

# **Reconsidering Pay Dispersion's Effect on the Performance of Interdependent Work: Reconciling Sorting and Pay Inequality**

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## ABSTRACT

Pay dispersion in interdependent work settings is virtually universally argued to be detrimental to performance. We contend, however, that these arguments often confound inequality with inequity, thereby overestimating inequity concerns. Consequently, we adopt a sorting (attraction and retention) perspective to differentiate between pay dispersion that is used to secure valued employee inputs and pay dispersion that is not. We find that the former is positively related to interdependent team performance, the latter has no effect or is detrimental, and the approach itself helps to reconcile the pay dispersion literature's disparate results. Curvilinearity tests reveal potential constraints on the sorting argument.

Because interdependent work requiring substantial employee interaction to complete core tasks is commonplace in today's organizations, it is critical to understand how to most effectively manage employees in this type of setting. Pay dispersion, a topic of great interest in the recent management literature, is virtually always presumed to be counterproductive when work is interdependent. Numerous authors from economics (e.g., Akerlof & Yellen, 1988; Hicks, 1963; Levine, 1991) and management (e.g., Bloom, 1999; Ferraro, Pfeffer, & Sutton, 2005; Harrison & Klein, 2007; Shaw, Gupta, & Delery, 2002) argue that pay dispersion in an interdependent work context causes inequity perceptions corrosive to employee attitudes, commitment, and cooperation, thereby hampering collective (i.e., team, unit, organizational) performance. In contrast, we argue here that the commonly held conceptual arguments against pay dispersion in interdependent work settings conflict with both relevant theory and the extant empirical research. It is, for example, difficult to reconcile the inequity-based denunciation of pay dispersion in interdependent work settings with the substantial pay-for-performance literature that advocates paying unequal contributors unequally (as failure to do so is itself an inequitable practice [Brown, Sturman, & Simmering, 2003; Heneman & Werner, 2005]).

Such inconsistency, however, is critical to redeveloping theory because it provides the opportunity to "challenge the value of a theory and to explore its weaknesses and problems" (Alvesson & Kärreman, 2007; p. 1265), which is our goal here. We believe the inconsistencies in this case to be consequences of conceptual and empirical approaches to employee inputs (e.g., equating pay inequality with pay inequity) that in fact are incompatible with key tenets of not only equity theory, but of sorting principles (i.e., the attraction and retention of quality employees) as well. This conceptual and empirical confluence risks leading scholars and professionals to adopt conceptual approaches and pay practices that are of questionable validity.

Thus, we aim to challenge the conventional wisdom with a theory-grounded framework that both contradicts the inequity-based critiques of pay dispersion in interdependent work and largely resolves the discrepancies in the relevant empirical research.

While authors studying the pay dispersion-performance relationship, at all levels of work interdependence, tend to pit the incentive potential of pay dispersion against its potential inequity-driven disruptiveness (e.g., Bloom, 1999; Kepes et al., 2009; Pfeffer & Langton, 1993; Shaw et al., 2002), we move beyond these existing perspectives by theorizing that sorting is a critical mechanism through which pay dispersion, even in highly interdependent work settings, can facilitate group performance. Additionally, we differentiate between pay dispersion that is explained by productivity-relevant employee inputs and pay dispersion that is not to illustrate why both positive and negative dispersion effects on performance emerge in the literature. We then, in a highly interdependent work context, test whether pay dispersion and team performance are positively related when (and only when) pay dispersion is explained by the sorting of employee inputs. Finally, given recent nonlinear approaches to the impacts of pay dispersion (Brown et al., 2003) and human capital (Ployhart, Weekley, & Ramsey, 2009), we explore possible curvilinear dispersion effects that would reveal constraints on the sorting rationale.

## **CONCEPTUAL DEVELOPMENT**

### **Key Definitions and Model Components**

We study pay dispersion in a team-based context in which the tasks required for team success are highly interdependent, defining interdependence as the degree to which completion of the organization's tasks require employees to interact (Cummings, 1978; Thompson, 1967). We investigate lateral pay dispersion within the dominant job in an industry. Lateral (or horizontal) pay dispersion involves pay differences across employees within the same job or

within a single organizational level (Bloom, 1999; Pfeffer, 1994). In contrast to vertical pay dispersion (i.e., pay differences between employees in jobs at different hierarchical levels), lateral pay dispersion is often the focus when there are many incumbents in a single core job, as is frequently the case in more professionalized occupations (e.g., sports professionals, physicians, nurses, lawyers, accountants, teachers, academicians, etc.).

Central to our thesis is an inputs-based differentiation of pay dispersion types. *Dispersion in explained pay* (DEP) is the amount of variation in the employee pay that is tied to sorting, the acquisition and retention of productivity-relevant employee inputs (see Figure 1). Specifically, because certain employee inputs (typically job performance) are associated with organizational productivity, they are productivity-relevant (and thus strategically-relevant) explanations for pay dispersion under both independent *and* interdependent work. Pay dispersion associated with the securing of these productivity-relevant employee inputs (via attraction and retention) is, by definition, DEP, as illustrated in Figure 1. In contrast, *dispersion in unexplained pay* (DUP) is the amount of variation in the employee pay that is unexplained by these productivity-relevant inputs. Thus, DUP is dispersion in the pay that is attributable to factors unrelated to employee productivity (e.g., politics, discrimination, favoritism, random decisions, etc.).

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 Insert Figure 1 and Table 1 about here  
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Researchers to date have typically studied overall pay dispersion, with each study's statistical modeling specification determining (at times inadvertently, in our view) whether DEP or DUP was primarily at work. In Table 1 we summarize the empirical pay dispersion—performance research, along with our informal assessment of whether the pay dispersion

modeled more closely represented DEP or DUP. Such classification should allow for a better understanding of the disparate research findings (we return to Table 1 in more detail later).

### **Pay Dispersion and Sorting**

The compensation literature (Gerhart & Rynes, 2003; Lazear, 2000) classifies pay effects on employee behaviors as associated with either incentives or sorting. While we believe that incentive pay can, under certain circumstances, have positive implications for team performance, our emphasis here is on sorting, which, as an explanation for interdependent performance, has been virtually ignored in the pay dispersion literature. The sorting premise stipulates that pay linked to inputs can yield human capital advantages by serving to attract and retain higher ability, better performing employees (Gerhart & Rynes, 2003; Lazear, 2000). In part because pay dispersion, pay level, and pay-for-performance practices are jointly tied to the exact same aggregated individual pay level decisions, there is indirect evidence that greater dispersion in the pay linked to productivity-relevant employee inputs (i.e., DEP) should facilitate such sorting. Larger pay differentials (and thus more DEP) are frequently characterized by high pay levels needed to secure the most talented employees, with research indicating that high pay level increases the ability to attract and retain the most talented workers (Krueger, 1988; Shaw, Delery, Jenkins, & Gupta, 1998). Similarly, pay-for-performance, as distinct from pay level, also appears to be associated with both larger inputs-based pay differentials (and thus more DEP) and sorting advantages, in that it positively affects the attraction of high ability, high performing employees (Cadsby et al., 2007; Lazear, 2000) and the retention of high performers (e.g., Salamin & Hom, 2005; Trevor, Gerhart, & Boudreau, 1997).

Although pay level and DEP are strongly related and thus have some similar sorting effects, DEP also has unique sorting advantages. Individuals, including those with high

performance and talent inputs, depend on social comparisons to evaluate their pay (e.g., Adams, 1963; Barnard, 1938; Pfeffer & Langton, 1993) and react to the degree of perceived advantage in these comparisons. DEP results in those high in the pay distribution (via performance or talent inputs) having high relative pay, and evidence shows that pay dispersion strengthens perceptions of favorable pay for these employees (Trevor & Wazeter, 2006). As a result, individuals located near the top of a highly dispersed pay distribution should feel relatively advantaged and, consequently, be less likely to quit (Pfeffer & Davis-Blake, 1992). Additionally, on the attraction side of sorting, because individuals enjoy the status associated with higher rank in a pay hierarchy, they have an incentive to choose the hierarchy in which they will enjoy the most relative pay and status advantages (Frank, 1985), which will be a distribution with high DEP. Finally, we note that a low-DEP alternative, paying everyone at the same high level, loses the social comparison-based sorting advantages, drives up labor costs, and assumes that all individuals and their roles are equally critical to success and thus require top-of-the-market pay.

Little empirical work, however, exists on whether pay dispersion in general, or DEP in particular, has sorting consequences. Using a sample of high-level administrative personnel from multiple academic institutions, a context that appears to be very low in work interdependence, Pfeffer and Davis-Blake (1992) found support for pay dispersion's sorting potential; specifically, for those high in the pay distributions, turnover diminished as pay dispersion (and presumably DEP) increased. Similarly, Shaw and Gupta (2007) found that, when performance-based increases were emphasized and the pay system was well-communicated (a likely context for DEP), greater pay dispersion predicted a reduction in the number of high performing truck drivers that quit. However, because this trucking sample (like the Pfeffer and Davis-Blake, 1992, sample) is *not* an interdependent work setting (Shaw et al., 2002, p. 495), the relevance of pay

dispersion to the retention of interdependent workers remains untested. Further, we found no research directly addressing pay dispersion effects on employee attraction. To formally examine the sorting premise that is the foundation for our unconventional team-performance predictions, we propose that teams with high DEP (i.e., teams that more closely tie pay to productivity-relevant inputs) will fare better in the attraction and retention of high inputs employees (i.e., those who previously have performed at high levels).

H1: Relative to low DEP teams, high DEP teams will attract more high inputs players and retain more high inputs players.

### **DEP's Sorting Effects (and Lack of Inequity Effects) on Team Performance**

Sorting advantages that accrue to DEP should, all else equal, contribute to enhanced team performance. But while there has been some recent progress in understanding the favorable incentives implications of pay dispersion when paying for inputs in a *highly independent* work context (see Shaw et al. [2002] and Kepes et al. [2009]), scholars agree that, in *interdependent* settings, pay dispersion is particularly detrimental to aggregate performance (e.g., Akerlof & Yellen, 1988; Bloom, 1999; Ferraro, Pfeffer, & Sutton, 2005; Franck & Nuesch, forthcoming; Harrison & Klein, 2007; Hicks, 1963; Levine, 1991; Kepes et al., 2009; Pfeffer & Langton, 1993), even if the dispersion is tied to inputs. Authors linking pay dispersion with unfairness at any level of work interdependence typically cite equity theory (Adams, 1963) principles to argue that large pay differentials yield inequity perceptions, psychological distress, reduced cooperation, disharmony, lower commitment, and increased turnover (e.g., Akerlof & Yellen, 1988; Bloom, 1999; Ferraro et al., 2005; Lazear, 1989; Levine, 1991; Pfeffer & Langton, 1993).

