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White collar incentives☆

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ABSTRACT

This study analyzes the incentive design structure for a sample of mid-level white collar managers (WCM) in large, technology-oriented U.S. firms whose knowledge-based outputs are difficult to measure objectively. Consistent with the limited availability of objective outcome measures for WCM, we find that the sample firms make significant use of tournament-like implicit promotion incentives to motivate WCM, in addition to using explicit financial incentives. We also find that implicit and explicit incentives are complements rather than substitutes in our setting in which sample firms are generally not constrained in their ability to adjust implicit and explicit incentives. Finally, while both implicit and explicit incentives increase in job level, explicit incentives increase more rapidly than implicit incentives, resulting in an increase in the intensity of explicit incentives relative to implicit incentives. We attribute this finding to WCM at higher job levels exercising greater influence on organization performance, making organization-level performance measures more informative. Overall, the results are consistent with the availability of objective performance measures for WCM influencing the structure of their implicit promotion and explicit financial incentives.

1. Introduction

The recent growth in research on organizational incentive systems has emphasized a mix of economics and behavioral concerns (Merchant, Van der Stede, & Zheng, 2003), identifying a variety of obstacles to providing efficient incentives for managers in large organizations. These obstacles include attracting employees with the appropriate mix of skills, generating contractible signals that are sufficiently informative about managers' actions, information asymmetry that prevents superiors from specifying the desired mix of actions for subordinate managers to take, and the counterproductive strategic behavior that subjective performance evaluations can engender (e.g., Golman & Bhatia, 2012). Among the most challenging incentive design settings in large organizations are those involving mid-level white collar managers (WCM).[1] We define WCM as non-executive employees with significant managerial or professional expertise who serve in functions without specific responsibility for either generating sales or the overall performance of a major organizational unit, such as a division or the entire firm. The absence of responsibility for either sales or broad organizational performance limits the availability of appropriate performance measures sufficient to support exclusive reliance on explicit financial incentives. At the same time, the presence of numerous job levels in large hierarchical organizations provides the potential for implicit promotion-based incentives. However, this potential is itself constrained by the absence of a mechanism to guarantee that firms will not renege on such implicit incentives. Therefore, our research question is how firms in the face of these constraints design efficient incentives for their WCM.

Limitations inherent to both explicit and implicit incentives suggest that large, hierarchical organizations will often rely on second-best designs that combine some mix of explicit and implicit

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[1] We use WCM to refer to either one or more white collar managers, depending on the context.

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incentives for WCM.[2] In a general review of incentives in organizations, Prendergast (1999, p.11 and p.57) attributes the fundamental limitations of explicit financial incentives for many employees, including WCM, to the fact that their output is typically very difficult to measure, and therefore not contractible. He emphasizes that "a critical avenue for future research should be to better understand the evaluation and compensation of those with noncontracted output" (1999, p.11). In that spirit, this study seeks to provide insight into the design of incentives for WCM along three dimensions. First, we provide evidence to confirm our initial suggestion that WCM typically face a mix of both significant explicit incentives and significant implicit incentives, and further that the implicit incentives reflect tournament theory features. Second, we examine whether firms generally design explicit and implicit incentives as substitutes versus complements. Third, we analyze how firms' relative reliance on explicit versus implicit incentives varies across white collar job levels within the firm.

"White collar employees" include salaried office workers and other employees not engaged in blue collar labor (Prandy, Steward, & Blackburn, 1982). With advances in technology, white collar employees constitute a large and growing proportion of the U.S. workforce, accounting for 61.5% of total employment in 2009 (Bureau of Labor Statistics, 2010).[3] Professional and technical white collar workers alone grew from about 11% of all employees in 1960 to 23% in 2000 (Wyatt & Hecker, 2006, p.38). This study focuses specifically on a subset of all white collar employees whom we term "white collar managers", operationalized by our including only employees with at least a bachelor's degree and excluding the firm's top five executives, division managers, managers of operational units and employees with sales responsibilities. We exclude the latter employees because the nature of their responsibilities generates relatively informative outcome measures with which to evaluate their performance, which we expect to significantly influence the resulting incentive structures.[4]

We analyze proprietary compensation data for a sample of WCM working in administrative, technical, and research and development functions in large U.S. technology-oriented firms during 1997–2002.[5] Typical job titles within our sample are Financial Analyst, Legal Counsel, Application Programmer, System Analyst, Semiconductor Process Engineer and Mechanical Design Engineer. WCM in such large U.S. firms typically operate in a hierarchical organizational structure in which an individual's advancement follows a relatively well defined path through specified job levels (Gibbs, 1995, pp.247–248). Consistent with this observation, our sample firms have well-defined job levels for each job.

We document the following empirical results for WCM. First, we find that the magnitude of both explicit financial incentives and implicit promotion-based incentives for WCM are economically significant. Further, we document an increasing, convex functional relation between various compensation measures and job levels for WCM. This finding is consistent with the tournament theory prediction (Rosen, 1986) and suggests that our sample firms make significant use of implicit promotion-based incentives to motivate their WCM. Second, we find that our sample firms generally use implicit promotion-based incentives and explicit financial incentives as complements. In particular, at a given job level, there is a positive association between implicit and explicit incentives in a cross-section of firms. Third, at higher job levels, both implicit and explicit incentives become stronger. However, consistent with broad-based performance metrics becoming more informative for jobs with more decision rights, we find that the relative intensity of explicit incentives compared to implicit incentives increases at higher job levels. That is, although both implicit and explicit incentives become stronger at higher job levels, explicit incentives increase faster.

These findings contribute to the compensation literature by providing new insight concerning the design of incentives for white collar managers, a large and rapidly growing category of employees for whom previous literature is limited. Prendergast (1999, p.11) calls for research on [professional] employees with "noncontracted output". To the extent that WCM in our sample represent the typical professional workers with noncontracted output in high technology industries, our findings provide insight on how firms design incentives for this group of employees. Further, because our sample consists of a broad cross-section of large, technology-oriented firms, our findings on WCM's incentive design are more likely to generalize and extend prior research on incentive design when compared to more detailed studies of a single firm.

With respect to specific incentive design features, our study makes the following contributions. First, we offer an explanation that helps reconcile the two opposing views on the use of implicit and explicit incentives. While some prior studies find a substitutive relation between implicit and explicit incentives in settings in which firms' ability to modify employees' implicit incentives is limited, our results suggest that firms use the two types of incentives as complements when they are free of such constraints and can optimally adjust both explicit and implicit incentives. Second, while most firms face both the problem of inducing employees to provide unobservable efforts and the problem of motivating efficient decisions for improving firm value, prior research has typically examined each of these problems in isolation (Athey & Roberts, 2001, p.200). Using a setting in which both the difficulty in prescribing employee input and the breadth of employee decision rights increase at higher job levels, we provide empirical evidence on how firms design incentives for WCM. Our findings suggest that explicit financial incentives tied to aggregate performance become more important as employees gain additional decision rights and carry out more complex tasks. This generates a positive association between the relative intensity of explicit incentives and the impact of a WCM's decisions on firm performance.

2. Literature review and hypothesis development

2.1. Promotion-based incentives for white collar managers

Lazear and Rosen (1981) demonstrate how tournaments in the form of internal competitions for promotions can be effective alternatives to output-contingent contracts when outcomes are

[2] Explicit incentive contracts link pay to individual or group performance. Examples include piece rates for production workers, commissions for sales persons, and performance bonuses and stock options for executives. Implicit incentives exist when the incentives are not contractible but are based on an implicit understanding between a worker and his supervisor. In this study, we define explicit incentives as any financial payments tied to performance, and implicit incentives as arising from promotion to the next higher job level.

[3] The Bureau of Labor Statistics (2010) breaks down the 61.5% into 21.9% employed in professional and related fields; 15.4% in management, business and financial operations; 13.0% in office and administrative support; and 11.2% in sales and related occupations.

[4] For example, top executives can be rewarded based on the firm's accounting and/or stock price outcomes; sales managers can be rewarded based on sales results; managers of operational units such as hotels or retail stores can be compensated based on accounting measures of revenue, expense or profit or non-financial measures of customer satisfaction; and production managers can be rewarded based on measures of production volume, cost and quality.

[5] The sample firms are generally comparable in size to S&P 500 firms during the same time period. The median market capitalization of the sample firms is $4.8 billion, compared to $5.7 billion for the median S&P 500 firm. Likewise, operating performance and growth opportunities of the sample firms are also comparable to those of S&P 500 firms. The median return on assets and market-to-book ratio are 6.8% and 3.95, respectively, for the sample firms versus 5.0% and 3.29 for the median S&P 500 firm.

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difficult to measure. Tournament theory assumes that promotions are determined by the relative performance of employees at a given job level, as measured by a combination of objective and subjective evaluations, and that employee effort is increasing in the magnitude of the prize associated with winning the tournament. Rosen (1986) extends the analysis to include a series of promotions in which the winners in each round advance to compete in successive rounds for promotion at higher levels. Rosen establishes conditions under which the option value of career advancement decreases after each tournament round, so that the wage increase associated with each successive round must be increasing in order to provide a risk-averse employee with sufficient incentives in later rounds. This implies a convex relation between job level and the magnitude of pay increases.[6]

Empirical studies have generally confirmed this prediction. For example, Finkelstein, Hambrick, and Cannella (2009) document that CEO compensation is disproportionately larger than the compensation of non-CEO executives. Likewise, Lambert, Larcker, and Weigelt (1993) use compensation data on top executives, division managers and plant managers of U.S. corporations to demonstrate an increasing, convex relation between managerial job levels and total compensation. However, Merchant et al. (2003, p.253 and p.270) call for further research on the role of tournaments in the context of mid-level managers.

