (i.e., the modules), nested within a single firm. Only 250 firms reported in all seven modules, and the number of distinct positions per firm ranges from three to 95. The average number of business units per firm is 4.4, and the average number of positions per firm is 25. The data is essentially a type of unbalanced panel, but instead of multiple observations on the same firm over time — as in the longitudinal panel case — there are multiple observations on the same firm across business units. In total, there are 9,951 position-firm observations.

There are two key advantages to using multi-level statistical techniques for this type of data. First, they account for the fact that the set of covariates may be measured at different levels, and thus standard errors are properly computed — avoiding the well-known Moulton problem where, under standard regression techniques, standard errors for covariates that only vary at a higher aggregation level are understated and thus t-statistics are overstated (Moulton, 1986). Second, they allow for a combination of fixed-effects and random-effects at different levels of the data. Multi-level techniques are ideal for this data because salary, bonuses and job titles are observed at the job title level while compensation policies, use of teams and other workplace practices vary at the business unit level. Finally, other characteristics may vary at the establishment level; however, my strategy is to use firm-fixed effects to absorb all cross-firm variation. As noted previously, the basic strategy is to use variation across business units within firms to identify the effects of human resource management practices.

A key question to ask at this point is: how much variation in incentive pay and use of teams exists within firms? Cross-firm variation accounts for around 65% of the variation in bonus and stock-based incentive contracts. Not surprisingly, the variation

in profit-sharing and gain-sharing plans as well as formal salary structures and merit-based salary progression is almost all across firms, estimated at around 90% in all of these cases.

I begin the analysis with a 'naïve' approach where I estimate regressions by business unit (i.e., a total of seven regressions) of the form:

$$y_{ik} = \beta_0 + \beta_1 X_{ik} + \beta_2 Z_k + \varepsilon_{ik} \quad (1)$$

where subscript i denotes the position and subscript k denotes the firm; y denotes the log of total compensation (salary plus bonus), X is a position dummies; Z is a vector of firm-level characteristics including the human resource management practices in Table 2 as well as industry, firm size, and so forth; and ε is an error.

Equation (1) simply uses the samples contained in Table 2, and is similar in spirit to the standard, cross-sectional regression that has been estimated in previous studies. The key difference is that I am estimating it by business unit and so restricting the sample to a set of homogenous employees — in that sense, the results from (1) may be of some interest particularly for those business units such as IT staff and support staff, where perhaps there is minimal unobserved heterogeneity across firms. Alternatively, there is likely less heterogeneity in the types of individuals represented by the data than in previous cases where purely establishment-level means are used. It is important to stress that while incentive pay information is available at multiple levels within firms, an empirical strategy such as (1) only uses across-firm variation in these incentive contracts.

The results from these regressions are contained in Table 3. As noted earlier, the number of observations is position-firm cells. Because formal salary structures and merit-based salary progression are not available for the executive modules, I also estimate (1) for the five non-executive units including these workplace characteristics. The latter findings are listed in Table 4. The standard errors in both Tables have been corrected for the fact that the human resource practices only vary by firm. The estimates reveal substantial earnings premiums for three incentive pay schemes — short- and long-term plans as well as team-based plans. In Table 4, there is some evidence that merit-based salary increases are associated with higher total compensation. It is worth noting that the results are not sensitive to the inclusion of bonus pay in the dependent variable. If only base salary is used, the estimates for short-term incentive contracts are somewhat smaller overall; otherwise, the results are very similar.

Of course, the key problem with the empirical strategy in (1) is that incentive contracts are likely endogenous: firms that have chosen to use incentive contracts may have unobserved characteristics that are confounding the results. In particular, firms that use incentive pay may be, in the terms of Abowd, Kramarz and Margolis (2001), 'high-wage' firms in that they have unobserved characteristics that lead them to pay more

Table 3
Estimated coefficients for effects of human resource management practices on total compensation: Analysis by business unit using cross-firm variation