Pay dispersion, however, tells us only that pay allocation is unequal, not that it is inequitable. Leventhal (1976) and Steers and Porter (1983) describe *pay equality* as equal pay for



all employees (i.e., low pay dispersion, regardless of pay equity) and *pay equity* as pay proportionate to employee inputs (i.e., potentially any level of pay dispersion, as long as pay is tied to productivity-relevant inputs). This equality versus equity difference, though often overlooked, is crucial: pay dispersion implies pay inequality, DEP implies pay equity, and only DUP implies pay inequity (see Figure 1). The equity and fairness literature clearly stipulates that it is pay inequity, rather than pay inequality, that prompts negative employee reactions (e.g., Ambrose & Kulik, 1999; Deutsch, 1985; Heneman & Judge, 2000; Leventhal, 1976). Therefore, pay dispersion that is explained by inputs regarded as productivity-relevant should be perceived as equitable and should not yield counterproductive responses. Hence, the idea that DEP (or even overall pay dispersion if primarily DEP) should yield negative reaction is *not*, contrary to what has often been contended, consistent with equity and fairness theories.

As long as individual contributions can be identified, nothing in the above argument is particular to independent work. In fact, in interdependent contexts where individual contributions are identifiable, inequity perceptions are more likely *without* pay dispersion, as pay equality, assuming variation in inputs, produces pay inequity. Indeed, researchers that focus on social loafing, which is the undesired tendency for people to reduce effort and productivity when in groups, maintain that money tied to individual inputs (Sheppard, 1993; p. 70) “can serve as powerful incentives for behavior, countering the reduction in effort typically exhibited by participants who are combining their efforts.” In this well-developed literature, it is the task interdependence itself that leads to motivation loss, while pay tied to individuals’ productivity-relevant inputs, and the subsequent DEP, is a tactic to combat it. Thus, when work is interdependent and pay is tied to individual inputs, we find little conceptual support for the predictions that pay dispersion will lead to perceived inequity and its behavioral fallout.

In terms of empirical support, perhaps because the conventional wisdom has so often been presumed to be true, only four Table 1 studies (Bloom, 1999; Eriksson, 1999; Main et al., 1993; Shaw et al., 2002) explicitly reported testing whether work interdependence would result in negative pay dispersion effects on performance or would mitigate any otherwise favorable pay dispersion effects. Of these, only Bloom (1999) reported clear support (later we argue that this study involves neither interdependent work nor DEP). Negative pay dispersion effects are reported in a number of studies in which work interdependence is not addressed, however, and it is likely that these have fueled the popular conception of pay dispersion as corrosive to teamwork. As we focus on in the next section, though, most of the empirical literature cited in support of detrimental pay dispersion effects, regardless of work interdependence, appears to be modeling DUP rather than DEP. DUP, by definition, has none of the sorting advantages of DEP, and is more susceptible to the inequity-based problems so often cited (see Figure 1).

In sum, under our conceptual model, and as predicted in H1, DEP should yield sorting advantages when work is interdependent (or independent for that matter), as larger pay differentials based on productivity-relevant inputs facilitate top talent attraction and retention. As is often stipulated (e.g., Barnard, 1938; Becker & Gerhart, 1996; Pfeffer, 1994), and as has been empirically demonstrated (e.g., Ployhart et al., 2009), enhanced human capital results in greater aggregate-level productivity. Thus, to the degree that DEP sorts higher aggregate human capital to the team, the effect on performance should be positive. Furthermore, DEP, by definition, entails pay inequality but *not* the pay inequity that fairness theories identify as problematic. Finally, the social loafing literature (e.g., Sheppard, 1993) stipulates that there is incentive value from pay tied to inputs in interdependent work. Consequently, we do not see DEP in the presence of work interdependence as likely to generate the considerable inequity perceptions and effort

reduction necessary to overwhelm DEP's sorting benefits. To address this, we provide the first empirical test of the entire pay dispersion → inputs → group productivity causal chain.

We first isolate DEP and DUP measures, then test for a DEP effect and for differences between DEP and DUP effects. Second (see Figure 1), we test whether the pay dispersion that is used to secure (is mediated by) employee inputs (i.e., the sorting effect) will have a positive effect on performance. This indirect effect, by definition, is a DEP effect. We then compare the indirect (DEP) effect of the pay dispersion used to secure inputs with the direct (DUP) effect of the pay dispersion that is independent of inputs; thus, we differentiate the pay dispersion that should facilitate team performance (DEP) from the pay dispersion less apt to do so (DUP).

H2a: Pay dispersion explained by productivity-relevant employee inputs (DEP) will be positively related to team performance; this positive effect will be more favorable than the effect of pay dispersion that is net of inputs (i.e., DUP).

H2b: Productivity-relevant employee inputs will mediate overall pay dispersion's relationship with team performance, resulting in a positive indirect, sorting effect (i.e., a positive DEP effect); this sorting (DEP) effect will be more favorably related to team performance than will be the direct (DUP) effect.

### **Modeling, the Loss of DEP, and the Emergence of DUP**

Given our arguments that DEP should positively affect organizational performance in interdependent work settings, why do studies often report negative overall pay dispersion effects? One reason may be that organizations actually do at times fail to adequately tie pay to productivity-relevant inputs such as performance (e.g., Kahn & Sherer, 1990; Heneman & Werner, 2005; Schwab & Olson, 1990), which negates sorting benefits and makes more likely the often-cited, inequity-driven problems. We argue that a second reason for negative pay

dispersion effects, at all levels of work interdependence, is a methodological artifact, in that DUP, which has none of DEP's sorting benefits, is sometimes inadvertently modeled in this research. Our concern is that, unless explicitly studying DUP (e.g., as in Cowherd & Levine's 1992 study), researchers may mistakenly attribute DUP effects to total pay dispersion or, worse yet, to DEP, thereby perpetuating the belief that pay dispersion is inherently detrimental.

Specifically, we contend that, via decisions about what covariates to include in regression models, authors have at times largely partialled out the DEP from total pay dispersion, thus increasingly leaving only DUP (i.e., H2b's and Figure 1's direct effect of dispersion that is independent of inputs and not expected to have positive effects). For example, pay level strategy (mean pay) appears as a control variable in several analyses of pay dispersion effects (see Table 1). One argument for including it is to account for a high wage effect that would manifest in talent advantages to organizations that paid more (e.g., Bloom, 1999). This rationale, however, is precisely why our emphasis on pay tied to productivity-relevant inputs necessitates a different modeling approach. Controlling for mean pay level "parcels out the positive effects of pay dispersion: attraction and retention of star players who are paid a great deal, thus resulting in better team performance, higher team pay, and greater dispersion" (Gerhart & Rynes, 2003, p. 182). In a second argument, Harrison and Klein (2007) contend that researchers should control for the within-group mean because it may be confounded with the disparity measure. In a pay-setting context, however, such confounding is exactly why we examine pay dispersion effects both with and without the mean controlled. Because paying for talent yields both high mean pay and high pay dispersion (Gerhart & Rynes, 2003), we focus on distinguishing the dispersion that covaries with high talent and mean pay (i.e., DEP) from the dispersion that does not (i.e., DUP). Isolating the degree of this covariation, or "confound," is central to our contribution.

Similarly, partialling out a pay-for-performance strategy measure risks parsing out DEP and increasingly leaving DUP as the dispersion modeled. Despite their insightful discussion regarding fair bases for pay dispersion, Pfeffer and Langton (1993) partialled out the within-department correlation between employee pay and productivity (which correlated with pay dispersion at .31) when predicting faculty productivity. Thus, they actually modeled only the pay dispersion that was unrelated to the pay tied to job performance inputs, likely largely capturing DUP effects. Moreover, the pay-productivity correlation was *positively* related to productivity in the Pfeffer and Langton data (Gerhart & Rynes, 2003), suggesting that, in contrast to the detrimental pay dispersion effect reported by the study's authors, conditions were present that would make a positive DEP effect likely.

As with partialling out pay strategies that yield productivity-relevant inputs, controlling for productivity-relevant inputs themselves also can yield the modeling of DUP and pay dispersion effects that do not reflect dispersion's sorting benefits. Bloom (1999), for example, in analyses leading to the reporting that pay dispersion hindered performance in interdependent work, partialled out a measure of baseball team talent. Similar partialling of productivity-relevant inputs occurs in several other studies reporting negative pay dispersion effects (e.g., Frank & Nuesch, forthcoming; Jewell & Molina, 2004; Leonard, 1990; Siegel & Hambrick, 2005). Such an approach, however, serves to parcel out the positive sorting effects of pay dispersion (Gerhart & Rynes, 2003), likely leaving DUP as the pay dispersion modeled in the regression analysis.

As an informal exploration of our belief that these modeling issues have led to confusion in the field, we applied our DEP/DUP logic to the extant work in Table 1. Thus, the table includes our judgment of whether DEP or DUP was the primary type of pay dispersion modeled in each study (see the table note for our decision rules). These judgments found that, while three

studies yielded results counter to our framework and three were ambiguous, 17 studies supported our positions: in general, DEP yields positive effects, DUP yields zero or negative effects, and partialling out pay strategies and the productivity-relevant employee inputs they produce leaves less DEP, more DUP, and lower likelihood of observing the sorting benefits that sound pay policy can provide. Thus, we contend that, *in both independent and interdependent work*, the pay dispersion effects reported often strongly depend on how pay dispersion is modeled.

H3: In an interdependent work setting, controlling for pay level strategy, pay-for-performance strategy, and productivity-relevant employee inputs will partial out positive effects of pay dispersion on team performance, resulting in a negligible or negative pay dispersion effect.

### **Pay Dispersion and Curvilinearity**

Although we have thus far challenged the inequity-based critique of pay dispersion and promoted a more favorable sorting-based characterization of DEP, we also acknowledge that a more nuanced approach to DEP may be necessary. Brown et al. (2003), for example, while recognizing the value of linking pay to inputs, still theorized on inequity grounds that pay that is too widely dispersed may be detrimental. At some point, even pay differences clearly explained by inputs might be seen as too large, and thus inequitable. Indeed, organizations attempt to ensure that performance-based pay differences between individuals are not disproportionate to actual performance differences (Milkovich & Newman, 2008). With such disproportion, pay dispersion may still be “explained,” but the explanation may be deemed inadequate, and the pay inequitable, given the extreme differentials. Thus, individual incentive effects in groups, such as those identified in the social loafing literature (e.g., Sheppard, 1993), could be tempered by inequity concerns when the subsequent pay differentials (i.e., DEP) are

very large. Moreover, any such inequity perceptions driven by extreme DEP may constrain the sorting advantages DEP would normally provide, as under-reward inequity perceptions can lead to voluntary turnover (Gerhart & Rynes, 2003; Heneman & Judge, 2000).