For several reasons it is unclear whether the preceding findings for executives, plant managers and division managers will also hold for WCM. First, tournaments naturally create competition among employees, which is likely to inhibit cooperation, a particularly critical feature of effective white collar environments (Prendergast, 1999, pp.35–36; Bloom, 1999; Siegel & Hambrick, 2005). Second, the difficulty in evaluating current outcomes for WCM can naturally lead to issues of favoritism and seemingly arbitrary decisions when a winner must be selected in each round, damaging morale and performance (Prendergast, 1999, pp.29–31; Bloom & Michel, 2002; Fredrickson, Davis-Blake, & Sanders, 2010; Rankin & Sayre, 2011).[7] Finally, whereas division managers competing for executive leadership positions are likely to require primarily the same set of managerial skills in both their original division leadership and subsequent executive positions, promoted WCM will often find that their new position demands a substantially different, and often much broader set of skills than their previous position (Baker, Jensen, & Murphy, 1988, p.604). These considerations create doubts as to whether tournaments will be effective mechanisms in many environments involving WCM. To the extent that they are not, the prediction of convex pay structures across white collar job levels may no longer hold.

Despite the preceding concerns with applying tournament theory to a setting with WCM, we nevertheless believe that the paucity of explicit incentive mechanisms created by the inherent difficulty in measuring WCM's outcomes will result in most firms relying to a significant degree on tournaments as a basis for white collar employees' incentives. That is, despite the significant issues noted above, in large technology-oriented firms we still expect to observe a convex relationship between job level and WCM compensation, consistent with tournament-like promotion-based incentives for WCM. Our reasoning reflects the difficulty in evaluating performance in such settings using other techniques. For example, Milkovich, Newman, and Gerhart (2011) describe obstacles to evaluating performance and determining compensation for white collar supervisors and professional employees, noting that firms "struggle to figure out what [their] pay should be" because of the difficulty in measuring such employees' knowledge-based outputs (2011, p.491). The preceding discussion leads to the following hypothesis:

H1. White collar managers' compensation is increasing in job level at an increasing rate.

2.2. Implicit and explicit incentives for white collar managers

Our two further hypotheses explore the nature of the relation between implicit promotion and explicit financial incentives for the white collar managers in our sample. Confirming earlier observations by Baker, Gibbs, and Holmstrom (1994a, p.905) and Gibbs (1995, pp.256–262), we first document that both implicit promotion incentives and explicit financial incentives are economically important for our WCM sample.[8] Hypothesis 2 analyzes whether our sample firms design WCM's implicit and explicit incentives as substitutes versus complements. Hypothesis 3 explores how the relative strength of implicit versus explicit incentives changes at different job levels for our sample employees.

To understand how firms design implicit and explicit incentives for WCM, Gibbons and Murphy (1992) and Gibbs (1995) construct models in which a firm chooses an optimal level of explicit incentives as a function of the implicit incentives an employee faces and predict that the two types of incentives are optimally substitutes. Both studies provide empirical evidence in settings with important constraints on implicit incentives. Specifically, Gibbons and Murphy (1992) analyze incentives for executives with limited career concerns because they are close to retirement and Gibbs (1995) addresses employees with limited promotion incentives because they have already been passed over for promotion, such that in both cases the employees face very weak implicit incentives. Both studies show that as these constraints on implicit incentives become more restrictive, firms will optimally substitute explicit financial incentives for the weakened implicit incentives. In a more recent study, Ederhof (2011) provides empirical evidence that for operational unit managers working in various countries for one multinational firm, stronger implicit promotion-related incentives are associated with weaker explicit bonus incentives, consistent with explicit incentives substituting for implicit incentives.

Other prior analytical research has established alternative conditions under which implicit and explicit incentives are complements (e.g., Baker, Gibbons, & Murphy, 1994b; Holmstrom & Milgrom, 1994; Kaarboe & Olsen, 2006). Baker et al. (1994b) model the use of explicit incentives based on an objective performance measure and implicit incentives based on a subjective performance measure in a multi-period setting in which the firm chooses the optimal levels of both types of incentives. Specifically,

[6] A convex relation between pay and job level is also consistent with promotions serving as a sorting mechanism (Rosen, 1982, pp.311–323; Baker et al., 1994a, p.884; Eriksson, 1999, p.273) in which the higher marginal productivity of more able employees adds more to firm productivity at higher job levels. In other words, firms use promotion-based incentives not only to induce greater effort from employees, but also to sort the employees into jobs based on their abilities (Gibbs, 1995; Campbell, 2008).

[7] Based on the 2015 Survey on Promotional Guidelines by the WorldatWork, 21% of the 317 survey participants responded that they do not share promotional guidelines or policies with employees, and 46% responded that such information is primarily used to guide personnel and management decisions. These results are consistent with opaque promotion decision processes involving subjective evaluations leading to significant employee concerns with favoritism and apparently arbitrary promotion decisions.

[8] Our focus on the combined effect of implicit and explicit incentives is also consistent with Prendergast's observation that, "There is little reason why the firm should pay solely on the basis of relative output, as occurs in tournaments … it is only in very special cases that the optimal means of compensation involve only relative performance evaluation" (Prendergast, 1999, p.36).

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Baker et al. (1994b, pp.1145–1146) illustrate a setting in which using explicit financial incentives in conjunction with implicit incentives can improve the efficiency of implicit incentives by increasing the value of the ongoing relationship, thereby reducing the firm's incentive to renege on the implicit contract. Further, as the objective performance measure becomes more precise, both the explicit and implicit incentives are strengthened, consistent with a complementary relation between the two types of incentives.[9] Holmstrom and Milgrom (1994) model optimal incentives of employees who carry out multiple tasks, establishing conditions under which the optimal incentives for different activities are complementary.

Consistent with the preceding analytical results, Anderson and Schmittlein (1984), MacDuffie (1995), and Ichniowski, Shaw, and Prennushi (1997) provide empirical evidence of firms designing a variety of incentive mechanisms and human resource practices as complements. For example, using panel data for steel production lines, Ichniowski et al. (1997) examine firms' use of various implicit and explicit incentive mechanisms, such as performance-based payments, job security, training and job flexibility. They find that firm level performance is better when a set of explicit and implicit mechanisms, collectively termed "human resource management" practices, are used together in a complementary manner than when only a subset of the practices is present.

The research described above provides support for implicit and explicit incentives operating as substitutes primarily in the context of a single firm (Gibbs, 1995; Ederhof, 2011) or when firms face significant constraints on the strength of implicit incentives (Gibbons & Murphy, 1992; Gibbs, 1995). In more general environments without significant constraints, the previous results tend to support a complementary relation between the two types of incentives (e.g., Abernethy, Dekker, & Schulz, 2015). Because we are unaware of significant constraints being generally present in our sample firms' settings, we rely on the latter studies as support for our second hypothesis:

H2. Firms design implicit promotion-based incentives and explicit financial incentives for WCM as complements.

2.3. Job level and relative intensity of implicit versus explicit incentives

In addition to the general issue of whether implicit and explicit incentives for WCM are designed as substitutes or complements, their relation can be further characterized in terms of how the relative strength of the two types of incentives varies across different job levels. Prior research (e.g., Bushman, Indjejikian, & Smith, 1995; Barron & Waddell, 2003) suggests that incentives generally are stronger at higher job levels, and we focus here on the further issue of which incentives, implicit promotion incentives or explicit financial incentives, generally increase more quickly with increases in job level for WCM.

As WCM rise through the organizational hierarchy, we expect them to exercise broader decision rights, suggesting that firms will provide stronger explicit incentives at higher job levels. At lower job levels, a manager working in a large, hierarchical organizational unit is likely to exert relatively limited control over the inputs of other managers in that unit. In contrast, managers at higher job levels have broader responsibilities, making it more likely that they can influence the inputs of subordinate managers through their roles in such processes as personnel selection, project control and evaluation. In these ways, managers at higher job levels can influence aggregate-level outcomes by how they select, evaluate, coordinate and reward subordinate managers. Because of managers' broader responsibilities at higher job levels, unit or firm outcomes typically are more informative about an individual manager's performance than would be true at lower job levels. The job descriptions of semiconductor engineers in Appendix B at different job levels for our sample firms illustrate the increasing breadth of responsibility at higher job levels.[10]

Prior research provides empirical support for expecting increasing informativeness of aggregate-level performance measures and increasing strength of explicit financial incentives at higher job levels. For example, Kauhanen and Napari (2012) provide survey evidence that white collar jobs involve broader tasks and decision rights than blue collar jobs, leading to correspondingly broader performance measures. Bushman et al. (1995) establish that the relative intensity of aggregate performance measures in corporate hierarchies increases in the extent to which a unit-manager influences the performance of other units or divisions. Using proprietary compensation data, they further show that as a manager advances from plant manager to division chief to Group CEO and to Corporate CEO, performance measures for the manager's target bonus become more aggregate. Ederhof (2011) provides further support for this expectation. She predicts and finds that at higher levels within a technology-oriented hierarchical organization, managers have greater decision making authority, wider span of control and greater marginal productivity, all of which are consistent with these managers operating under contracts with stronger explicit financial incentives.

At the same time, the original tournament literature (Lazear & Rosen, 1981; Rosen, 1986) predicts that implicit incentives will also become stronger at higher job levels. Because the option value of career advancement decreases after each tournament round, the wage increase associated with each successive round must be increasing in order to provide a risk-averse employee with sufficient incentives in later rounds. The resulting convex relation between job level and the magnitude of pay increases implies that implicit incentives become stronger at higher job levels.

Given the preceding expectation that both implicit and explicit incentives become stronger at higher job levels, how the intensity of explicit financial incentives relative to implicit promotion-based incentives varies with job level becomes an empirical question. Therefore, we present our third hypothesis in null form.

H3. The relative intensity of implicit and explicit incentives does not change in job level.