Variable	Upper executives	Lower executives	Middle managers	IT managers	Non-supervisory professional	IT non-managers	Support staff
Short-term incentive pay	.134*** (.036)	.104*** (.024)	.080*** (.011)	.023 (.021)	.082*** (.011)	.077*** (.012)	.002 (.009)
Long-term incentive pay	-.035 (.041)	.153*** (.030)	.086*** (.014)	.067** (.029)	.091*** (.014)	.016 (.017)	.012 (.012)
Team or group incentive pay	.092* (.051)	.078* (.041)	.016 (.016)	.081** (.038)	.066*** (.016)	.056** (.025)	.031*** (.013)
Teams	.092* (.052)	.019 (.036)	.006 (.015)	.050* (.033)	.012 (.015)	.024 (.019)	.003 (.012)
Peer-based perform. review	-.120* (.068)	-.038 (.044)	.017 (.018)	-.003 (.033)	.001 (.019)	.011 (.019)	.069*** (.017)
Profit-sharing plan	.052 (.040)	-.042 (.031)	-.021 (.015)	-.047 (.031)	-.036* (.016)	.001 (.018)	-.047*** (.012)
Gain-sharing plan	-.019 (.100)	.074 (.076)	.034 (.026)	-.031 (.058)	-.003 (.027)	-.009 (.034)	.015 (.019)
Position dummies	Yes						
Firm characteristics	Industry, Ownership, Organizational structure, Number of employees						
Adjusted R^2	.468	.469	.245	.450	.408	.512	.550
Number of observations	488	770	2699	459	2628	1441	1466
Number of firms	275	275	339	293	331	293	388

NOTES: Dependent variable is the log of total compensation (salary plus bonus). Standard errors are in parantheses. Statistical significance is denoted by *** for 1% level, ** for 5% level, and * for 10% level.

Table 4
Estimated coefficients for effects of human resource management practices on total compensation: Analysis by business unit using cross-firm variation, additional HRM practices

Variable	Middle managers	IT managers	Non-supervisory professional	IT non-managers	Support staff
Short-term incentive pay	.038*** (.011)	.016 (.022)	.051*** (.011)	.036*** (.012)	.004 (.009)
Long-term incentive pay	.046*** (.015)	.067** (.028)	.094*** (.015)	.017 (.017)	.024** (.013)
Team or group incentive pay	.015 (.015)	.085** (.035)	.066*** (.016)	.054** (.025)	.030* (.013)
Teams	-.007 (.015)	.050* (.033)	.013 (.015)	.028 (.019)	-.001 (.013)
Peer-based perform. review	.020 (.018)	-.006 (.033)	-.003 (.019)	.010 (.019)	.068*** (.017)
Profit-sharing plan	-.013 (.015)	-.040 (.031)	-.036* (.016)	.004 (.018)	-.045*** (.012)
Gain-sharing plan	.036 (.026)	-.026 (.058)	.001 (.026)	-.009 (.034)	.015 (.019)
Merit-based salary progression	.042*** (.011)	.027 (.019)	.014 (.012)	.023** (.012)	.030*** (.009)
Formal salary structure	.006 (.011)	.021 (.021)	.003 (.011)	-.017 (.012)	-.024*** (.009)
Position dummies	Yes				
Firm characteristics	Industry, Ownership, Organizational structure, Number of employees				
Adjusted R^2	.249	.454	.409	.514	.554
Number of observations	2699	459	2628	1441	1466
Number of firms	339	293	331	293	388

NOTES: Dependent variable is the log of total compensation (salary plus bonus). Standard errors are in parantheses. Statistical significance is denoted by *** for 1% level, ** for 5% level, and * for 10% level.

for unobserved reasons. For example, firms that use incentive pay may employ higher skill workers (perhaps because of better hiring practices, or because more productive workers are more likely to be attracted to an incentive-based firm, and so forth) that would earn more anyway.

I now proceed to an empirical framework that addresses some of the shortcomings of the above approach where only cross-firm variation is exploited. The regression of interest is as follows:

$$y_{ijk} = \beta_0 + \beta_1 X_{ijk} + \beta_2 Z_{jk} + \beta_3 \lambda_k + \varepsilon_{ijk} \quad (2)$$

and where subscripts j represent the business unit level; y is the log of total compensation; X contains a vector of 192 job position dummies; Y contains business-unit level covariates including all human resource management practices; λ represents establishment fixed-effects (i.e., 414 firm dummies); and ε is an error term.