There is an additional basis for expecting diminishing sorting returns to DEP. There are often inherent limitations in an organization's development of certain capabilities, such as the capacity to utilize resources (Helfat & Peteraf, 2003). That is, as talent resources (inputs) grow beyond a certain point, the organization may become less effective at managing them, thus constraining the leveraging of DEP-driven talent into performance. For instance, work teams may perceive some level of a capability such as managing talent as satisfactory and refrain from developing the capability further (Winter, 2000). Based on this capability argument, Ployhart et al. (2009) hypothesized and found that the positive effect of sales force human capital on store performance diminished at higher human capital levels. Similarly, Barry and Stewart (1997) found a curvilinear effect of the personality dimension extraversion on group performance, perhaps indicating "too much of a good thing" (Gerhart & Rynes, 2003). Hence, despite DEP's sorting advantages, the enhanced inputs that greater DEP yields may not be accompanied by proportionate increases in managing those inputs and, subsequently, in team performance. This potential, coupled with the inequity-based argument for diminishing returns to DEP, suggests the following nonlinear relationship.

H4: The positive effect of DEP on team performance will be attenuated at high levels of DEP.

## **METHODS**

To test our hypotheses, we study National Hockey League (NHL) teams, a population in which data on pay and readily observable performance are available at both individual and

organizational levels, and in which there is considerable player movement across teams. Also, team performance in hockey depends on strong work interdependencies (Beaucamp & Bray, 2001; Foster & Washington, 2009; Frey et al., 1986; Gerhart & Rynes, 2003), which is regularly cited as the context in which pay dispersion will be particularly disruptive (e.g., Akerlof & Yellen, 1988; Bloom, 1999; Levine, 1991; Pfeffer & Langton, 1993; Pfeffer, 1994).

## **Data**

The individual player and team performance data used for this study are from the official records of the NHL. We acquired these records from the websites hockeydb.com and hockeyzoneplus.com, as well as annual editions of the NHL's Official Guide & Record Book (e.g., National Hockey League, 2002). The dataset used for the team-level analyses consists of pay and performance data for each team in the NHL during each of the seasons ending in 1998 through 2004. Thus, the dataset consisted of 201 total team-years, as the league housed 26 teams in 1998 and expanded to 27 teams in 1999, 28 teams in 2000, and 30 teams in 2001-2004. The usable sample for our team-level analyses dropped to 175, as we used year  $t-1$  measures of productivity-relevant employee inputs when predicting year  $t$  team performance.

Our team-year measures were built from an initial dataset of 4,465 player-year observations, which included annual performance and salary statistics for each individual non-goalie player that played in the league during our study period. We focused on non-goalies because performance criteria (and thus pay-for-performance strategies) are distinctly different for goalies; moreover, the small number of goalies per team (two or three) precludes reliable measures of within-team pay dispersion for that group of players. Also, to enhance reliability in our productivity-relevant measures, we limited inclusion in the database to individual players who appeared in at least 20 of their team's 82 games in any given season.



## Dependent Variable

**Team performance.** Our first on-ice measure, *points*, is calculated by the NHL by summing two points for each regular season win, one point for each tie, and one point for each overtime loss (this component was added by the NHL two years into our study window). Points determine position in the standings during the regular season of play, which teams make the playoffs, and how those teams will be seeded in the playoffs. Because the ultimate on-ice goal of NHL teams is to win the Stanley Cup championship, however, our second on-ice measure, *round*, is each team's final position in the playoff tournament bracket. Each year 16 teams make the playoffs, with teams advancing to subsequent rounds only by winning a best-of-seven series of games. Round takes on the following values for each year: 0 (all non-playoff teams); 1 (8 teams that lost in the first round); 2 (4 teams that lost in the second round); 3 (2 teams that lost in the third round); 4 (1 team that lost in the fourth round); and 5 (1 championship team). Because playoff injuries, opponent match-ups, and reduced variance in the measure suggest that round will be less reliably predicted than points, we expected that the support for our hypotheses might be weaker when predicting round. We restrict our analysis to the prediction of on-ice performance because the linkage between pay strategies and team off-ice performance (e.g., profitability) is significantly more distal and tenuous.

## Independent Variables

Because empirically isolating DEP and DUP is challenging, we take three approaches (partialling, mediation, and predicted values/residuals) and assess whether our findings are robust to technique choice. We summarize our approach to the key predictors in Table 2.

**Inputs.** Job performance is the classic employee input from a rewards perspective (Steers & Porter, 1983), and is the basis for our sorting arguments for pay dispersion effects on

team performance. Based on a measure of individual player value officially approved by the National Hockey League Players' Association (NHLPA) for use in fantasy hockey league play, our inputs measure represents the performance aspect of the productivity-relevant employee inputs depicted in Figure 1. The sanctioned measure is the sum of seven on-ice performance components: goals, assists, plus/minus (the differential between goals scored and allowed when the individual is on the ice and the team scoring is not on a power play), power play and shorthanded goals and assists (we use goals here, as power play and shorthanded assist data were unavailable for all years; our amended formula produced scores that correlated with the official measure's scores at .994 in 2002-2004), penalty minutes, shots on goal, and defensive goals and assists (ESPN, 2007). Each component was standardized (within-year) prior to the addition of the components. To account for injury and other sources of unreliability among inputs, we used a two-year average (from years  $t-1$  and  $t-2$ ) when the data were available. We used the within-team-year mean of individual inputs to create team-year *inputs* (i.e., the team-year level of productivity-relevant employee inputs). Inputs correlated with raw salary at .69 at the individual level and .79 at the team-year level. Year  $t-1$  inputs are used to predict year  $t$  performance.

**Pay variance.** We use *pay variance* within each team-year observation to operationalize pay dispersion. Unlike some previously used dispersion measures, variance does not explicitly factor out the mean and is thus consistent with our emphasis on avoiding the partialling of mean pay effects (as noted in the Discussion section, alternative dispersion measures yielded results highly similar to those found with the variance operationalization).

**Dispersion in explained pay (DEP).** To estimate DEP and DUP, we used an individual-level, league-wide regression of logged (due to extreme positive skew) CPI-adjusted pay on individual-level performance inputs. The regression equation used was:

$$Y_{it} = P_{it-1}A + X_{it}B + e_{it}, \quad (1)$$

where  $Y$  = a vector of CPI-adjusted and logged pay level observations for player  $i$  in year  $t$ ,  $A$  and  $B$  = regression coefficient vectors,  $X$  = a matrix of dummy variables representing years,  $e$  = an error term reflecting the residual for player  $i$  in year  $t$ , and  $P$  = a matrix of values from the individual-level inputs measure and its square from year  $t-1$ .

The  $R$  for this equation was .72 and the  $R^2$  was .52, indicating that just over half of the individual pay level in the population was a function of the observable performance data captured in the individual-level inputs measure. Each player's predicted value of pay level (i.e.,  $\hat{y}_{it}$ ) from this league-wide regression represents their expected pay, given how the entire market rewards the observable inputs in the equation. Thus, within-team variation in these predicted pay values is variation in pay that can be explained by observable productivity-relevant data. Consequently, our measure of *DEP\_predicted* is simply the variance of the predicted values of individual pay level for all players on the team-year observation (i.e.,  $\sigma^2_{\hat{y}_{it}}$ ).

**Dispersion in unexplained pay (DUP).** To measure DUP, we again make use of the league-wide individual-level regression described in equation (1). Each residual from the analysis is the individual pay that is independent of the productivity-relevant player observables. Thus, the variance of these residuals (within team-year) represents pay dispersion that is unexplained by these data. Because this variance of player residuals is dispersion in unexplained pay, we refer to this measure as *DUP\_residual*.

**DEP and DUP from model specification.** Pay dispersion used to secure productivity-relevant employee inputs is, by definition, DEP. Consequently, in mediation models where we test the indirect (sorting) effect of pay variance through employee inputs, this indirect effect is a DEP effect, while the remaining direct effect is a DUP effect. Consistent with our critique of the

modeling of pay dispersion in earlier research, we also assess DUP via our independent variable combinations in our analyses. Controlling for pay strategies and productivity-relevant employee inputs leaves DUP as the unpartialled component of pay variance (see Table 2 and Figure 1).

**Pay-for-performance strategy.** We also correlated, within each team-year, individual inputs from year  $t-1$  and logged individual pay from year  $t$  to create the pay strategy variable, *pay-for-performance* (see Pfeffer and Langton, 1993, for a similar measure of pay-for-performance). Logged salary was used in these team-year correlations to account for the exponentially increasing pay returns as individual inputs increase.

**Pay level strategy.** Mean pay level is the average salary for individual players within each team-year and was used to measure pay level strategy. Before averaging, we adjusted the salaries for the Consumer Price Index (CPI), leaving all salaries in 1998 dollars.

## Analysis

**Dependent variable distributions.** While our points dependent variable is relatively normally distributed, the rounds dependent variable is distributed as event count data. The Cameron and Triveldi (1986) regression-based test for overdispersion indicated that the conservative negative binomial regression model, rather than Poisson regression, was appropriate when predicting round.

**Dependent observations.** Because we needed to account for the fact that teams appeared in the data set an average of 5.83 times, we used random and fixed effects models to reduce concern that any unmeasured organization-level variable could be driving both team pay and team performance. Random effects models produce matrix-weighted averages of the between-unit and within-unit effects, whereas fixed effects models, by definition, partial out stable between-unit differences, leaving the regression coefficients as estimates of purely within-unit

effects (e.g., Wooldridge, 2002). Thus, our fixed effects analyses yield within-team effects of pay dispersion, with the coefficients indicating the expected increase in a team's performance when that team increases pay dispersion by one unit (i.e., a fixed effects model is essentially equivalent to estimating a separate regression of team performance on pay dispersion within each team, using the multiple years of data as observations, and then averaging these separate regressions' dispersion effects to obtain the fixed effects estimates).

Our fixed effects (within-team) analyses evoke, but must be interpreted differently than, the within-individual analyses in Lazear's (2000) influential individual-level study of pay-for-performance's sorting and incentives effects on productivity. Under the assumption that ability was stable over time, Lazear's adding of individual-specific dummy variables (the equivalent of a fixed effects analysis) controlled out stable between-individual ability differences; this was interpreted as controlling out pay-for-performance's sorting effects. The remaining pay-for-performance effect (i.e., the pay-for-performance coefficient after controlling out ability) was interpreted as the impact of a change in one's motivation brought on by a change to his/her pay-for-performance status. In contrast, our analysis is at the team level, where rather than remaining constant, each team's "ability" (i.e., player inputs) changes from year-to-year (46% of the year  $t$  variation in team inputs was left unexplained by year  $t-1$  inputs). Thus, while stable individual differences were partialled out via fixed effects in Lazear's study, stable team differences, which do *not* include the changes in team inputs, are partialled out here. That is, within-team sorting effects are *not* partialled out from pay dispersion coefficients via our use of fixed effects models.