[9] Baker et al. (1994b) identify a potential interaction between explicit and implicit incentives. In particular, they establish specific settings for which the provision of implicit incentives depends on the availability of sufficiently precise performance measures for corresponding explicit incentives. In Fig. IV of Baker et al. (1994b, p.1146), initially as the explicit performance measures become more precise, explicit and implicit incentives are complements. Over this region the value of the ongoing relation between the firm and the manager is great enough that the firm prefers to honor an earlier implicit agreement rather than reneging on the implicit agreement. However, Fig. IV also shows that further increases in the precision of the explicit performance measures change this relation such that the two types of incentives become substitutes. At the extreme in which explicit measures are sufficiently close to perfect, the firm cannot resist reneging on the implicit agreement, reverting to using just explicit incentives.

[10] For example, entry-level engineers perform tasks that have a basic degree of complexity and limited latitude for independent action. In comparison, engineers in the highest non-management level are responsible for developing advanced research techniques, and directing and coordinating efforts of technical staff on multiple projects. Engineers in the top management level are responsible for not only planning and coordinating activities of multiple research programs, but also developing long-range plans and cost management.

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3. Data, key variables, and descriptive statistics

3.1. Data

We use professional and managerial compensation data for the period 1997–2002, as compiled by the Pearl Meyer & Partners (PM) consulting firm. PM offers fee-based membership to firms and provides various compensation-related services to its members. Member firms provide their proprietary compensation data to PM. PM organizes the data into reports that enable the member firms to benchmark their compensation policies to those of similar firms.

The professional and managerial employees in the data are white collar managers who hold at least a bachelor's degree in a sample of technology-oriented firms.[11] PM structures their data collection process to require each participating firm to classify white collar managers into one of 85 jobs in three functional areas: Research and Development (*R&D*), Technical (*TECH*), and Administrative (*ADMIN*), as listed in Appendix A. The data collection process identifies eight job levels, consisting of non-supervisory levels one through five and supervisory levels six through eight, for each of the 85 jobs. The job levels reflect a combination of the task complexity and the level of supervisory responsibility associated with the position (see Appendix B for examples). Combining the three functional areas (*R&D*, *TECH*, and *ADMIN*) and the eight job levels yields 24 unique "job categories" for each firm-year.

The original data include compensation information for 2.4 million employees working for 254 unique firms, yielding 759 unique firm-years over the period 1997–2002. We use the mean compensation data for each of the 24 job categories for each firm-year in our empirical analysis for several reasons. First, our hypotheses primarily focus on the relation between WCM job levels and compensation. Second, implicit promotion-based incentives, a key variable of interest, is based on job level compensation measures. Finally, measuring compensation at the job level as opposed to the individual employee level helps us mitigate potential noise introduced by heterogeneity in employee attributes that are difficult to measure, such as their ability, knowledge, and opportunities in the external labor market. Averaging the compensation data in this way yields 16,250 observations, where each observation is a unique job category, firm and year combination.[12] From this original data, we retain only firms with data available from both CRSP and COMPUSTAT, reducing the sample size to 11,485 observations. Finally, dropping one bank and 11 firms with less than 100 employees yields the base sample of 11,393 observations for 525 firm-years. We winsorize the financial and stock return variables at the top and bottom 1% levels.

3.2. Key variable descriptions

3.2.1. Job Level

Job levels *S1 – S5* are five non-supervisory positions and job levels *M6 – M8* are three supervisory positions. An *S1* position is an entry-level non-supervisory position for an individual with a bachelor's degree and up to two years of experience. An *S5* position is an experienced non-supervisory job, requiring a bachelor's degree and a minimum of ten years of experience or a master's degree and six years of experience. *M6* is the entry level supervisory position, and *M8* is the highest position included in our data. Employees in *M8* positions supervise over 25 employees and establish plans and strategies in support of objectives determined by senior executives.

3.2.2. Compensation

The annual compensation data include base salary (*SALARY*), short-term performance incentives (*STI*), long-term equity incentives (*LTI*), deferred compensation, healthcare benefits and other benefits such as flexible spending accounts. We include only base salary, *STI*, and *LTI* in our measures of WCM compensation because these components represent the majority of total remuneration and the theories that we rely on are more pertinent to these components of compensation than to deferred compensation or other benefits.[13] *STI* includes all cash awards based on annual individual, unit, division, or corporate performance. In addition to the cash payment, *STI* also includes the value of equity compensation with a vesting period of less than one year. *LTI* encompasses the annual equity-based compensation, including stock options, stock appreciation rights, restricted stock awards and performance shares. Values of *LTI* are estimated based on the Black-Scholes option pricing model. Total cash compensation (*Total Cash*) is the sum of *SALARY* and *STI*; and total compensation (*Total Comp*) is the sum of *SALARY*, *STI*, and *LTI*.

3.2.3. Implicit Incentives

We use promotion incentives (*Promotion Incentives*) as a measure of implicit incentives. Following prior studies (e.g., Lambert et al., 1993), we measure the promotion incentives of WCM at job level *i* as the difference between the average total compensation at job levels *i* and *i*+1 for each job function and firm-year.

3.2.4. Explicit Incentives

Our hypothesis tests focus on explicit incentives tied to broad-based performance measures, such as unit, division, or firm performance. We measure such explicit incentives as either *LTI* or *STI*. Values of *LTI* are tied to the firm's stock price at the time of exercise. *STI* are based on not only business unit and firm performance, but also individual performance. Therefore, depending on the extent to which *STI* are determined based on individual performance, *STI* could reflect primarily individual performance incentives rather than incentives tied to organization-level (unit, division or firm) performance.[14]

3.3. Descriptive statistics

Table 1, Panel A reports the number of firms by year. The number of firms participating in the PM program gradually increased from 69 firms in 1997 to 99 firms in 2001 and 2002. When sample firms

[11] Production and sales employees are covered in a separate survey, consistent with our general notion that white collar managers constitute a unique set of employees.

[12] While a firm's pay structure generally reflects the firm's job hierarchy, the number of job levels varies across firms. For example, defense contractor Lockheed Martin defines six job levels, whereas GE Plastics uses five job levels (Milkovich et al., 2011, pp.59–66). As a result, not all firms in our sample classify their employees into eight job levels. Our analysis uses job levels as reported by the sample firms. We expect variation in the number of job levels across our sample firms to add noise to the data and to operate against finding support for our hypotheses. Nonetheless, to examine the robustness of our results, we replicate all our tests using a subsample of only those firms that report exactly eight job-levels. Limiting our tests to this subsample does not yield any meaningful changes in our results.

[13] By focusing on salary plus short-term and long-term incentives, our analysis captures on average 79% of total WCM compensation for our sample. The remaining 21% that we exclude consists of pensions (7%), healthcare and welfare benefits (10%) and other (4%).

[14] Our data do not distinguish *STI* that are based on individual performance from *STI* tied to unit or firm performance. According to the 2014 compensation survey by WorldatWork, on average, 40% of short-term incentives (*STI*) of exempt salaried employees are based on firm-performance, 33% are based on division/unit performance, and 27% are based on individual performance (p.21). These statistics suggest that organization-level performance is the most important determinant of *STI*.

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Table 1
Descriptive statistics.

Year					# Of firms
Panel A – firm distribution by year					
1997					69
1998					86
1999					82
2000					90
2001					99
2002					99
Total					525
Fama-French 48 industry groups	Industry				Number of firms
Panel B – Industry distribution					
6	Recreational products				1
8	Printing and publishing				2
9	Consumer goods				3
10	Apparel				1
12	Medical equipment				1
13	Pharmaceutical products				1
14	Chemicals				1
19	Steel works, etc.				1
21	Machinery				9
22	Electrical equipment				4
23	Automobiles and trucks				2
24	Aircraft				1
25	Ship-building, railroad equipment				1
26	Defense				1
32	Telecommunications				8
34	Business services				40
35	Computers				38
36	Electronic equipment				40
37	Measuring and control equipment				6
47	Trading				1
48	Misc.				2
	Total				164
	Mean	Median	25th	75th	StdDev
Panel C: Firm characteristics (N = 525)					
Assets ($ million)	11,603	2127	737	12,182	23,370
RET	0.2209	0.0833	−0.3007	0.5319	0.7466
ROA	0.0492	0.0676	−0.0054	0.1295	0.1656
Market-to-Book	6.4928	3.9512	2.2925	7.3154	8.3450
Idiosyncratic Risk	0.1427	0.1357	0.1065	0.1713	0.0521
R&D Exp.	0.1223	0.1215	0.0542	0.1695	0.0917

Assets is book value of assets. *RET* denotes stock performance and is measured by the buy-and-hold return over 12 months period prior to the compensation year. *ROA* denotes return on assets and is measured by the ratio of income before extraordinary items divided by book value of assets at the beginning of the year. *Market-to-Book* denotes the ratio of market value of equity to book value of equity measured at the beginning of the year. *Idiosyncratic Risk* is measured by standard deviation of residuals from a market model of monthly returns over 36-month period prior to the compensation year. *R&D Exp* denotes annual expenses on research and development scaled by annual net sales, and is measured at the beginning of the year.

are grouped into the 48 Fama-French industries, 77.4% of the sample firms are in the Machinery, Business Services, Computers, and Electronic Equipment industries, consistent with the sample orientation toward technology-intensive industries (Table 1, Panel B).

Panel C of Table 1 reports descriptive statistics for key financial variables. The sample firms are generally large with mean (median) book value of assets (*Assets*) of $11.6 billion ($2.1 billion). The median 12-month buy-and-hold return (*RET*) of 8.33% and the median annual return on assets (*ROA*) of 6.76% indicate that the sample firms generally performed well during the sample period. The average (median) idiosyncratic risk has the same order of magnitude as *RET*. Consistent with this relatively good firm performance, sample firms have a median market-to-book (*Market-to-Book*) ratio of 3.95. The median sample firm spends 12.15% of their net sales revenue on R&D, consistent with the concentration of our sample firms in technology-intensive industries.