Two approaches to ε will be taken: one case where it is considered a standard i.i.d disturbance term with mean zero and variance σ_ε^2 and one case where I use

$$\varepsilon_{ijk} = \eta_{jk} + \nu_{ijk} \quad (3)$$

where η_{jk} is a business unit-specific discrete random effect, which captures unobserved business-unit heterogeneity. In the first case, no allowance is made for some business units within firms being systematically different in an unobserved manner from other business units within the firm in a way that is correlated with both the level of salaries and with human resource management strategy. For example, a firm may have a specific reason for using incentive pay for IT managers, but not for IT staff — a decision that we do see in the data. Of course, whatever this rationale is must also play a role in the decision on setting salary levels within the firm in order to bias the estimates in (2). The second case uses (3), and models unobserved business-unit factors as a discrete random effect. This type of model is similar to the Heckman and Singer (1984) model in the case of duration data, and is also known as a mixture regression model. Estimation is by maximum likelihood. Rather than assuming η has a bivariate normal distribution as in a standard random-effects model, we assume η has a bivariate discrete distribution and so takes on a number of discrete values, or mass points, with a certain probability. The premise is that business units fall into a certain number of types that we do not observe. I begin by assuming two mass points which is consistent with there being two types of business units, ‘high-paying’ units and ‘low-paying’ units where by ‘high-paying’ we mean that the firm would pay the relevant business unit more for reasons that are not observed in the data. The Gateaux derivative method can then be used to see if adding another mass point yields a larger maximized likelihood — and is therefore a preferred characterization of the data (Follmann and Lambert, 1989).

Table 5 presents the results from the firm fixed-effects regression where only within-firm variation is used to identify incentive effects. The findings contrast starkly with the previous results of Tables 3 and 4. The short-term incentive pay estimate vanishes while the long-term incentive pay estimate is around half the size found in the previous analysis, depending on the business unit. That said, the long-term incentive premium is still sizeable at 5.5%. Clearly, if the earnings regressions translate into productivity results, this is an important implication for firms. The most striking feature of Table 5 is the effect of teams. Recall that the team / group incentive pay variable indicates the business units that use teams also have an incentive pay program that uses team / group-based performance measures. The results indicate that such business units have earnings premiums on the order of 8-11%.

Table 5
Estimated coefficients for effects of human resource management practices on total compensation: Pooled analysis using within-firm-variation, and no random-effect for business units

Variable	Including executives	Excluding executives
Short-term incentive pay	.020 (.015)	.022 (.017)
Long-term incentive pay	.055*** (.013)	.034** (.015)
Formal salary structure	-	-.023 (.017)
Merit-based pay increases	-	-.027 (.019)
Team or group incentive pay	.031** (.015)	.030** (.016)
Teams	.049** (.021)	.082*** (.024)
Peer-based perform. review	.034* (.019)	.022 (.024)
Profit-sharing plan	.025 (.023)	-.000 (.032)
Gain-sharing plan	.063 (.079)	-.026 (.109)
191 position dummies	Yes	No
160 position dummies	No	Yes
414 firm dummies	Yes	Yes
Adjusted R^2	.837	.714
Number of observations	9951	8693

NOTES: Dependent variable is the log of total compensation (salary plus bonus). Standard errors are in parantheses.

5. Summary

This paper uses unique data on firms where human resource management practices are observed for different levels of the firm's hierarchy and compensation is observed for all job positions. This data allows for a different methodological approach than has been used in the previous literature. Moreover, the data is more representative of different types of establishments — for instance, different industries — than previous studies where the focus has been on manufacturing (often narrowly defined).

Overall the results indicate that while short-term bonus plans are associated with large earnings premiums in a cross section of firms — even when a homogenous group of workers is used as the sample — these premiums vanish when within-firm variation is used and the job position is held constant. The apparent incentive effects of long-term stock-based schemes persist when within-firm variation is used although the magnitude of these effects falls by 50%.