Actually, it is our mediation analyses, where we do partial out team inputs completely, that parallel Lazear's individual-level fixed effects approach. In both cases the ability/inputs effect (sorting) is partialled and the pay strategy coefficient is considerably reduced. In our study,

the pay dispersion effect essentially disappears when inputs are controlled, indicating sorting, rather than incentives, as responsible for positive pay dispersion effects on team performance.

**Mediation versus moderation.** We use mediation to isolate the effects of pay dispersion that operate either via inputs (i.e., DEP effects) or independent of inputs (i.e., DUP effects). A moderation approach is less appropriate in that it tells us about the effects of overall dispersion when a moderator is high or low, potentially independent of dispersion's actual explanations. For example, pay dispersion, even under high pay-for-performance, could still be largely attributable to other factors, as performance is often less important than factors such as seniority in the prediction of pay (Bishop, 1987; Medoff & Abraham, 1980).

**Generated regressors.** In some models we use residuals and predicted values from an individual-level pay level regression (see equation [1] above) in our attempts to isolate DEP and DUP effects in subsequent regressions. Because such generated first stage terms are subject to error when estimated, standard errors tend to be underestimated in the second analysis (Pagan, 1984). Consequently, to account for this generated regressor bias, for all models in our primary analyses that include the generated DEP\_predicted and DUP\_residual terms, we use a bootstrapping technique to obtain appropriate standard errors (e.g., Efron & Tibshirani, 1993; Mooney, 1996; Stine, 1990). Specifically, we resampled the data 1,000 times, with replacement (by cross-sections to account for the panel structure); in each of the 1,000 bootstrapped samples, we conducted both the stage-one and stage-two regressions. We then used standard deviations from the stage-two sampling distributions of regression coefficients to provide appropriate stage-two standard errors. This commonly used method is asymptotically valid and has recently been shown to perform acceptably when the number of clusters (teams in our study) approaches 30 (Cameron, Gelbach, & Miller, 2008), which is the number of teams in our data.

## RESULTS

Our framework recognizes that organizations may implement decisions on pay from a strategic perspective (so as to better attract, retain, and motivate talented employees). We can draw inferences about whether pay is in fact implemented strategically from the stability of certain pay practices over time. That is, relatively stable pay practices over time would suggest that these practices reflect strategic policy (Gerhart & Milkovich, 1990; Mintzberg, 1978), rather than random fluctuation. Consequently, we computed the year-to-year correlations in pay practice for several of our measures. The mean year-to-year correlations for pay variance (.86), pay level (.84), pay-for-performance (.51), and DEP\_predicted (.69) support the idea that organizations are consistently following particular policies with regard to pay-setting. Because productivity-relevant employee inputs should then reflect what we believe to be strategic approaches to pay-setting, we should also see evidence of stability in this measure. The mean year-to-year correlation for employee inputs was .74.

Means, standard deviations and intercorrelations are presented in Table 3. Although we standardized the independent variables in all regression analyses to aid in interpretation, the Table 3 means and standard deviations are in the original metrics. There is a strong positive relationship between pay variance and pay-for-performance ( $r = .45$ ), and between pay variance and mean pay level ( $r = .86$ ). This is consistent with our contention that the two pay strategies and pay dispersion are jointly tied to the exact same aggregated individual pay level decisions. Similarly, Table 3 reveals strong positive relationships between pay variance and inputs ( $r = .65$ ). This relationship is quite consistent with our sorting explanation of pay dispersion benefits. In combination, these correlations suggest that our sample is characterized by a high degree of strategically allocated pay.

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Insert Table 3 about here  
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### **Pay Dispersion and Sorting (H1)**

In H1 we predicted that DEP will yield advantages in the attraction and retention of the productivity-relevant inputs that subsequently facilitate team performance. At the team level, this hypothesized sorting advantage is supported by three types of evidence: the .68 correlation between DEP\_predicted and inputs; the multivariate regression, which is one step in the H2b mediation analysis, and reveals a large positive, statistically significant effect of overall pay variance on inputs; and the mediation results themselves in which overall pay dispersion drives team performance through inputs (see the H2b results). Additionally, because sorting is an organization-level perspective that is derived from aggregated individual-level employee movement outcomes, particularly revealing data are accessible at the individual player level. To focus on the sorting of players of varying value, we examined players in the upper quartile, the lower quartile, and the middle 50% on our individual-level measure of player inputs. All players continuing in the league from one year to the next were characterized as either stayers (remained with the prior year's team) or movers (went to a new team via a trade or as a free agent). Mover and stayer inputs were measured as of year  $t-1$ , and the DEP levels of the teams on which these movers and stayers flowed to were measured as of year  $t$ , thus allowing us to assess whether low, average, and high inputs players tended to differentially flow to and from teams with more DEP.

Table 4 reveals the inputs-specific movement patterns of movers and stayers, as well as a depiction of total player movement. Each of the three breakdowns yields an overall chi-squared value that is statistically significant, meaning that year  $t$  player inputs level is related to whether players flowed to high or low DEP teams in year  $t+1$ . The nature of the relation is revealed



through the percentage of players in each cell and through each row's contribution to the overall chi-squared value. These row contributions in each breakdown indicate that the high inputs players (i.e., high performers) are primarily responsible for the overall chi-squared value and statistical significance; this high inputs player sorting accounted for approximately 71% (for stayers; i.e., 45.2 / 63.9), 79% (for movers), and 75% (for all players) of the overall chi-squared value that itself indicates a relationship between DEP and player inputs. Focusing, then, on the high inputs row, Table 4's stayers analysis (top) shows that 419 (65%) of the high inputs stayers spent the next year on teams above the DEP median, which is 25.6% greater than the cell's expected value if DEP and stayer inputs were unrelated (i.e., 51.7% of the 645 high inputs stayers, which is 333.5); as the 1.85 (i.e., 419/226) in the ratio column indicates, this means that 85% more high inputs stayers remained with high DEP teams than remained with low DEP teams (see the Discussion section for the nuances of the high DEP retention advantage). Similarly, for movers (Table 4, middle), 104 (61.5%) of the high inputs movers spent the next year on teams above the DEP median, which is 29.2% greater than the cell's expected value if DEP and mover inputs were unrelated (i.e., 47.6% of the 169 high inputs movers, which is 80.4); here the 1.60 in the ratio column reveals that 60% more high inputs movers went to high DEP teams than went to low DEP teams. Finally, Table 4's total player movement analysis (bottom) mirrors the mover and stayer sorting component analyses, as, overall, 80% more high inputs players played the following year on high DEP teams than on low DEP teams (moderate and low inputs players were slightly more likely to play on low DEP teams the following year). Clearly, the statistically significant relationship between DEP and player inputs is driven by high DEP teams faring better than low DEP teams in the attraction and retention of high inputs players (additional regression analyses confirmed this point, as the DEP of the team that the player

moved to or stayed at had a positive and statistically significant effect on the inputs level of the acquired/retained player). In short, as predicted in our framework and in H1, DEP yielded clear sorting advantages in our data. Not surprisingly given the high level of explained pay in our data, these results were replicated when we substituted overall pay variance for the DEP measure.

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Insert Table 4 about here  
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### **DEP and Team Performance (H2a, H2b)**

Tables 5 (points) and 6 (round) provide tests of our hypotheses that DEP should, via sorting effects, lead to more effective team performance, and should yield more favorable effects than DUP. Models three and eight in each table yield support for H2a. Specifically, under both random and fixed effects models, DEP\_predicted (i.e., the within team-year variance in predicted values from the individual-level regression of pay on prior year performance inputs) had a statistically significant, positive association with points and round. For example, the DEP\_predicted coefficients from Model three in Tables 5 and 6 reveal, respectively, that a one standard deviation increase in DEP\_predicted predicts 5.04 additional points, which is .32 of a standard deviation, and a .34 increase in logged rounds advanced in the playoffs (a 40% increase in actual rounds). In terms of the relative sizes of DEP and DUP effects, we tested for statistical differences between the two. As indicated in the Wald tests summarized at the bottom of Table 5's Models three and eight, the DEP\_predicted coefficient was larger than the DUP\_residual coefficient using both the random effects (5.04 versus -.12) and fixed effects (3.64 versus -.93) approaches. Similarly, in Table 6's Models three and eight, when predicting round, the DEP\_predicted coefficient was again statistically greater than the DUP\_residual coefficient

under both random (.34 versus .04) and fixed effects (.28 versus -.02) estimation. Thus, H2a was supported, as DEP effects on performance were positive and more favorable than DUP effects.

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 Insert Tables 5 and 6 about here  
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Support for a pay dispersion effect through sorting also emerged in our mediation tests of H2b. Sobel (1982) tests consistently revealed a statistically significant, positive effect of pay dispersion on team performance that operated through the securing of inputs. In three of the four mediation scenarios, the nested models' positive pay variance effects essentially completely disappeared once inputs were incorporated as predictors. For example, in Table 5, the pay variance coefficient declined from 5.10 in Model 1 to -.05 when inputs were added in Model 2 (see also Table 5's Models 6 and 7, and Table 6's Models 1 and 2). In Table 6's Models 6 and 7, the pay variance effect went from near zero to negative when the inputs mediator variable was included, still revealing a positive indirect effect (see Mackinnon et al., 2002, for how indirect effects can be present in the absence of total effects). The indirect effects are calculated by multiplying the mediator (inputs) effect by the effect, from a separate (unreported) regression, of pay variance on inputs. In terms of effect size, a one standard deviation increase in pay variance leads to inputs enhancements that ultimately translate, under random and fixed effects specifications, to 5.39 points and 3.58 points, respectively, and to .40 and .35 increases in logged rounds advanced in the playoffs, respectively (the latter two effects represent 49% and 42% increases in actual rounds).

In terms of testing the relative DEP and DUP effects through mediation, as described in H2b, we compared the indirect (DEP; sorting) effect of pay variance through inputs to the direct pay variance (DUP) effect. Indirect effects appear to be more favorable than direct effects under

all conditions, though available estimation techniques limited our testing of statistical differences to the more conservative fixed effects models. Wald tests revealed that pay variance produced indirect (DEP) effects through inputs that were statistically greater than direct (DUP) effects (3.58 versus -.05 when predicting points and .35 versus -.19 when predicting round). Thus, we found support for H2b as mediation analysis indicated that overall pay dispersion that secures productivity-relevant inputs produces more favorable effects on performance than does DUP.

In sum, whether predicting points or round, and whether using the mediated approach or the more direct measure of DEP\_predicted, DEP was positively related to team performance, and was more favorably so than DUP. Both approaches indicate this is a manifestation of pay dispersion's sorting advantages when paying for productivity-relevant inputs.