4. Empirical analysis and results

4.1. H1 test: job level and convexity of pay increases

4.1.1. Univariate analysis for job level and compensation

Table 2 provides statistics on the distribution of total WCM compensation and its components across job levels for our sample firms. Mean (median) total compensation increases monotonically (with one exception) from $51,666 ($47,845) for entry level *S1* to $235,413 ($185,387) for job level *M8*. The exception occurs between job levels 5 and 6. WCM in job level *S5* earn average annual total compensation of $144,385 versus $120,113 for job level *M6*. Our examination of untabulated WCM tenure data reveals a corresponding monotonic pattern of tenure increasing with job level except between job levels *S5* and *M6*, where WCM in job level *S5* have mean tenure of 8.19 years versus 7.79 years for WCM at job level *M6*.

We interpret the reversals between job levels *S5* and *M6* as reflecting two related, but distinct, job hierarchies in which supervision is an important job component in job levels *M6* to *M8* but not in job levels *S1* to *S5*. WCM who have significant technical talent but lack supervisory skills (or the interest in employing those skills) advance in job levels *S1* through *S5*, while WCM with supervisory skills or interests can also advance to levels *M6* to *M8*. This interpretation is consistent with "dual-career ladders" described by Milkovich et al. (2011, pp.492–493) that provide both a professional ladder with increasing technical responsibilities and a managerial ladder with increasing supervisory responsibilities.

Overall, the results in Table 2 for total compensation strongly suggest that promotion to the next level comes with significant pay increases. We next examine whether the magnitude of the pay increases associated with promotion is consistent with the convex relation of pay to job levels that tournament theory predicts.

4.1.2. Multivariate analysis for H1 – Job level and convexity of pay increases

Hypothesis H1 predicts that WCM compensation increases in job level at an increasing rate, yielding a convex relation as tournament theory predicts (Rosen, 1986). Following Lambert et al. (1993), we estimate the following OLS model for non-supervisory positions *S1–S5*, and separately for supervisory positions *M6-M8*:

$$\begin{aligned}\text{Compensation}_{nijt} = {} & \beta_0 + \sum \text{Job} - \text{Level Indicator}_{nijt} \\ & + \beta_1 \text{ROA}_{jt-1} + \beta_2 \text{RET}_{jt-1} \\ & + \beta_3 \text{Idiosyncratic Risk}_{jt-1} \\ & + \beta_4 \log(\text{Assets}_{jt-1}) \\ & + \beta_5 \text{Market} - \text{to} - \text{Book}_{jt-1} \\ & + \beta_6 \log(\text{R\&D} - \text{Exp}_{jt-1}) + \beta_7 \text{Missing} \\ & - \text{R\&D Exp}_{jt-1} + \beta_8 \text{R\&D Job}_{njt} \\ & + \beta_9 \text{Tech Job}_{njt} + \text{Year\&Industry Effects} \\ & + \varepsilon_{nijt}\end{aligned}$$

where Compensation $_{nijt}$ is the average total compensation, total cash compensation, or base salary for job functional area *n*, job level *i*, firm *j* and year *t*.[15] Job-Level Indicator is a set of indicator variables

[15] Our results for H1 remain unchanged when we use median values instead of means for compensation.

Table 2
Compensation of white collar managers by job level (N = 11,393).

Job level	Total compensation		Salary		Short-term incentives (STI)		Equity incentives (LTI)	
	Mean	Median	Mean	Median	Mean	Median	Mean	Median
S1	51,666	47,845	45,668	44,973	845	143	5131	385
S2	63,907	57,820	54,120	53,457	1194	308	8557	1213
S3	80,575	71,966	65,673	64,815	1889	595	12,938	2913
S4	105,214	90,333	79,688	78,982	3177	1298	22,240	6507
S5	144,385	119,522	97,359	96,698	6236	3335	40,540	12,358
M6	120,113	101,116	84,518	83,053	4760	2665	30,764	9851
M7	164,267	131,261	102,185	101,025	8215	5354	53,477	19,931
M8	235,413	185,387	123,185	121,999	13,829	10,754	96,743	45,805

This table reports mean and median compensation by job level. Salary is annual base salary. Short-term incentive (*STI*) is comprised of cash incentives related to annual individual, unit/division, and firm performance. It also includes stock grants to be vested in one year. Long-term equity incentive (*LTI*) includes incentive stock options, stock appreciation rights, and restricted stock awards with longer than one-year vesting period. Total Compensation is the sum of base salary, *STI* and *LTI*.

for job levels *S2*–*S5* and *M7*–*M8*. To control for the effect of firm performance on WCM compensation, we include return on assets (*ROA*) and 12 month buy-and-hold return (*RET*). We also include other variables that prior literature documents as being associated with employee compensation, including idiosyncratic firm risk (*Idiosyncratic Risk*) and firm size (*Assets*) as proxies for monitoring costs. Following Smith and Watts (1992) and Core and Guay (2001), we use the market-to-book value of equity (*Market-to-Book*) and the natural log of annual R&D expense scaled by net sales (*R&D Exp*) as proxies for growth opportunities. To control for differing levels of employees' task-specific knowledge, we include indicator variables for jobs in the R&D (*R&D Job*) and technical (*Tech Job*) areas.

Besides job and firm characteristics, external labor market conditions may also affect WCM incentives (Oyer & Schaefer, 2011). For example, Holmstrom (1982) demonstrates that employees may be motivated by potential opportunities available in the external labor market, and this effect is stronger when the market's prior beliefs about employee ability are more diffuse. We use industry and year fixed effects to control for variations in external labor market conditions across industries and time. We measure control variables as of the beginning of the compensation year and use the same set of control variables in all models unless stated otherwise. Appendix C provides detailed descriptions of all variables used in the analysis.

Because we use pooled cross-sectional regressions with multiple observations for some sample firms, we report t-statistics based on standard errors that are robust to heteroscedasticity and clustering at the firm level. Table 3 reports estimation results.

Coefficients on the job level indicator variables, *S2*–*S5* and *M7*–*M8*, measure the strength of implicit promotion incentives. For example, in the non-supervisory total compensation regression, the coefficient of 12.38 on *S2* is the estimated average increase of $12,380 in total compensation between job levels *S1* and *S2*. In turn, the difference between the estimated coefficients on *S3* and *S2* (29.03−12.38 = 16.65) reflects the estimated average increase of $16,650 in total compensation between job levels *S2* and *S3*.[16] A convex functional relationship between job level and compensation then implies that the following conditions must hold: i) $S2 > 0$, ii) $(S3–S2) > S2$ or $S3 - 2{*}S2 > 0$, iii) $(S4–S3) > (S3–S2)$ or $S4 - 2{*}S3 + S2 > 0$, and iv) $(S5–S4) > (S4–S3)$ or $S5 - 2{*}S4 + S3 > 0$, with corresponding convexity conditions for supervisory positions *M6* – *M8*. Results of testing these convexity conditions are reported at the bottom of Table 3, as we describe next.

For total compensation in non-supervisory positions, the estimated coefficient of 12.38 on *S2* is significantly different from zero ($p < 0.01$). Further, statistical tests indicate that the difference *S3*–*S2* is significantly larger than *S2* ($p < 0.01$). Similarly, all other corresponding tests for the convexity of total compensation also yield results that have the expected signs and are statistically significant ($p < 0.01$). These results also hold when we replace total compensation with either total cash compensation or salary. Further, we find a similar convex relation between job level and compensation increases for supervisory positions. Overall, the results provide strong support for H1, consistent with sample firms making significant use of implicit promotion-based incentives for WCM.[17]

The results for control variables are generally consistent with prior studies. For example, similar to Smith and Watts (1992) and Core, Holthausen, and Larcker (1999), larger firms and firms with greater growth opportunities pay significantly greater total compensation ($p < 0.01$). These results are consistent with firms with more complex operating environments (as measured by *Assets*) and greater growth options (as measured by *Market-to-Book* and *R&D Exp*) hiring higher quality WCM. Finally, WCM in R&D or technical functions earn greater total compensation than those in administrative positions.

4.2. H2 test: relation between implicit and explicit incentives

4.2.1. Univariate analysis

Hypothesis H2 predicts that firms use implicit promotion incentives and explicit financial incentives as complements. We test H2 by examining how the two types of incentives are correlated. Panel A of Table 4 reports Pearson correlations between $\log(1 + \textit{Promotion Incentives})$ and $\log(1 + \textit{LTI})$, and alternatively between $\log(1 + \textit{Promotion Incentives})$ and $\log(1 + \textit{STI})$, for each job level.[18] The results show that implicit promotion incentives are highly positively correlated with both *LTI* and *STI* ($p < 0.01$) across all job levels, with correlations ranging from 0.44 to 0.59 for *LTI* and from 0.15 to 0.30 for *STI*. These large positive correlations are consistent with firms using implicit promotion incentives and explicit financial incentives as complements and provide strong support for H2.

[16] The difference $(S3 - S1) - (S2 - S1)$ reduces to $S3 - S2$.

[17] The results in Table 3 also suggest that implicit promotion-based incentives are economically significant for our sample firms, varying from $16,650 between job levels *S2* and *S3* to $68,430 between job levels *M7* and *M8*. As a crude comparison, from Table 2, the corresponding values of mean annual explicit incentive compensation (short-term plus long-term) at job levels *S2* and *M7* are $9751 and $61,692, respectively.

[18] We exclude job levels *S5* and *M8* from the tests involving implicit promotion incentives because, as the highest level for each job function, further promotions are not available at these job levels.

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Table 3
Promotion-based incentives for white collar managers.