On the other hand, I find no effect of teams on earnings across firms, but when business units within firms are compared, substantial earnings premiums for teams are estimated. Moreover, team or group-based incentive pay plans are systematically associated with positive incentive effects across all models. When we combine the teams effect with the team-based incentive pay effect, we are left with a sizeable premium of around 8-11% — even when business-unit unobserved heterogeneity is controlled for. Two caveats must be stressed. First, the analysis assumes that earnings premiums arise from productivity gains. This assumption is reasonable in the case of incentive pay plans, but may be a strong assumption for teams (or any other high-performance workplace practice). It could be the teams effect is capturing a transfer of rents from the firm to the workers rather than a productivity effect. Second, in order to use within-firm variation, I must make the assumption that incentive effects are the same across the firm hierarchy. That said, analysis that exclude executives indicates that the latter assumption is not inappropriate.

References

Abowd, J., F. Kramarz, and D. Margolis. 1999. 'High wage workers and high wage firms.' *Econometrica*, Volume 67, Number 2, pages 251-333.

Appelbaum, E. and R. Batt. 1994. *The new American workplace: Transforming work systems in the United States*. Ithaca, N.Y.: ILR Press.

Banker, R.D., J.M. Field, R.G. Schroeder, and K.K. Sinha. 1996. 'Impact of work teams on manufacturing performance: A longitudinal analysis.' *Academy of Management Journal*, Volume 39, Number 4, pages 867-890.

Brown, C. 1992. 'Wage levels and method of pay.' *Rand Journal of Economics*, Volume 23, Number 3, pages 366-375.

Cappelli, P. and D. Neumark. 2001. 'Do "high-performance" work practices improve establishment-level outcomes.' *Industrial and Labor Relations Review*, Volume 54, Number 4, pages 737-775.

Follmann, D.A. and D. Lambert. 1989. 'Generalizing logisitic regression by nonparametric mixing.' *Journal of the American Statistical Association*, Volume 84, pages 295-300.

Griffin, R.W. 1988. 'Consequences of quality circles in an industrial setting: A longitudinal assessment.' *Academy of Management Journal*, Volume 31, Number 2, pages 338-358.

Heckman, J. and B. Singer. 1984. 'A method of minimizing the impact of distributional assumptions in econometric models for duration data.' *Econometrica*, Volume 52, pages 271-320.

Huselid, M.A. 1995. 'The impact of human resource management practices on turnover, productivity and corporate financial performance.' *Academy of Management Journal*, Volume 38, Number 3, pages 635-672.

Huselid, M.A. and B.E. Becker. 1996. 'Methodological issues in cross-sectional and panel estimates of human resource-firm performance link.' *Industrial Relations*, Volume 35, Number 3, pages 400-422.

Ichniowski, C., K. Shaw, and G. Prennushi. 1997. 'The effects of human resource management practices on productivity: A study of steel finishing lines.' *American Economic Review*, Volume 87, Number 3, pages 291-313.

Jensen, M.C. and K.J. Murphy. 1990. 'Performance pay and top-management incentives.' *Journal of Political Economy*, Volume 98, Number 2, pages 225-264.

Lazear, E. 2000. 'Performance pay and productivity.' *American Economic Review*, Volume 90, Number 5, pages 1346-1361.

Paarsch, H. and B. Shearer. 1999. 'The response of worker effort to piece rates: Evidence from the British Columbia tree-planting industry.' *Journal of Human Resources*, Volume 34, Number 4, pages 643-667.

Paarsch, H. and B. Shearer. 2000. 'Piece rates, fixed wages, and incentive effects: Statistical evidence from payroll records.' *International Economic Review*, Volume 41, Number 1, pages 59-92.

Parent, D. 1999. 'Methods of pay and earnings: A longitudinal analysis.' *Industrial and Labor Relations Review*, Volume 53, Number 1, pages 71-86.

Rabe-Hesketh, S., A. Skrondal, and A. Pickles. 2005. 'Maximum likelihood estimation of limited and discrete dependent variable models with nested random effects.' *Journal of Econometrics*, Volume 128, pages 301-323.

Seiler, E. 1984. 'Piece rate vs. time rate: The effect of incentives on earnings.' *Review of Economics and Statistics*, Volume 66, Number 3, pages 363-376.

Shearer, B. 2004. 'Piece rates, fixed wages, and incentives: Evidence from a field experiment.' *Review of Economic Studies*, Volume 71, Number 2, pages 513-534.