### **Partialling Covariates and DUP (H3)**

In several tests of H3, we found that controlling for pay level and pay-for-performance strategies, and for productivity-relevant inputs, removed the positive pay dispersion effects on team performance; presumably this occurred because what remained of pay variance was DUP, which resulted in a negative or negligible pay dispersion effect. For example, whereas an increase of one standard deviation in pay variance in Table 5's Models one and six predict statistically significant increases of 5.10 and 3.76 points, Models five and ten reveal that the same pay variance increase predicts statistically significant *decreases* of 5.16 and 5.89 points when pay level and pay-for-performance strategies were controlled. When inputs are added to the baseline Models one and six, the pay variance effects essentially go to zero (see Models two and seven). A similar general pattern emerges in the round models. In all cases, the pay variance coefficient when pay strategies or inputs were present as covariates was statistically different from the coefficient when pay strategies or inputs were absent.

These H3 findings illustrate the enormous impact of covariate decisions on whether DEP or DUP is modeled, as well as the stark contrast between DEP and DUP effects on performance. The results support not only H3, but also our interpretation of the Table 1 research. Controlling for relevant inputs or the pay strategies designed to produce them partials out DEP from pay variance and largely leaves DUP to predict performance. Thus, negative pay dispersion effects in such scenarios should not implicate overall pay dispersion, or DEP in particular, as detrimental.

#### **Curvilinearity (H4)**

Table 5's Models four and nine indicate that DEP has a curvilinear effect on team performance, as the squared DEP\_predicted term, as predicted, is negative and statistically significant when predicting points. Plotting the relationships indicates that positive DEP\_predicted effects not only diminish in size as DEP\_predicted increases, but also become negative as the curve turns slightly downward at the higher DEP\_predicted levels in the data. Additional analysis, however, qualifies this inference. Following the procedure in Aiken and West (1991) for analyzing curvilinearity, we computed several simple slopes (i.e., the DEP\_predicted linear effects, which are tangents to the curvilinear plot, at specified values of DEP\_predicted) and their standard errors. For Table 5's Model 4, this produced statistically significant DEP\_predicted effects of 13.08 when DEP\_predicted is at its minimum (-1.85 SD), 10.00 when at negative one SD, 6.38 when at the measure's mean, and 2.76 at plus one SD. But at values of DEP\_predicted that were at plus 1.5 SD and above, the DEP\_predicted effects were not statistically significant, though they do become negative at two SD's and above.

Curvilinearity under fixed effects (Model 9) followed a very similar pattern.

For the round regressions, the statistically significant squared term in the random effects model also indicated curvilinearity. Simple slope analysis of Table 6's Model four produces

DEP\_predicted effects of 1.10 when DEP\_predicted is at its minimum (-1.85 SD), .84 when at negative one SD, .52 when at its mean, and .37 at plus one half SD. At values of DEP\_predicted that were at plus one SD and above, the DEP\_predicted effects were not statistically significant, though, as in the points analysis, they do become negative at two SD's and above. The squared DEP\_predicted term in the fixed effects round model was not statistically significant. We interpret the round findings as supportive of curvilinearity, however, as the Hausman (1978) test indicated that random effects modeling, which is more efficient, was appropriate in this instance.

In sum, both the points and round analyses produced an attenuated positive effect of DEP\_predicted on team performance. As DEP\_predicted increases, its positive effects diminish, eventually becoming no different from zero (though negative in sign).

### **Supplemental Analyses with Instrumental Variables**

While our primary analyses supported our hypotheses, we also conducted supplementary analyses using instrumental variables to more conservatively test causal direction. As instruments, we used metropolitan area population and metropolitan area income, which should (via income stream, subsequent ability to pay, and the inputs ultimately secured by pay) primarily affect team performance through pay and inputs. Because lagged values of independent variables are frequently suitable as instruments (e.g., Blalock, 1985), we also use one-year lags of the pay and employee input variables. The two commonly cited requirements for instrument suitability, association with the independent variable to be instrumented (once the other predictors have been partialled) and lack of correlation with the error term (e.g., Wooldridge, 2002), generally appeared to be satisfied here. These instrumental variable analyses (available upon request) generally supported our predictions of positive DEP effects on team performance, diminishing returns at high DEP, and less favorable DUP effects. Support was less consistent in

round models, though round was expected to be more difficult to predict because it is a less reliable indicator of team performance than is points.

## DISCUSSION

In this study we conceptually and empirically distinguished between dispersion in the pay explained by productivity-relevant inputs and dispersion in the pay left unexplained by such inputs. We couched this distinction in a sorting explanation in which, contrary to conventional wisdom, pay dispersion when work is interdependent can facilitate team performance. In support, and robust to a variety of empirical techniques, DEP in a highly interdependent work context produced sorting advantages that resulted in team performance gains.

### **Pay Dispersion and Interdependence**

The conceptual approach and empirical findings presented here are not only new, but are in stark contrast to the prevailing wisdom, as interdependence is virtually always cited as the context in which pay dispersion will be particularly disruptive (e.g., Akerlof & Yellen, 1988; Bloom, 1999; Levine, 1991; Pfeffer & Langton, 1993; Pfeffer, 1994; Shaw et al., 2002). *Indeed, we were unable to find a single example of a hypothesized positive effect of pay dispersion on performance in an interdependent work setting.* Empirical work on pay dispersion, however, has focused primarily on independent settings, or not addressed the issue. For example, of the 23 studies in Table 1, we identified two as from high work interdependence settings, seven from low interdependence settings, one that used samples from each, and 13 in which interdependence was unknown. Some studies have asserted that they test pay dispersion effects under interdependence but have, in fact, used only settings with unknown or low levels of interdependence. For instance, Bloom (1999) argues that his baseball performance finding underscores the problem with pay dispersion in interdependent work. However, we note that

baseball is a sport characterized by pooled interdependence (Foster & Washington, 2009; Keidel, 1987), which is the least interdependent form of work as described in Thompson's (1967) hierarchical ordering. Keidel (1987) further describes baseball player interaction as minimal and baseball itself as (p. 592) "a metaphor for the autonomy of organizational parts." In another attempt to (empirically) examine the role of interdependence (Shaw et al., 2002, Study 2), the "high" interdependence condition was actually not very high. Interdependence was measured as "extent of use of self-managed teams." The response options were 1 (None), 2 (Almost none, 1-20%), 3 (Some, 21-40%), 4 (About half, 41-60%), 5 (Most, 61-80%), 6 (Almost all, 81-99%), and 7 (All, 100%). The overall mean score in the sample was 1.45. Thus, "high" interdependence (mean + 1 SD), 2.29, fell closest to response option 2, "Almost None." Similarly, in two studies that failed to find evidence that "interdependence" moderated dispersion effects (Eriksson, 1999; Main et al., 1993), the work itself was never described. In contrast, one aspect of our sample that made it of considerable interest here is that hockey is a highly interdependent work setting (Beaucamp & Bray, 2001), as hockey team performance is characterized by reciprocal interdependencies (Foster & Washington, 2009; Frey et al., 1986; Gerhart & Rynes, 2003) in which the outputs of individual members become the inputs for other members and vice versa. Thompson (1967) characterizes such reciprocal interdependence as the most interdependent form of work.

Although the prevailing view of pay dispersion as detrimental in interdependent work contexts may be a reasonable position under DUP, where equity theory predicts such problems, DEP appears unlikely to yield such disruption. Indeed, interdependent work may even allow employee perceptions of co-worker inputs to be more accurate (via greater observability), further reducing the likelihood of disruption due to DEP. Moreover, it may be that most team members



understand that success hinges on having talented team members, which hinges on paying to attract and retain them. In sum, given our conceptual framework, the lack of prior work on pay dispersion in truly interdependent settings, and our findings of DEP's positive effects in an interdependent context, we believe the common characterization of interdependent work as incompatible with pay dispersion is unwarranted, unless explicitly addressing DUP.

### **Sorting Benefits of Pay Dispersion**

The incorporation of sorting, a fundamental avenue for examining pay effects (Gerhart & Rynes, 2003; Lazear, 2000), into the dispersion-performance debate informs the issue and maintains an emphasis on inputs. Our findings demonstrate a potent sorting role in explaining dispersion benefits to team performance, as well as in understanding what differentiates DEP and DUP. Hence, we strongly encourage pay dispersion researchers to address sorting, which may well be the primary determinant of dispersion's effect. Indeed, the absence of a sorting role in prior pay dispersion work likely contributed to the disparate results and overly negative view of pay dispersion, even when work was independent in nature.

Our sorting findings indicate that, generally, high DEP teams are better at retaining and attracting the talent that ultimately drives team performance. A closer look at the retention side, however, yields a more nuanced inference. High DEP teams retain many more high inputs players than do low DEP teams, but actually retain only a slightly higher proportion of them (80% to 78%). Thus, the retention advantage is that high and low DEP teams retain similar proportions of differently sized talent pools, as high DEP teams tend to have more high inputs players to begin with.

In addition (or in contrast) to our position on DEP yielding sorting advantages, it might also be argued that simply paying high, and equally high (i.e., high pay, low DEP), for all talent

(from a pay level perspective) or for all performance (from a pay-for-performance perspective) would yield sorting advantages as well. This approach, however, would usually be untenable from a labor cost perspective, requires teams or organizations to be comprised of only members with equally high talent or equally high performance (otherwise, high pay for all necessitates DUP), and runs contrary to the strong tendency for teams and organizations to be designed around roles that contribute unequally to success (e.g., hierarchies in organizations, surgical teams, law firms in which partners bring in business and associates conduct research, stars and role players in professional sports teams, etc.). Thus, we see little practical or conceptual reason to doubt the contention that high pay for talent and pay-for-performance suggest positive DEP effects on sorting, rather than uniformly high pay effects.

### **Sorting and Incentives**

Although we have grounded this study in employee sorting, with incentives conspicuously downplayed, we suggest that sorting is often consistent with the incentive approach. Expectancy theory (Vroom, 1964) stipulates that two major influences on motivation to perform are valence (the attractiveness of the reward) and instrumentality (the perceived likelihood that performance will be rewarded). DEP's larger pay returns to productivity-relevant employee inputs should result in not only sorting, but also in enhanced motivation via greater valence (assuming that a larger payoff is more attractive) and a clarified line-of-sight (instrumentality) between such inputs and pay. In our sample, however, controlling for sorting (i.e., partialling the prior year's [year  $t-1$ ] individual performance inputs) controls out (i.e., mediates) virtually the entire positive pay dispersion effects (e.g., see Models 1 and 2, Table 5; and see Models 1 and 2, Table 6). Because the positive pay dispersion effect essentially

disappears when players' prior performance inputs are controlled, sorting, rather than incentives, is primarily responsible for positive pay dispersion effects on team performance in our study.