	Non-supervisory			Supervisory		
	Total Comp	Total cash	Salary	Total Comp	Total cash	Salary
S2	12.38***	8.87***	8.49***			
	(16.84)	(40.01)	(40.74)			
S3	29.03***	21.08***	20.02***			
	(21.63)	(59.28)	(63.87)			
S4	53.07***	36.15***	33.84***			
	(21.07)	(63.08)	(72.83)			
S5	91.39***	56.40***	51.05***			
	(19.50)	(61.52)	(74.73)			
M7				44.00***	21.07***	17.49***
				(16.54)	(32.48)	(42.65)
M8				112.43***	47.60***	38.12***
				(16.30)	(42.66)	(57.96)
ROA	13.24	6.11***	2.22	75.07*	20.64***	7.72**
	(0.62)	(2.66)	(1.20)	(1.69)	(4.64)	(2.59)
RET	−0.39	0.16	−0.26	1.02	1.25	−0.15
	(-0.17)	(0.40)	(-0.85)	(0.18)	(1.52)	(-0.30)
Idiosyncratic Risk	138.98**	20.19	17.09	375.64**	33.02	33.28*
	(2.36)	(1.43)	(1.43)	(2.36)	(1.32)	(1.83)
log(Assets)	5.83***	1.41***	0.84***	16.89***	3.39***	1.88***
	(3.46)	(4.39)	(3.26)	(4.12)	(4.87)	(3.90)
Market-to-Book	1.06***	0.01	0.01	2.94***	0.07	0.03
	(3.15)	(0.14)	(0.18)	(3.17)	(0.72)	(0.49)
log(R&D Exp)	114.02***	30.39***	26.56***	236.90**	46.47***	37.79***
	(3.15)	(4.45)	(4.77)	(2.48)	(3.09)	(3.61)
Missing R&D Exp	−0.35	−3.88*	−3.18*	27.45	−2.45	−2.73
	(-0.04)	(-1.81)	(-1.85)	(0.75)	(-0.68)	(-1.36)
R&D Job	18.02***	12.16***	11.71***	35.58***	15.78***	13.91***
	(12.57)	(22.22)	(24.91)	(10.12)	(17.44)	(20.32)
TECH Job	5.55***	5.66***	5.55***	9.82***	6.18***	5.71***
	(5.10)	(13.20)	(15.72)	(5.05)	(9.80)	(11.13)
Constant	−32.92*	28.78***	33.53***	−125.73***	50.60***	61.17***
	(-1.81)	(6.30)	(8.98)	(-2.65)	(5.44)	(9.52)
Year & Industry	Yes	Yes	Yes	Yes	Yes	Yes
Observations	7360	7360	7360	4033	4033	4033
Adjusted R^2	0.4644	0.8286	0.8565	0.4320	0.6933	0.7440

Hypothesis tests

	Total Comp	Total Cash	Salary
Non-supervisory			
S2 = 0	12.38 (F = 283.47, p < 0.01)	8.87 (F = 1600.87, p < 0.01)	8.49 (F = 1660.14, p < 0.01)
S3 − S2 = S2	4.27 (F = 25.93, p < 0.01)	3.34 (F = 125.81, p < 0.01)	3.04 (F = 120.79, p < 0.01)
S4 − S3 = S3 − S2	7.39 (F = 62.32, p < 0.01)	2.86 (F = 86.48, p < 0.01)	2.29 (F = 70.49, p < 0.01)
S5 − S4 = S4 − S3	14.28 (F = 60.00, p < 0.01)	5.18 (F = 80.32, p < 0.01)	3.39 (F = 50.78, p < 0.01)
Supervisory			
M7 = 0	44.00 (F = 273.45, p < 0.01)	21.07 (F = 1054.78, p < 0.01)	17.49 (F = 1819.23, p < 0.01)
M8 − M7 = M7	24.43 (F = 41.73, p < 0.01)	5.46 (F = 39.19, p < 0.01)	3.14 (F = 22.73, p < 0.01)

This table reports estimation results of the functional relationship between compensation measures (Total Comp, Total Cash and Salary in $ '000) and job level for each subsample of non-supervisory positions and supervisory positions. Non-supervisory group includes levels *S1*–*S5*, where *S1* is the lowest and *S5* is the highest job level. Supervisory group includes levels *M6*–*M8*, where *M6* is the lowest and *M8* is the highest job level. *S2*–*S5* and *M7*–*M8* are indicator variables for corresponding job levels. All other control variables are described in Appendix C. Year and industry indicators are included in the model but not reported. T-statistics are based on standard errors that are robust to heteroscedasticity and clustering at the firm level.***p < 0.01,**p < 0.05,*p < 0.1.

4.2.2. Multivariate analysis

When testing complementarity using correlations between two choice variables, Arora and Gambardella (1990) advocate testing correlations of residuals estimated from OLS regressions for each of the choice variables. Following this suggestion, Abernethy et al. (2015) test complementarity between implicit incentives (selection) and explicit incentives (incentive contracting) using seemingly unrelated regressions (SUR), because SUR provide a direct assessment of the correlations between residuals from the regressions. Similar to Abernethy et al. (2015), we estimate the following model using SUR to examine the association between implicit promotion incentives and explicit financial incentives (*STI* and *LTI*):

$$\log(1+\mathrm{LTI})_{nijt} = \alpha_0 + \alpha_1 \mathrm{Job-Level}_{nijt} + \alpha_2 \mathrm{R\&D\ Job}_{jt-1} + \sum \mathrm{Controls} + \mathrm{Year\ \&\ Industry\ Effects} + \varepsilon_{nijt}$$

Table 4
Relation between implicit and explicit incentives.

Job level	Corr. (Implicit incentive, LTI)	Corr. (Implicit incentive, STI)
Panel A: Pearson correlations		
S1	0.439***	0.152***
S2	0.532***	0.204***
S3	0.588***	0.268***
S4	0.544***	0.234***
M6	0.590***	0.281***
M7	0.568***	0.298***

	Dependent variables:		
	log(1 + LTI)	log(1 + STI)	log(1 + Promotion incentives)
Panel B: Seemingly unrelated regressions			
Job-level	0.560***	0.491***	0.241***
	(28.68)	(27.50)	(57.98)
R&D job	0.418***	0.048	0.197***
	(4.86)	(0.62)	(10.74)
ROA	3.406***	2.519***	0.587***
	(10.84)	(8.77)	(8.77)
RET	−0.272***	0.271***	0.031**
	(-4.20)	(4.58)	(2.26)
lag(Assets)	0.484***	0.630***	0.107***
	(13.95)	(19.87)	(14.44)
Idiosyncratic risk	12.920***	−1.873	2.132***
	(9.94)	(-1.58)	(7.70)
Market-to-Book	0.034***	−0.039***	0.011***
	(5.42)	(-6.82)	(8.21)
log(1 + R&D Exp)	18.015***	2.011***	2.271***
	(22.54)	(2.75)	(13.34)
Missing R&D	−1.678***	0.360	0.105*
	(-6.60)	(1.55)	(1.94)
Constant	−9.050***	−1.909***	7.368***
	(-13.62)	(-3.14)	(52.06)
Year & Industry	Yes	Yes	Yes
Observations	7980	7980	7980
R^2	0.3407	0.2414	0.3957

Residual correlations	log(1 + LTI)	log(1 + STI)	log(1 + Promotion incentives)
log(1 + LTI)	1		
log(1 + STI)	0.1191***	1	
log(1 + Promotion incentives)	0.3136***	0.1283***	1
Breusch–Pagan test	Chi2 = 1029.43 (p < 0.000)		

Panel A reports Pearson correlations between implicit promotion incentives and explicit financial incentives by job level. Implicit promotion incentives are measured as log(1 + *Promotion Incentives*). Explicit financial incentives are measured as either log(1 + *STI*) or log(1 + *LTI*). *STI* is short-term performance cash incentives, and *LTI* is long-term equity incentives.*** 0.01 (two-tailed).
Panel B examines the association between explicit incentives, measured as either *STI* or *LTI*, and implicit promotion incentives. *STI* is short-term performance cash incentives, and *LTI* is long-term equity incentives. Year and industry indicators are included in the model but not reported. T-statistics are based on standard errors that are robust to heteroscedasticity and clustering at the firm level.*** 0.01,** 0.05,* 0.10 (two-tailed).

$$\log(1+\text{STI})_{nijt} = \beta_0 + \beta_1 \text{Job} - \text{Level}_{nijt} + \beta_2 \text{R\&D Job}_{jt-1} + \sum \text{Controls} + \text{Year \& Industry Effects} + \zeta_{nijt}$$

$$\log(1+\text{Promotion Incentives})_{nijt} = \gamma_0 + \gamma_1 \text{Job} - \text{Level}_{nijt} + \gamma_3 \text{R\&D Job}_{jt-1} + \sum \text{Controls} + \text{Year \& Industry Effects} + \eta_{nijt}$$

A positive correlation between the residuals ε and η (or ζ and η) would suggest a complementary relation between explicit and implicit incentives, while a negative correlation would suggest a substitutive relation. Table 4 Panel B reports the results.

The residual correlations between explicit financial incentives and implicit promotion incentives are positive and significant, suggesting a complementary relation. Specifically, the correlation between *Promotion Incentives* and *LTI* (*STI*) is 0.3136 (0.1283). The Breusch–Pagan test of overall independence of the residuals also rejects the null that the residuals are independent. This result further supports the inference that our sample firms use implicit promotion incentives and explicit financial incentives as complements for WCM.[19]

These results are contrary to the findings in Gibbons and Murphy (1992) and Gibbs (1995) that implicit incentives and explicit financial incentives are substitutes in their settings. We attribute this difference to our sample firms generally facing an unrestricted choice of implicit incentives. That is, in the environments analyzed by Gibbons and Murphy (1992) and Gibbs (1995), implicit incentives are exogenously constrained by CEOs being near retirement age (Gibbons & Murphy, 1992) or by employees who had been passed over for promotion and face little prospect of future promotion (Gibbs, 1995). As a consequence, in such settings firms are constrained in their ability to adjust the level of implicit incentives, whereas in our study the sample firms face no such systematic constraints and therefore have greater leeway in determining an optimal level of implicit and explicit incentives for each job level. Overall, the results in Table 4 suggest that firms use implicit and explicit incentives as complements when their ability to adjust implicit incentives is not significantly constrained.