Another potential role of incentives in a sorting scenario emerges when considering more closely the member characteristics of those that self-select into teams. It could be that high-DEP teams are more attractive to players that are more attuned to the pay-for-performance aspects of high DEP environments. For example, as a result of their heightened attention to the proportionality of rewards and inputs, players more sensitive to pay equity may tend both to be more likely to self-select into high-DEP scenarios and to be more motivated by the high instrumentality. Consequently, DEP could yield incentive benefits in addition to sorting advantages (though our context yielded little evidence of such incentive effects). To the degree, however, that those high in equity sensitivity also are high in raw ability, a sorting explanation for DEP's benefits becomes more nuanced, as high performers are attracted to high-DEP teams, but we cannot necessarily attribute the pre-sorting performance to ability rather than motivation. Thus, while it is clear that DEP led to team performance through the sorting of prior high performers to current high-DEP teams (rather than through incentives per se, as explained above), we cannot be certain of the relative contributions of ability and motivation to the individuals' prior performance.

The sorting and incentives synthesis suggested here is further complicated, and generalizability is potentially constrained, under at least two conditions. First, recent research indicates that, for equity-sensitive individuals, pay secrecy constrains perceived instrumentality, thereby reducing task performance (Bamberger & Belagolovsky, 2010). Thus, for those individuals otherwise likely to self-select into high-DEP scenarios under highly visible pay structures, a lack of transparency in pay amounts may make high DEP less attractive (from a

sorting perspective) and less motivating. Second, the sorting and incentives synthesis is considerably more viable when individual contributions are identifiable. Absent this visibility, instrumentalities become less clear and inequity perceptions may increase. Organizations also then may find it more difficult to align individual incentives with group objectives. Ultimately, we encourage a more balanced view of pay dispersion that recognizes DEP's sorting advantages, its potential incentives benefits, and, when individual contributions cannot be identified or pay amounts are unknown, its potential incentives liabilities.

An additional concern with a lack of some degree of individual performance visibility is that it may open the door for the emergence of incentives for counterproductive behaviors. The pay dispersion literature we reviewed, as well as other work (Ambrose, Seabright, & Schminke, 2002; Latham & Pinder, 2005), indicates that the main cause of counterproductive team behaviors, such as sabotage of team members or lack of cooperation, is perceived inequity (which DEP, except perhaps when at extreme levels, should preclude). We acknowledge, however, that such behaviors can also result from raw self-interest and/or incentives that strongly incentivize only individual performance, rather than team performance. However, even as performance visibility diminishes, it often may be unlikely that the conditions necessary for such problematic behaviors to occur exist. These enabling conditions include (Alchian & Demsetz, 1972; Prendergast, 1999): a lack of penalties for and an inability to observe such counterproductive behaviors (interdependent work will tend to allow team members to be aware of each others' actions, making behaviors such as anonymous sabotage unlikely); little importance of reputation among peers; a significant lack of goal alignment between team members and the organization; and a true zero-sum situation where the performance and/or pay of one team member comes at the expense of another (Kandel & Lazear, 1992). Most team

settings, however, probably do not satisfy these conditions very well. In most settings where significant interdependence exists, the success of one team member does not come at the expense of another. The development and timely launch of a successful new product, for example, will reflect well on the product team members and success is most likely when everyone on the team performs at a high level; hence, even with some difficulty in identifying individual performance contributions, DEP in such situations should not tend to result in counterproductive behavior. Moreover, even if such behavioral incentives exist, teams have strong norms and expectations of their members that can also act as a powerful deterrent to behaviors that will harm the team and its members (Barker, 1993). Of course, careful consideration must always be given to how best to balance individual, team, and organization-level incentives.

### **Context and Generalizability**

Given our sample, considerable attention must be paid to various contextual and generalizability concerns. Two key contextual elements when considering dispersion's effects are the degree of pay-for-performance and, as discussed above, the identifiability (i.e., measurability) of the performance inputs, which have important implications for sorting and pay system design, respectively. Professional hockey is very high on the pay-for-performance and individual contribution identifiability dimensions. Hence, future research is needed on DEP and DUP effects when these two contextual dimensions are lower than in our study.

Relatedly, although performance is the classic input from an equity perspective (Steers & Porter, 1983), other inputs that drive pay dispersion may well be seen as productivity-relevant proxies and thus as acceptably strategic explanations for dispersion (e.g., skills, tenure, formal certifications). It is likely, however, that the acceptability and value of dispersion lessen as the explanation for pay differentials increasingly deviates from objectively assessed performance, as

will occur as individual performance contribution identifiability declines. And the greater this deviation the more likely that the sorting, incentive, and equity arguments that we have attempted to synthesize would diverge. Pay tied to seniority, for example, may be viewed as equitable if seniority is believed to proxy performance, but may neither attract and retain high performers nor incentivize performance.

Additional generalizability questions arise because professional athletes are extremely well paid people, have very short careers, and are among the very best in the world at what they do. These three qualities in combination put them in a rather unique position, relative to what we consider to be mainstream employees in commonly held jobs. On the other hand, in an economy where individual talent is increasingly at a premium (e.g., *The Winner Take-All Society*, Frank & Cook, 1995; *The War for Talent*, Michaels, Handfield-Jones, & Axelrod, 2001) and there are likewise star performers with star salaries in a variety of occupations (e.g., attorneys, consultants, executives, realtors, investment bankers, entertainers, salespeople), perhaps the situation outside of sports is not always so different. In any case, we welcome pay dispersion research that goes beyond the sports realm to further our examination of DEP and DUP. Moreover, although team performance often defines organizational success in professional sports (Danielson, 2004), non-sports research can directly speak to DEP effects on financial outcomes by assessing whether DEP's benefits (i.e., sorting and incentive effects) outweigh its costs.

Finally, we reiterate that our sample does have the critical high work interdependence that much of the prior pay dispersion research has either lacked or not addressed. Often cited as the context in which pay dispersion will be particularly disruptive, interdependence appears here to provide little constraint on pay dispersion's potential to produce, via sorting, positive effects on team performance.

## The Pay Dispersion Construct and Modeling Issues

Our research suggests several meaningful conceptual and empirical considerations for pay dispersion research that we have yet to fully address. An important concern here that has received little attention elsewhere is the possibility of a curvilinear pay dispersion effect (see Brown et al., 2003, for an exception). Results suggest that, at least in our sample, at higher levels of dispersion in explained pay (DEP), increases to this dispersion yield diminishing returns and, ultimately, no additional performance advantages. Additional (unreported) analyses using mediation replicated this finding, as pay variance as a whole had a diminishing, though never counterproductive, effect on points and round that operated through inputs. Future research into the generalizability of this curvilinear DEP effect is needed, as is exploration of the effect's explanation, which we speculated to be inequity perceptions or limitations in organizational capabilities to manage valued resources (see the derivation of H4).

A second modeling issue is the operationalization of pay dispersion. We used pay variance because it does not factor out mean pay in any way (and is thus consistent with our position on avoiding the partialling of mean pay effects in dispersion modeling). We recognize, however, that most pay dispersion research has deployed alternative operationalizations that do, in their computation, account to some degree for mean pay. Hence, we reran our analyses after replacing pay variance with pay's coefficient of variation (i.e., the standard deviation of pay divided by mean pay level) and the Gini Coefficient, two commonly used pay dispersion measures that correlate with pay variance in our data at .70 and .74, respectively. These substitutions did not change the overall pattern of results.

Third, productivity-relevant reasons for pay dispersion, and thus the makeup of DEP and DUP, will rarely be known with complete certainty. DUP measures probably will, to at least

some degree, be associated with pay based on rational or logical pay elements that we do not have data sophisticated enough to detect. Indeed, this may be one reason why DUP frequently yields zero, rather than negative, effects, both in the extant research and in our study. Relatedly, even determining what exactly is “productivity-relevant” in principle and what is not is a subjective process likely to produce disagreement among researchers. Despite this limitation, consistent results across the partialling, mediation, and predicted value/residual techniques lend support to our conceptual and empirical modeling of DEP and DUP.

Finally, while our study involves lateral (within-job) dispersion, whether its logic generalizes to vertical (across-job) dispersion is also of interest. Certainly jobs vary tremendously in productivity implications, as evidenced by enormous differences in job pay. Because the job held is the primary driver of pay (Gerhart & Milkovich, 1992), job differences may even surpass job performance as the quintessential productivity-relevant explanation for pay dispersion, meaning that controlling out these differences could change overall pay dispersion or DEP effects to DUP effects. Overall, the Table 1 studies appear to confirm this contention, as vertical pay dispersion tends to be positively related to performance in studies where aspects of the job were not partialled out, but tended to be unrelated or negatively related in studies where these job inputs are partialled. Hence, we encourage researchers to consider the DEP/DUP implications in vertical, as well as lateral, pay dispersion research.

### **Implications for practice**

One reaction to our results would be to presume that we advocate pay dispersion. First, we reiterate that pay dispersion makes sense only to the extent that it represents DEP; positive DEP effects are what our conceptual framework and empirical analyses support. Second, it would be shortsighted to suggest that even DEP is the correct strategic approach in all situations.



Such a sweeping recommendation conflicts with our belief that context is vital in terms of the efficacy of HR practices in general and pay practices in particular. For instance, the SAS Institute is an intriguing, albeit rare, example of a highly successful company that has been identified as a proponent of a less dispersed pay system, which appears to effectively support its business strategy and company culture (Gerhart & Rynes, 2003).

That said, however, absent such a fit or contingency model that calls for the use of less pay dispersion, we do believe that DEP, by virtue of sorting (and incentives) benefits, will often be a good idea. Of course, DEP is not always viable. Though pay-for-performance systems often effectively sort and motivate, they also can be fraught with problems, particularly in contexts where individual performance differences are difficult to accurately infer and/or measure credibly in the eyes of employees. Without such measurability, as well as the perception thereof, the rationales for the sorting and incentive benefits quickly disintegrate. Thus, possessing a high-quality performance assessment system and convincing employees of its validity are primary concerns for organizations following a high DEP approach. Additionally, when considering the investment into more DEP, management should be sure to consider where they already are with regard to the construct. Our curvilinear analyses indicate that for companies already high on the construct, more DEP may garner little or no organization-level advantages.

## **Conclusion**

In their 1993 study of pay dispersion effects, Pfeffer and Langton (1993, p. 382) quoted Barnard's (1938, pp. 145-146) statement that differentials in money "are a source of jealousy and disruption if not accompanied by other factors of distinction." We believe that many scholars addressing pay dispersion effects in interdependent settings may have focused on Barnard's "source of jealousy and disruption" idea without adequate regard for his "accompanying factors

of distinction” contingency. Relative inattention to inputs (i.e., Barnard’s factors of distinction) in pay dispersion research is arguably at the heart of what we have characterized as the literature’s conceptual and empirical confounding of inequity and inequality. In response, our framework’s inputs-based distinction between DEP and DUP provides noteworthy resolution to inconsistencies in prior empirical work and to ostensibly conflicting theoretical perspectives. Specifically, incorporating a sorting-based focus and isolating DEP, while limiting inequity concerns to DUP, ultimately leaves us with a considerably more favorable view of pay dispersion in interdependent work settings than that found in previous research. Simply put, when work is interdependent, pay dispersion explained by productivity-relevant employee inputs provides sorting advantages that lead to a positive relationship with team performance, while pay dispersion net of these inputs does not.

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**TABLE 1**  
**Key Elements of Studies on Pay Dispersion Effects on Performance**

Study	Sample	Performance Measure	Pay Dispersion Type	Level of Work Interdependence	Study Appears to Control Out Dispersion in Explained Pay (DEP)			Estimated Pay Dispersion Modelled	Overall Effect of Pay Dispersion on Performance
					Via Mean Pay Level (covariate)	Via Pay-for-performance (covariate)	Via Employee Inputs (covariate)		
<b>Beaumont &amp; Harris (2003)</b>	UK firms in five industries	plant-level labor productivity	vertical	unknown	No	No	No	DEP	primarily positive
<b>Becker &amp; Huselid (1992)</b>	Professional auto racing drivers	race finishing position	lateral	low	No	No	No	DEP	positive
<b>Bloom (1999)</b>	Professional baseball players/teams	various on-field and off-field measures	lateral	low	Yes	No	Yes (team talent)	DUP	negative
<b>Brown, Sturman &amp; Simmering (2003)</b>	Acute care centers in California hospitals	average length of stay; survival rate; ROA	vertical	unknown	Yes	No	No	DEP	mixed
<b>Canyon, Peck &amp; Sadler (2001)</b>	UK stock market firms	ROA; total shareholder return	vertical	unknown	No	No	No	DEP	no effect
<b>Cowherd &amp; Levine (1992)</b>	Business units with headquarters in USA and EU	product quality	vertical	unknown	No	No	Yes (business unit size argued to be a proxy for interclass human capital differences; job pay differences also removed in one of the dispersion measures by using ratio of two pay-relative-to-market indicators as dispersion)	DUP	negative
<b>Depken (2000)</b>	Professional baseball teams	winning percentage	lateral	low	Yes	No	No	DUP	negative
<b>Ding, Akhtar, &amp; Ge (2009)</b>	Chinese manufacturing and service firms	subjective reports of sales growth and product or service quality	lateral and vertical	unknown	No	No	No	DEP	mixed
<b>Eriksson (1999)</b>	Danish firms	profits/sales	vertical	unknown <sup>a</sup>	Yes	No	No	DEP	positive
<b>Franck &amp; Nuesch (forthcoming)</b>	Professional soccer teams	winning percentage; league standing	lateral	high	Yes	No	Yes (talent heterogeneity)	DUP	negative
<b>Frick, Prinz, &amp; Winkelmann (2003)</b>	Teams from four professional sports	winning percentage	lateral	mixed	Yes	No	No	DUP	mixed
<b>Grund &amp; Westergaard-Nielsen (2008)</b>	Danish firms	value added per employee	vertical	unknown	Yes	No	Yes (education and education dispersion)	DUP	no effect
<b>Heyman (2005)</b>	Swedish firms	profits per employee	vertical	unknown	No	No	Yes (human capital levels)	DUP	positive
<b>Hibbs &amp; Locking (2000)</b>	Swedish firms	productivity	vertical	unknown	Yes	No	No	DEP	positive

(table continued on next page)



**TABLE 1 (continued)**  
**Key Elements of Studies on Pay Dispersion Effects on Performance**

Study	Sample	Performance Measure	Pay Dispersion Type	Level of Work Interdependence	Study Appears to Control Out Dispersion in Explained Pay (DEP)			Estimated Pay Dispersion Modelled	Overall Effect of Pay Dispersion on Performance
					Via Mean Pay Level (covariate)	Via Pay-for-performance (covariate)	Via Employee Inputs (covariate)		
<b>Jewell &amp; Molina (2004)</b>	Professional baseball teams	winning percentage	lateral	low	No	No	Yes (several human capital and on-field performance measures)	DUP	negative
<b>Kepes, Delery, &amp; Gupta (2009)</b>	Truck transportation firms (drivers)	safety; ROE; productivity; operating ratio	lateral	low	Yes	No	Yes (seniority-based pay)	DUP	positive
<b>Lee, Lev, &amp; Yeo (2008)</b>	Top management groups in public firms	market valuation; ROA	lateral and vertical	unknown	No	No	No	DEP	positive
<b>Leonard (1990)</b>	U.S. firms	ROE; change in ROE	vertical	unknown	Yes	No	Yes (job pay partially captured by ratio of level 1 and 2 pay to level 5 and 6 pay; hierarchy index may also partial job pay)	DUP	no effect
<b>Main, O'Reilly &amp; Wade (1993)</b>	U.S. firms	ROA	vertical	unknown <sup>a</sup>	No	No	No	DEP	positive
<b>Pfeffer &amp; Langton (1993)</b>	University faculty	publications	lateral	low	No	Yes (within-department correlation between pay and productivity)	No	DUP	negative
<b>Shaw, Gupta &amp; Delery (2002)</b>	Truck transportation firms (drivers);	safety; productivity; performance perceptions	lateral	low	Yes	No	Yes (seniority-based pay)	DUP	primarily negative/no effect
	Concrete pipe plants (production workers)		lateral	low <sup>a</sup>	Yes	No	Yes (seniority-based pay)	DUP	primarily negative/no effect
<b>Siegel &amp; Hambrick (2005)</b>	Top management groups in public firms	market-to-book value; total shareholder returns	lateral and vertical	unknown	No	Yes (firm size and number of level two executives argued to proxy pay-for-performance differences)	Yes (top management group size argued to be a proxy for job function differences that would legitimately warrant pay differences)	DUP	no effect
<b>Sommers (1998)</b>	Professional hockey teams	team points (the team standings determinant)	lateral	high	Yes	No	No	DUP	negative

Note: We used two decision rules to make the DEP/DUP distinction: (1) we judged lateral pay dispersion studies as modeling DUP if we coded as “yes” at least one of the three columns representing avenues for controlling out strategic pay dispersion explanations; (2) given that vertical pay dispersion incorporates job pay differences, and that job pay is the primary determinant of actual pay (Gerhart & Milkovich, 1992), vertical pay dispersion studies that did not partial out job pay or job level indicators were judged to model DEP. Studies included numerous dependent variables, quadratic terms, and or interaction terms; to simplify our summary, the final column reflects our impression of the overall linear pay dispersion effect, usually as interpreted by the studies' authors.

<sup>a</sup>While these three studies included, via interaction terms, attempts to examine dispersion effects at lower and higher interdependence, in none of the three is it clear that the work itself is ever truly interdependent in nature (e.g., with percent of employees on self-managing teams as the interdependence measure, the “high interdependence” value [mean plus one standard deviation] in Shaw et al. was closest to the scale anchor indicating “almost none”).

**TABLE 2**  
**Measurement and Modeling of Key Constructs**

<b>Variable</b>	<b>Description of Team-year Measurement/Modeling</b>
<b><i>Productivity-Relevant Reasons for Pay Dispersion</i></b>	
inputs	mean, within team-year, of individual performance inputs from the NHLPA measure <sup>a</sup>
<b><i>Overall Pay Dispersion</i></b>	
pay variance	variance, within team-year, of player salary (raw CPI-adjusted dollars)
<b><i>DEP (dispersion in explained pay)</i></b>	
pay variance	the pay variance term becomes DEP when it shares variation with (is mediated by) productivity-relevant inputs; hence, the pay variance that affects performance indirectly through inputs is actually DEP
DEP_predicted	variance, within team-year, of predicted value from individual-player regression of logged salary on productivity-relevant inputs
<b><i>DUP (dispersion in unexplained pay)</i></b>	
pay variance	the pay variance term becomes DUP when strategically-relevant reasons for pay dispersion are partialled; hence, the pay variance term in regression models that include these reasons as covariates actually represents DUP
	the pay variance term also becomes DUP when it shares no variation with (is not mediated by) productivity-relevant inputs; hence, the direct pay variance effect, when inputs are included in the model, is a DUP effect
DUP_residual	variance, within team-year, of residuals from individual-player regression of logged salary on productivity-relevant inputs
<b><i>Pay Strategies other than Pay Dispersion</i></b>	
pay level	mean, within team-year, of player salary
pay-for-performance	within team-year correlation between player pay and individual inputs from the NHLPA measure

<sup>a</sup> Individual performance inputs are from a measure of player value that was officially approved by the National Hockey League Players' Association (NHLPA) for use in fantasy hockey league play. This sanctioned measure is the sum of seven standardized (within-year) on-ice components.

**TABLE 3**  
**Descriptive Statistics and Correlations – Team Level Variables<sup>a</sup>**

Variable <sup>b</sup>	Mean	s.d.	1	2	3	4	5	6	7	8
1. Points	85.75	15.96	--							
2. Round	1.06	1.31	.70	--						
3. Pay variance <sup>c</sup>	1.90	1.83	.40	.26	--					
4. Pay level strategy	1.35	.49	.55	.32	.86	--				
5. Pay-for-performance strategy	.67	.18	.31	.16	.45	.43	--			
6. Inputs	.57	1.37	.65	.43	.65	.79	.40	--		
7. DEP_predicted	.29	.15	.44	.32	.72	.62	.55	.68	--	
8. DUP_residual	.28	.13	.15	.12	.34	.38	-.33	.29	.18	--

<sup>a</sup>  $N = 175$ ; correlations greater than .15 are significant at  $p < .05$ .

<sup>b</sup> Although we standardized the independent variables in all regression analyses, the Table 3 means and standard deviations are in the original metrics. Pay variance is in hundred billions; pay level strategy is in millions; DEP\_predicted and DUP\_residual are variances of predicted values and residuals from the prediction of logged pay.

<sup>c</sup> Because pay variance is in raw dollars, it does not equal the sum of the means of DEP\_predicted and DUP\_residual. The mean pay variance of logged pay, however, is .57, which is the sum of the means of DEP\_predicted and DUP\_residual.