4.3. H3 test: relative intensity of implicit versus explicit incentives

4.3.1. Univariate analysis

Because most WCM work in relatively structured and hierarchical organizations, hypothesis H3 analyzes how the relative intensity of implicit promotion incentives versus explicit financial incentives varies at increasing job levels within the hierarchy. H1 predicts that implicit promotion-based incentives are increasing in job levels. With respect to explicit incentives based on aggregate-level performance measures, we predict that increasing decision rights at higher job levels will make aggregate-level performance measures more informative. The expectation that both implicit and explicit incentives are increasing in job levels leaves the impact of job level on the relative intensity of implicit versus explicit incentives as an empirical question.

To examine H3, we measure the intensity of implicit incentives relative to explicit incentives as log(1 + *Promotion Incentives*) − log(1 + *Explicit Incentives*)[20] and examine how the relative intensity changes over job level. Fig. 1 plots the relative intensity of implicit promotion incentives across job level and Table 5 tests the statistical significance of the changes in the relative intensity.

Fig. 1 shows that both measures of the relative intensity of implicit versus explicit incentives, log(1 + *Promotion Incentives*) − log(1 + *LTI*) and log(1 + *Promotion Incentives*) − log(1 + *STI*), decrease as job level increases. The results in Table 5 confirm this

[19] The results are similar when we use an ordinary least square (OLS) regression in which explicit financial incentives are a function of implicit promotion incentives. Consistent with the positive residual correlations in Table 4 Panel B, the coefficient on implicit promotion incentives in the OLS regression is positive and significant (p < 0.01).

[20] We use log transformed ratios of implicit incentives to explicit incentives to mitigate the potential effects of outliers and to address the issue of zero denominator values in a ratio variable. The results are similar when we use raw ratios in place of log-transformed ratios. We measure implicit and explicit incentives in dollars.

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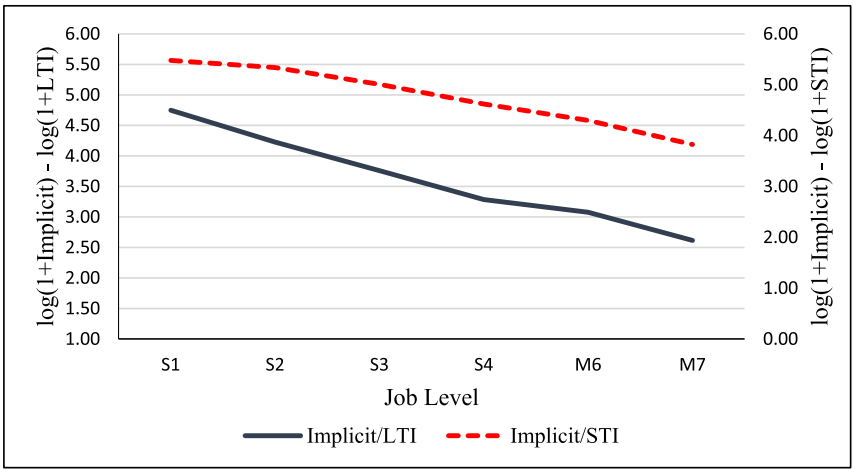

Fig. 1. The figure shows the average relative intensity of implicit promotion incentives versus explicit financial incentives. The solid line indicates the intensity of implicit promotion incentives relative to long-term incentives (*LTI*) measured as log(1 + *Promotion Incentives*) − log(1 + *LTI*). The dotted line indicates the intensity of implicit promotion incentives relative to short-term incentives (*STI*) measured as log(1 + *Promotion Incentives*) − log(1 + *STI*).

pattern. The middle two columns of Table 5 show that the mean (median) intensity of promotion incentives relative to *LTI* decreases from 4.75 (3.46) for *S1* to 2.62 (0.92) for *M7*. The decrease is statistically significant at the $p < 0.01$ level. The results are similar when we examine the intensity of promotion incentives relative to *STI* in the last two columns of Table 5. The mean (median) relative intensity decreases from 5.48 (4.24) for *S1* to 3.82 (2.42) for *M7* ($p < 0.01$).

4.3.2. Multivariate analysis

Table 6 re-examines the association between job level and the intensity of implicit promotion incentives relative to explicit financial incentives, while controlling for such firm characteristics as performance, size, risk, and growth opportunities, as well as year and industry effects. The dependent variable in the first column (Model 1) is the intensity of implicit promotion incentives relative to long-term financial incentives, measured as log(1 + *Promotion Incentives*) − log(1 + *LTI*).

The key independent variable, *Job-Level*, takes a value of 1 for job level *S1*, 2 for job level *S2*, and so on to 6 for job level *M7*, where we exclude job levels *S5* and *M8*. The coefficient of −0.318 on *Job-Level* in Model 1 is significant at the $p < 0.01$ level, suggesting that the intensity of implicit promotion incentives relative to *LTI* decreases in job level. The results are generally comparable in the second column of results where the dependent variable is log(1 + *Promotion Incentives*) − log(1 + *STI*) (Model 2). Consistent with the univariate results, the coefficient on *Job-Level* in Model 2 is −0.250 ($p < 0.01$), suggesting that the intensity of promotion incentives relative to *STI* decreases in job level. These results in Table 6 are consistent with the univariate results in Fig. 1 and Table 5.

These findings are consistent with the conjecture that greater decision rights in higher level jobs improve the informativeness of organization-level performance measures. More importantly, at higher job levels, increases in informativeness of the aggregate performance measures make explicit financial incentives grow faster than promotion-based implicit incentives, resulting in decreases in the relative intensity of promotion-based incentives.

Given the non-directional hypothesis in H3, the generalizability of the preceding findings is a significant issue. We believe that there are at least two reasons to expect that the results are reasonably likely to generalize to other settings. First, in untabulated tests, we extend the analysis in the current paper to compare the relative intensity of implicit promotion incentives of white collar supervisors to that of non-CEO executives. The results confirm our expectation that moving further up in a firm's job hierarchy from the white collar supervisor level to the non-CEO executive level produces a continuing decline in the intensity of implicit promotion incentives relative to total explicit financial incentives from 1.25 to 0.56. Second, we can consider whether the preceding reasoning can be further extended to a comparison of the form of incentives for non-CEO executives versus for the CEO. One reason to expect that the earlier results will generalize to the CEO level is the well-established empirical regularity that the majority of CEO compensation takes the form of incentives tied to firm performance. In particular, over the 2000 to 2008 period, salary constitutes less than 20% of total CEO compensation for S&P 500 firms (Frydman & Jenter, 2010). Further, as the CEO position is the highest rank in the job hierarchy, there are no implicit promotion incentives for the CEO. In other words, 100% of the CEO's incentives are from explicit financial incentives and hence the intensity of implicit promotion incentives relative to explicit financial incentives decreases to zero.

Table 5
Relative intensity of implicit versus explicit incentives by job level: Univariate analysis.

Job complexity	Obs.	log(1 + *Promotion Incentives*) − log(1 + *LTI*)		log(1 + *Promotion Incentives*) − log(1 + *STI*)	
		Mean	Median	Mean	Median
Non-supervisory					
S1	1402	4.75	3.46	5.48	4.24
S2	1482	4.23	2.48	5.34	3.88
S3	1457	3.76	1.93	5.01	3.50
S4	1239	3.29	1.44	4.62	3.15
Supervisory					
M6	1307	3.08	1.13	4.30	2.72
M7	1093	2.62	0.92	3.82	2.42
Difference test		t-stat	z-stat	t-stat	z-stat
S1 = S4		9.45***	7.30***	6.18***	4.32***
M6 = M7		2.81***	3.52***	3.17***	3.57***

This table reports the mean/median of the intensity of promotion-based implicit incentives relative to explicit financial incentives across job levels. The relative intensity is measured as either log(1 + *Promotion Incentives*) − log(1 + *LTI*) or log(1 + *Promotion Incentives*) − log(1 + *STI*). *LTI* and *STI* are explicit financial incentives. *LTI* is long-term equity incentives and *STI* is short-term performance-based cash incentives. Job level *S5* and *M8* are excluded for this table, because these are the highest job levels for each category and hence have no implicit promotion-based incentives. *** 0.01, ** 0.05, * 0.10 (two-tailed).

Table 6
Relative intensity of implicit versus explicit incentives and job level: Multivariate analysis.

	Log(1 + *Promotion Incentives*) − log(1 + *LTI*)	Log(1 + *Promotion Incentives*) − log(1 + *STI*)
	Model 1	Model 2
Job-Level	−0.318***	−0.250***
	(-9.82)	(-6.80)
ROA	−2.820**	−1.932*
	(-2.33)	(-1.84)
RET	0.304	−0.241
	(1.46)	(-1.11)
log(Assets)	−0.378**	−0.523***
	(-2.39)	(-3.74)
Idiosyncratic Risk	−10.789*	4.006
	(-1.72)	(0.81)
Market-to-Book	−0.023	0.049**
	(-0.84)	(2.24)
log(R&D Exp)	−15.783***	0.286
	(-5.16)	(0.09)
Missing R&D Exp	1.796	−0.263
	(1.35)	(-0.26)
Constant	10.625***	9.072***
	(5.35)	(5.22)
Year & Industry	Yes	Yes
Observations	7980	7980
Adjusted R^2	0.2735	0.1711

The dependent variable is the intensity of implicit promotion-based incentives relative to explicit financial incentives. The relative intensity is measured as log(1 + *Promotion Incentives*) − log(1 + *LTI*) in Model 1, and log(1 + *Promotion Incentives*) − log(1 + *STI*) in Model 2. *STI* is cash incentives for short-term performance, and *LTI* is long-term equity incentives. *Job-Level* is job level of white collar managers and takes a value in the range of 1–6 (*S1–S4* and *M6-M7*). *S5* and *M8* are excluded from the sample for this table because they are the highest level for non-supervisory or supervisory job functions and hence have no promotion incentives. Year and industry indicators are included in the model but not reported. T-statistics are based on standard errors that are robust to heteroscedasticity and clustering at the firm level. *** 0.01, ** 0.05, * 0.10 (two-tailed).