TABLE 4

**Player Acquisition and Retention by Player Inputs (Performance) and Team DEP Levels**

<i>Where Stayers Play Next Year</i>				
	Year $t$ Teams			
<u>Year <math>t-1</math> Players</u>	Low DEP Teams (teams below the DEP median)	High DEP Teams (teams above the DEP median)	Ratio of Stay at High DEP to Stay at Low DEP	Row Contribution to Overall Chi-square
High inputs players (top quartile in league)	226 (35.0%)	419 (65.0%)	1.85	45.2***
Moderate inputs players (25th-75th percentile)	614 (54.3%)	517 (45.7%)	0.84	16.4***
Low inputs players (bottom quartile in league)	274 (51.5%)	258 (48.5%)	0.94	2.2
Total	1,114 (48.3%)	1,194 (51.7%)		
			Overall chi-square:	63.9***
<i>Where Movers Play Next Year</i>				
	Year $t$ Teams			
<u>Year <math>t-1</math> Players</u>	Low DEP Teams (teams below the DEP median)	High DEP Teams (teams above the DEP median)	Ratio of Move to High DEP to Move to Low DEP	Row Contribution to Overall Chi-square
High inputs players (top quartile in league)	65 (38.5%)	104 (61.5%)	1.60	13.1***
Moderate inputs players (25th-75th percentile)	270 (54.4%)	226 (45.6%)	0.84	0.8
Low inputs players (bottom quartile in league)	161 (57.1%)	121 (42.9%)	0.75	2.5
Total	496 (52.4%)	451 (47.6%)		
			Overall chi-square:	16.5***
<i>Where All Players Play Next Year</i>				
	Year $t$ Teams			
<u>Year <math>t-1</math> Players</u>	Low DEP Teams (teams below the DEP median)	High DEP Teams (teams above the DEP median)	Ratio of Play at High DEP to Play at Low DEP	Row Contribution to Overall Chi-square
High inputs players (top quartile in league)	291 (35.8%)	523 (64.3%)	1.80	61.2***
Moderate inputs players (25th-75th percentile)	884 (54.33%)	743 (45.7%)	0.84	15.4***
Low inputs players (bottom quartile in league)	435 (53.4%)	379 (46.6%)	0.87	5.2*
Total	1,610 (49.5%)	1,645 (50.5%)		
			Overall chi-square:	81.8***

Note: Overall chi-square is a test of the null hypothesis that there is no relationship between player inputs and the DEP level of next year's team. H1 is more specifically addressed by the row chi-square tests for

high inputs players, which indicate rejection of the null hypothesis that high DEP and low DEP teams do not differ in their attraction and retention of high inputs players.

TABLE 5

Regressions of Points on Pay Dispersion Types and Strategically-relevant Reasons for Pay Dispersion<sup>a</sup>

Variable	Random Effects					Fixed Effects				
	1	2	3	4	5	6	7	8	9	10
Constant	85.52 *** (1.94)	85.70 *** (1.28)	85.57 *** (1.95)	87.43 *** (1.84)	84.83 *** (1.74)	85.75 *** (.00)	85.75 *** (.00)	85.78 *** (2.05)	85.25 *** (1.94)	85.00 *** (.19)
Pay variance <sup>b</sup>	5.10 *** (1.66)	-.05 (1.71)			-5.16 * (2.38)	3.76 † (1.85)	.05 (1.48)			-5.89 * (2.76)
DEP_predicted			5.04 ** (1.71)	6.38 *** (1.84)				3.68 * (1.67)	4.74 ** (1.88)	
DEP_predicted <sup>2</sup>				-1.80 * (.80)					-1.47 * (.88)	
DUP_residual			-.12 (1.36)	-.31 (1.34)				-.93 (1.36)	-1.03 (1.39)	
Inputs		9.22 *** (1.24)					6.84 *** (1.46)			
Pay level					10.75 *** (2.20)					10.22 *** (2.60)
Pay-for-performance					2.07 † (1.22)					2.03 (1.26)
$R^2$	.16	.43	.19	.23	.33	.16	.43	.16	.21	.32
$\chi^2$	9.40 **	69.17 ***	8.84 *	12.38 **	32.91 ***			4.92 †	6.55 †	
F						4.14 †	13.64 ***			7.36 ***
$b_{DEP} > b_{DUP} ?^c$			Yes	Yes				Yes	Yes	

<sup>a</sup> Robust standard errors are in parentheses for all but models three, four, eight, and nine, where we use bootstrapped standard errors to account for generated regressor bias (bootstrapped and random effects models yield model fit statistics in terms of  $\chi^2$  rather than  $R^2$ ); all independent variables were standardized prior to the regressions. N=175 for all models.

<sup>b</sup> As described in Table 2, pay variance becomes DEP when it affects points indirectly through inputs (see the Results section for the indirect effects calculated from models one and two and from models six and seven). Due to the covariates modeled, pay variance becomes DUP in models two, five, seven, and ten.

<sup>c</sup> “Yes” indicates statistical difference ( $p < .05$ ) between DEP\_predicted and DEP\_residual; tests conducted in Models three, four, eight, and nine.

†  $p < .10$ , \*  $p < .05$ , \*\*  $p < .01$ , \*\*\*  $p < .001$

**TABLE 6**  
**Regressions of Round on Pay Dispersion Types and Strategically-relevant Reasons for Pay Dispersion<sup>a</sup>**

Variable	Random Effects					Fixed Effects				
	1	2	3	4	5	6	7	8	9	10
Constant	1.37 * (.65)	1.16 * (.58)	1.55 (4.37)	1.67 (4.32)	1.25 * (.63)	1.64 * (.81)	1.22 * (.62)	1.55 (4.62)	1.69 (4.86)	1.56 † (.83)
Pay variance <sup>b</sup>	.22 * (.11)	-.12 (.12)			-.23 (.19)	.04 (.15)	-.19 (.15)			-.43 † (.24)
DEP_predicted			.34 *** (.10)	.52 *** (.14)				.28 * (.12)	.40 * (.17)	
DEP_predicted <sup>2</sup>				-.16 † (.12)					-.11 (.10)	
DUP_residual			.04 (.13)	.01 (.12)				-.02 (.12)	-.04 (.12)	
Inputs		.68 *** (.13)					.67 *** (.16)			
Pay level					.47 ** (.17)					.49 * (.21)
Pay-for-performance					.15 (.12)					.15 (.14)
$\chi^2$	4.17 *	30.92 ***	12.21 **	14.60 **	13.59 **	.07	16.59 ***	5.35 †	5.64	6.59 †
$b_{DEP} > b_{DUP}$ ? <sup>c</sup>			Yes	Yes				Yes	Yes	

<sup>a</sup> We use bootstrapped standard errors in models three, four, eight, and nine to account for generated regressor bias; all independent variables were standardized prior to the regressions;  $N=175$  for random effects models, but  $N=160$  for fixed effects models because 15 observations were eliminated due to teams' all zero values for round across years in fixed effects models.

<sup>b</sup> As described in Table 2, pay variance becomes DEP when it affects points indirectly through inputs (see the Results section for the indirect effects calculated from models one and two and from models six and seven). Due to the covariates modeled, pay variance becomes DUP in models two, five, seven, and ten.

<sup>c</sup> "Yes" indicates statistical difference ( $p < .05$ ) between DEP\_predicted and DEP\_residual; tests conducted in Models three, four, eight, and nine.

†  $p < .10$ , \*  $p < .05$ , \*\*  $p < .01$ , \*\*\*  $p < .001$

FIGURE 1

### Conceptual and Empirical Perspectives on Dispersion in Explained Pay (DEP)

#### Conceptual Framework

##### Overall pay dispersion

- sorting and potential incentive benefits depend on relative amounts of DEP and DUP
- pay *inequality*

##### Productivity-relevant employee inputs

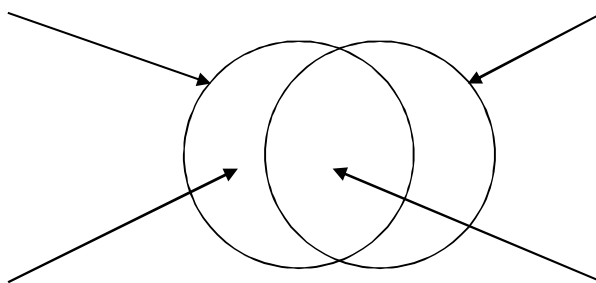
- job performance, ability
- job held

##### Dispersion in unexplained pay (DUP)

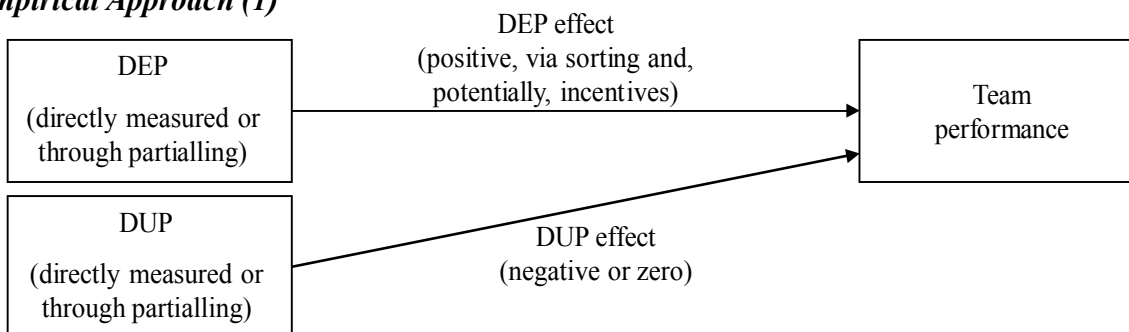
- pay dispersion independent of productivity-relevant inputs
- no obvious sorting or incentive benefits
- pay *inequity*

##### Dispersion in explained pay (DEP)

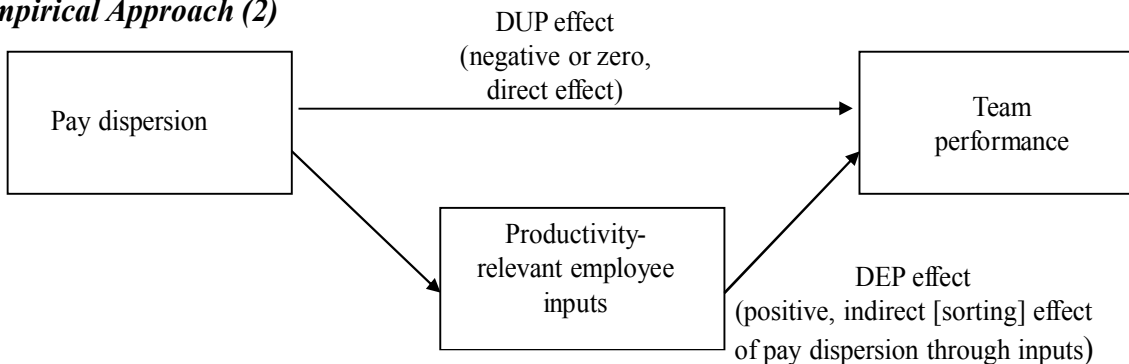
- pay dispersion used to secure productivity-relevant employee inputs
- sorting and potential incentives benefits
- pay *equity*



#### Empirical Approach (1)



#### Empirical Approach (2)



Note: Both empirical approaches are consistent with the conceptual framework presented above (top).



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