These regularities suggest our findings for H3 are likely to hold in at least some other settings in which decision rights increase with job level.

5. Additional analysis

5.1. R&D jobs versus Non-R&D jobs — alternative measure of decision rights

This sub-section re-examines hypothesis H3 using the distinction between R&D and non-R&D jobs as an alternative measure of decision rights. This distinction reflects several effects. First, compared to non-R&D jobs, R&D jobs typically involve more complex and less structured tasks, suggesting that it is more difficult to prescribe standard procedures for R&D tasks and to establish standardized outcomes for such tasks. Therefore, we expect R&D employees to be granted more extensive decision rights concerning how they perform their tasks. Second, R&D outputs are strategically important for our sample of high technology firms, suggesting that their decisions have a greater impact on firm performance. Finally, R&D outputs are often long-term in nature. Based on these attributes of R&D jobs, we expect that compared to WCM in non-R&D jobs, WCM in R&D jobs possess more decision rights and have greater influence on long-term organization-level performance. Table 7 reports the results of using an indicator variable for R&D jobs (*R&D Job*) to re-examine hypothesis H3.

Table 7, Panel A provides a univariate comparison of the level of implicit promotion incentives and explicit financial incentives, as well as their relative intensity, for R&D jobs versus non-R&D jobs. For brevity, we measure total explicit financial incentives as the sum of *LTI* and *STI*. The test results at the bottom of the first two columns show that both promotion incentives and explicit incentives are significantly larger for R&D jobs than for non-R&D jobs ($p < 0.01$). Related to H3, the last two columns of Table 7, Panel A report that the intensity of implicit promotion incentives relative to explicit incentives is significantly smaller for R&D jobs than for non-R&D jobs. The mean (median) measure is 2.03 (0.99) for R&D jobs and 2.16 (1.24) for non-R&D jobs, where the difference in the means is marginally significant ($p < 0.10$) and the difference in the medians is significant at the $p < 0.01$ level.

Table 7, Panel B re-examines the preceding results using multivariate regressions. Because job level is significantly associated with the magnitude of promotion and explicit financial incentives, we include *Job-Level* as well as other firm characteristics as control variables in the regressions. Consistent with the univariate results, *R&D Job* is positively associated with both implicit promotion incentives (coefficient = 0.197, $p < 0.01$) in Model 1 and explicit financial incentives (coefficient = 0.356, $p < 0.01$) in Model 2. Further, the results in Model 3 show that *R&D Job* is negatively and significantly associated ($p < 0.01$) with the relative intensity of implicit promotion incentives.

Overall, the results based on R&D versus non-R&D jobs are consistent with the primary results based on white collar job levels, and provide further support for our inference that jobs involving more decision rights are associated with weaker (stronger) relative intensity of implicit (explicit) incentives.

6. Summary and conclusion

WCM constitute a large and increasing proportion of the U.S. labor force and play an increasingly important role in the U.S. economy. Therefore, recruiting and retaining high quality WCM and providing them with appropriate incentives have become significant strategic objectives for many firms. Nonetheless, we know little about the incentive design of WCM. Using unique data on WCM compensation for the years 1997–2002, we provide several important findings on the WCM compensation practices of a sample of large, technology-oriented U.S. corporations.

Our analysis of compensation design for WCM yields three primary findings. First, our sample firms compensate WCM with a

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Table 7
Implicit and explicit incentives for R&D jobs versus Non-R&D jobs.

		Level of implicit & explicit incentives				Relative intensity of implicit incentives	
		Promotion Incentives ($)		*LTI* + *STI* ($)		log(1 + *Promotion Incentives*) − log(1 + *LTI* + *STI*)	
Panel A: Univariate analysis							
	Obs.	Mean	Median	Mean	Median	Mean	Median
R&D	2620	37,918	21,184	28,195	8302	2.03	0.99
Non-R&D	5360	33,610	18,520	21,045	5564	2.16	1.24
Difference Test		t-stat	z-stat	t-stat	z-stat	t-stat	z-stat
R&D = Non-R&D		7.52***	7.46***	6.19***	6.58***	−1.83*	−4.42***

	Level of implicit & explicit incentives		Relative intensity of implicit vs. Explicit incentives
	log (1 + *Promotion Incentives*)	log(1 + *LTI* + *STI*)	log(1 + *Promotion Incentives*) − log(1 + *LTI* + *STI*)
	Model 1	Model 2	Model 3
Panel B: Multivariate Analysis			
R&D Job	0.197***	0.356***	−0.159***
	(10.51)	(6.00)	(-2.72)
Job-Level	0.241***	0.522***	−0.281***
	(26.76)	(17.81)	(-10.23)
ROA	0.587**	2.711**	−2.124**
	(2.15)	(2.44)	(-2.34)
RET	0.031	0.107	−0.076
	(1.04)	(0.57)	(-0.45)
Log(Assets)	0.107***	0.465***	−0.358***
	(3.99)	(4.17)	(-3.49)
Idiosyncratic Risk	2.132**	8.194	−6.062
	(2.17)	(1.48)	(-1.26)
Market-to-Book	0.011**	0.009	0.002
	(2.38)	(0.37)	(0.11)
log(1 + R&D Exp)	2.271***	11.656***	−9.385***
	(4.18)	(4.75)	(-4.39)
Missing R&D Exp	0.105	−0.185	0.290
	(0.53)	(-0.26)	(0.47)
Constant	7.624***	0.002	7.622***
	(24.84)	(0.00)	(5.52)
Year and Industry	Yes	Yes	Yes
Observations	7980	7980	7980
Adjusted R^2	0.3931	0.3057	0.1966

This table examines how the level of implicit and explicit incentives and their relative intensity vary across R&D jobs and Non-R&D jobs. Panel A reports the univariate analysis and Panel B reports the regression analysis. Implicit incentives are measured as promotion incentives and explicit incentives are measured as the sum of *LTI* and *STI*. *LTI* is long-term equity incentives and *STI* is short-term performance cash incentives. Intensity of implicit incentives relative to explicit incentives is measured as log(1 + *Promotion Incentives*) − log(1 + *LTI* + *STI*). R&D Job is an indicator variable coded as 1 if job function is R&D, and 0 otherwise. T-statistics (in parenthesis) reported in Panel B are based on standard errors that are robust to heteroscedasticity and clustering at the firm level. *** 0.01, ** 0.05, * 0.10 (two-tailed).

mix of implicit promotion-based and explicit financial incentives where the magnitude of both components is economically significant. Further, as expected, the design of implicit promotion-based incentives features compensation that is convex in job level, consistent with tournament theory predictions. This result confirms the importance of both implicit and explicit incentives for white collar managers whose knowledge-based outputs are difficult to objectively measure. Second, our sample firms generally design implicit and explicit incentives as complements rather than substitutes. That is, WCM with stronger implicit incentives are also provided with stronger explicit incentives. This result is consistent with incentive design structure for WCM generally reflecting environments in which firms are relatively unconstrained in their ability to adjust both implicit and explicit incentives. Third, as job level increases, both implicit and explicit incentives increase. However, explicit incentives grow faster than implicit incentives, and therefore the intensity of explicit incentives relative to implicit incentives is increasing in job level. We attribute this result to WCM in higher level jobs exercising greater decision rights.

We note the following caveats concerning our analysis. First, our data are limited to the six years from 1997 through 2002 and to large, technology-oriented firms in those years. As is often the case, the sample is opportunistic and our efforts to expand the data to more recent years have not been successful.[21] Second, our data aggregate various short-term incentives into a single measure, *STI*, without distinguishing how much of the total *STI* are based on individual, unit and firm performance measures or the identity of the specific measures being used. More disaggregate data would permit a more detailed analysis of performance measures at individual, unit and firm levels, as well as the effect of using these alternative performance measures. Third, as discussed earlier, although we offer reasons to believe that our results for H3 will generalize to other similar settings, the lack of a directional prediction for H3 does bring the generalizability of the H3 results into question. Finally, we classify short-term performance-based cash incentives and long-term equity incentives as explicit financial

[21] More recent compensation surveys by WorldatWork in 2007 and 2014 document pay practices of large U.S. companies with important similarities to this study's findings for our sample firms. These more recent results provide a modest indication that the general compensation patterns we find are likely to persist in more current data.

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incentives. However, firms may also use incentive compensation, particularly equity-based compensation, to attract or retain certain types of employees (Oyer & Schaefer, 2005; Ittner, Lambert, & Larcker, 2003; Goldmanis & Ray, 2015). A future study that examines when and how firms use variable compensation for incentive effects and/or sorting and retention of employees could generate additional insight on this issue.

Appendix A. Job list by functional area

R&D jobs
Application-Specific Integrated Circuit Design Engineering
Computer-Aided Design Engineering
Chemist
Development Engineering
Electronic Design Engineering
Firmware Engineering
Human Factors Design Engineering
Hardware Engineering
Mechanical Design Engineering
Network Product Development Engineering
RF/Wireless Development Engineering
Research Scientist
Software Applications Engineering
Semiconductor Design Engineering
Software Operating Systems Engineering
Semiconductor Process Engineering
Software Engineering
Telecom Product Development Engineering
Network/Telecommunications Development Engineering

Technical jobs
Website Application Developer
Applications Engineering
Business/System Analyst
Channel Marketing
Database Analyst
Equipment Engineering
Facilities Engineering
Internal Network Engineering
Industry Marketing
Manufacturing Process Engineering
Manufacturing Engineering
Marketing (Default)
Marketing Research
Network Engineering
Network System Analyst
Oracle/SAP Database Administrator
Application Programmer/Analyst
Project Manager – Inter/Intra/Extranet
Product Marketing
Programmer/Analyst
Quality Engineering
Reliability and Quality Engineering
Semiconductor Product Engineer
Software Quality Engineering
Software Service Consulting
Operating Systems Programmer/Analyst
Technical Editor
Test Engineering
Technical Marketing Support
Telecommunications
Applications Engineering
Technical Support Engineering
Technical Training
Technical Writing
Website Administrator
Webmaster – Content/Marketing
Website Designer
Web Technologist

Administrative jobs
Accounting
Financial Analyst/Accountant
Buyer/Planner
Purchasing
Cost Accounting
Compensation and/or Benefits
Credit/Collections
Contract Negotiation
Controller
Employee Communications
Environmental Health and Safety
Finance
Human Resource Generalist
Human Resources Information System
Human Resource Specialist
Legal
Marketing Communications
Manufacturing Production Management
Material/Production Control Planning
Occupational Health Nurse
Public Relations
Product Marketing
Security
Staffing
Training
Tax
Treasury
Vendor Management

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Appendix B. Examples of job description

The following job descriptions are excerpts from the survey documents prepared by Pearl Meyer & Partners:

Semiconductor design engineering (R&D Job)

Level 1 (S1): Performs semiconductor design engineering assignments to a basic degree of complexity under direction and supervision, with limited latitude for independent action. Assignments include the routine engineering and design of chip layout circuit design; and modification and evaluation of semiconductor devices and components. Typical requirements are a Bachelor's degree or equivalent and up to two years of experience.

Level 2 (S2): Performs semiconductor design engineering assignments of some complexity under general direction with considerable discretions to work details. Performs developmental and/or test work which requires comprehensive knowledge of semiconductor device and component theory and design … Typical requirements are a Bachelor's degree and two to four years of experience, or Master's degree and up to two years of experience.

Level 3 (S3): Performs complicated and difficult design engineering assignments of major complexity requiring a high degree of technical competence under general supervision. Duties include full technical responsibility for planning, organizing, and conducting technical projects … Typical requirements are a Bachelor's degree and four to six years of experience, or a Master's degree and two to four years of experience.

Level 4 (S4): Develops and applies advanced semiconductor theory, methods and research techniques in the investigation and solution of complex and advanced semiconductor devices and component design problems … .Typical requirements are a Bachelor's degree and six or more years of experience, or a Master's degree and four to six years of experience.

Level 5 (S5): Develops and applies advanced semiconductor design theories and research techniques … Plans, conducts and technically directs projects or major phases of significant projects, coordinating efforts of technical support staff in the performance of assigned projects. Typical requirements are a Bachelor's degree and ten or more years of experience, or a Master's degree and six or more years of experience.

Manager 1 (M6): Supervises the design and development of chip layout, circuit design … Participates in developing management policies for the semiconductor design group. Typically manages up to 10 employees performing similar tasks. First level of management with human resources responsibilities.

Manager 2 (M7): Establishes work environment for design and development of complete semiconductor design programs. Develops long range plans, schedules and cost objectives. Typically manage 10–25 employees.

Manager 3 (M8): Plans, develops, and directs and coordinates the activities of semiconductor design managers and staff … Develops long-range plans, schedules, and cost objectives. Typically manages over 25 employees from multiple disciplines.

Database specialist (Technical Job)

Level 1 (S1): Participates in writing and maintaining simple systems and programs relating to database management. Works on projects of limited scope and technical complexity … Works as a member of a team and under close supervision. Typical requirements are Bachelor's degree or equivalent and up to two years of experience.

Level 2 (S2): Design, implements, and/or maintains several aspects of database projects. Works on projects of various scope and moderate technical complexity. Works as a member of a team. Typical requirements are a Bachelor's degree and two to four years of experience, or a Master's degree and up to two years of experience.

Level 3 (S3): Designs, plans, and implements most aspects of database management, including security access … Provides technical assistance in identifying, evaluating, and developing voice, data, or video systems and procedures. Works on projects with a large scope and great technical complexity. Typical requirements are a Bachelor's degree and four to six years of experience, or a Master's degree and two to four years of experience.

Level 4 (S4): Designs, implements, and maintains complex database systems. May be responsible for all aspects of operation, including monitoring standards and integration of systems. Develops technical/organizational specifications for systems. Works on projects of great scope and advanced technical complexity … Typical requirements are a Bachelor's degree and six or more years of experience, or a Master's degree and four to six years of experience.

Level 5 (S5): Serves as a consultant to senior management of the company on database programs and strategies. Typically sets agenda and priorities within the function. Works under minimal supervision. Maintains state-of-the-art knowledge of technical changes and new products. Works closely with functional management to initiate and lead strategic efforts. Typical requirements are a Bachelor's degree and ten or more years of experience, or a Master's degree and six or more years of experience.

Manager 1 (M6): Develops, organizes, and implements cost-effective solutions in the areas of installing, using, and maintaining databases. Plans and directs the efforts of individual contributors. Plans and organizes a department to meet specific objectives established by senior management. Typically manages up to 10 employees performing similar tasks. First level of management with human resources responsibilities.

Manager 2 (M7): Manages and operates the database systems. Plans and directs the efforts of subordinate managers and individual contributors. Plans and organizes a department to meet general objectives established by senior management. Typically manages 10 to 25 employees, including first level managers.

Manager 3 (M8): Directs the operation of the database systems. Establishes long-term plans and strategies. Directs the efforts of subordinate managers and senior individual contributors. Plans and organizes a group to meet general objectives established by senior executives. Typically manages over 25 employees.

Human resources generalists (Administrative Job)

Level 1(S1): Assists in carrying out policies and programs covering several or all of the following: recruiting, compensation and benefits, training, employees and labor relations … Typical requirements are a Bachelor's degree or equivalent, and up to two years of experience.

Level 2 (S2): Carries out policies and programs under general supervision covering several or all of the following: recruiting, compensation, benefits, training, employees and labor relations … Typical requirements are a Bachelor's degree and two to four years of experience, or a Master's degree and up to two years of experience.

Level 3 (S3): Carries out policies and programs under limited supervision covering several or all of the following: recruiting, compensation, benefits, training, employees and labor relations … May have supervisory responsibility. Typical requirements are a Bachelor's degree and four to six years of experience, or a Master's degree and two to four years of experience.

Level 4 (S5): Carries out policies and programs under general

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direction covering … recruiting, compensation, benefits, training, employees and labor relations … May provide technical guidance and training to less experienced human resource representatives. Provides inputs in defining short- and long-term goals and objectives … Typical requirements are a Bachelor's degree and six or more years of experience, or Master's degree and four to six years of experience.

Level 5 (S5): Carries out policies and programs with limited direction covering … recruiting, compensation, benefits, training, employees and labor relations … Responsible for defining short-term goals and objectives of the human resources service … Provides technical guidance and training … May serve as a program manager. Typical requirements are a Bachelor's degree and ten or more years of experience, or a Master's degree and six or more years of experience.

Manager 1 (M6): Manages delivery of a full spectrum of human resource issues while focusing on short-term operation. Participates in the development and implementation of business plans. Typically manages up to 10 employees performing similar tasks. First level of management with human resources responsibilities.

Manager 2 (M7): Manages the development and implementation of human resource strategies and programs. Defines and negotiates the organization's role and objectives. Typically manages 10 to 25 employees, including first level managers.

Manager 3 (M8): Manages the development and implementation of long-range human resource strategies and programs. Serves as a business partner to senior line management. Typically manages over 25 employees from multiple disciplines.

Appendix C. Variable definitions

Variable name	Variable description
Idiosyncratic risk	Standard deviation of residuals from a market model of monthly returns over 36-month period prior to the compensation year.
Industry indicator	Indicator variable for each of the 48 Fama-French industries.
Job-level	White collar job levels consist of five levels of non-supervisory positions and 3 levels of supervisory positions. S1–S5 are for non-supervisory positions (S1 is the lowest and S5 is the highest levels), and M6-M8 are for supervisory positions (M6 is the lowest and M8 is the highest levels).
LTI	Average long-term equity incentive compensation amount for a job level. It includes stock options, stock appreciation rights, and restricted stock awards with more than one year vesting.
log(Assets)	Firm size measured as natural log of book value of assets measured at the beginning of the compensation year.
M7, M8	M7 is an indicator variable coded as 1 if the job is second highest level supervisory position, and 0 otherwise. M8 is measured similarly.
Missing R&D Exp	Indicator variable for missing R&D expense on COMPUSTAT. It is coded as 1 if R&D expense amount is missing, and 0 otherwise.
Market-to-Book	Market-to-book value of equity at the beginning of the compensation year
Promotion Incentives	Expected increase in total compensation from a promotion to a next higher level job. It is measured as [Average total compensation for job level i+1 minus average total compensation for job level i].
log(R&D Exp)	Natural log of one plus annual R&D expenses scaled by total net sales, measured at the beginning of the year.
R&D Job	Indicator variable coded as 1 if job function is R&D, and 0 otherwise.
RET	12 month buy-and-hold return prior to the compensation year.
ROA	Return on assets measured as income before extraordinary item divided by total assets at the beginning of the year.
Salary	Average annual base salary for a job level.
STI	Average short-term incentive compensation amount for a job level. It includes all cash awards related to annual firm, division, unit or individual performance. It also includes the cash values of stock grants to be vested in a year.
S2, S3, S4, S5	S2 is an indicator variable coded as 1 if the job is second lowest level non-management job, and 0 otherwise. S3 through S5 are measured similarly.
TECH Job	Indicator variable coded as 1 if job type is technical professional, and 0 otherwise.
Total Cash	Average total cash compensation for a job level. It consists of annual salary and short-term incentives (STI).
Total comp	Average total compensation for a job level, which consists of annual salary, short-term incentives (STI) and long-term incentives (LTI).

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