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STOCK OPTION COMPENSATION FOR LOWER LEVEL EMPLOYEES

By

Kathleen M. Weiden

A dissertation submitted to the Graduate Faculty in Business in
partial fulfillment of the requirements for the degree of
Doctor of Philosophy, The City University of New York
2001

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Abstract

STOCK OPTION COMPENSATION FOR LOWER LEVEL EMPLOYEES

By Kathleen M. Weiden

Advisor: Joseph B. Weintrop

The use of broad-based stock option plans has increased significantly during the last decade. I investigate whether firms compensate lower level employees in a manner consistent with reducing agency costs, by examining firms' use of stock options for this group of employees. I develop hypotheses about the costs of measuring behaviors or outcomes associated with firm decision hierarchies, the level and type of innovation opportunity set available to firms, firm size, task programmability, taxes and the deadweight costs of options. I find that the level of the innovation opportunity set, firm size and the deadweight financial capital costs are associated with firms' use of stock options for lower level employees. Overall, my results provide mixed support for the general hypothesis that firms use stock options to reduce agency costs.

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1. Introduction

I investigate whether firms compensate lower level employees in a manner consistent with reducing agency costs, by examining firms' use of stock options. I examine the association between the fraction of the annual stock option award granted to lower level employees and proxies for firms' agency costs. I consider how a firm's agency costs of measuring behaviors and outcomes for this group of employees affect a firm's use of this particular type of equity-based compensation. I predict the following. First, when the costs of measuring behaviors are high or when the costs of measuring outcomes are low, firms likely will increase their use of equity-based compensation for lower level employees, *ceteris paribus*. Second, when the costs of measuring behaviors are low or when the costs of measuring outcomes are high, firms likely will decrease their use of equity-based compensation for lower level employees, *ceteris paribus*.

Whether firms compensate lower level employees in a manner consistent with the reduction of agency costs is interesting from a number of perspectives. First, firms differ in how they grant options to lower level employees. Consider the table immediately below, which presents the fraction of the annual firm stock option award and grant date total dollar value of stock options granted to the lower level employees, for six firms from the SIC 2000 group, Food and Kindred Products. The information on stock options is presented for their fiscal years 1995 and 1996.

Fraction of firm total stock option award and grant date total dollar value of stock options granted to lower level employees				
FIRM	FISCAL 1995		FISCAL 1996	
Campbell Soup	.873	\$17,347,102	.871	\$70,538,556
General Mills	.915	\$103,831,987	.869	\$120,232,787
H J Heinz	.958	\$17,882,664	1.00	\$13,506,207
Philip Morris Cos.	.953	\$115,635,083	.903	\$147,022,792
RJR Nabisco Holdings	.864	\$81,345,004	.707	\$18,697,905

Ex ante, I would expect that firms in the same industry, having relatively the same access to capital, product and labor markets, would behave in a similar fashion, when compensating lower level employees. The table above seems to

indicate that this is not the case. The observation that firms differ in how they grant options to lower level employees, even while in the same industry, prompts an analysis of the underlying economic differences. Second, equity is an important source of firm financing, and the firm's constituents are interested in how it is utilized. Finally, stock options are often a significant asset for individual employees, and, as such, can be the subject of debate in the setting of child support payments or a negotiation with respect to an employer's plan to substitute stock options for more traditional type retirement plans, to provide two examples.¹

Academic researchers have long been interested in the valuation, use, financial reporting and tax considerations of stock-based compensation. The accounting, finance and economics literature on the relation between shareholder value and employee incentives is a subset of such research. In particular, accounting and economics researchers have studied firms' use of stock options in the context of agency and contracting theories, to assess whether firms award stock options in accord with those theories. As Indjejikian (1999) points out, however, the overwhelming majority of the studies on the link between share value and employee performance and compensation have examined compensation practices at the CEO or other senior executive level. He suggests that empirical research on performance evaluation and compensation practices at lower organizational levels could make a significant contribution to the literature. I extend research on the determinants and

¹ *Wall Street Journal*, 3/17/99, p. B1, B4, and *Wall Street Journal*, 3/24/99, p. B10.

consequences of performance evaluation and compensation practices, by focusing on firms' use of outcome-based compensation for lower level employees (employees other than those named in the firm's annual proxy statement). I rely on the economics, finance, accounting, tax and organizational behavior literature to develop hypotheses on how firms' costs of measuring behavior and outcomes affect the award of equity-based compensation to lower level employees.

My results, based on a sample of 737 firm-years for the years 1995 -1997, indicate that when firms' costs of measuring behavior are high, or when firms' costs of measuring outcomes are low, firms tend to increase their use of equity-based compensation for lower level employees. I also find that when firms' costs of measuring outcomes are high, firms tend to decrease their use of equity compensation. My results do not provide support for the hypotheses that firms' low costs of measuring behavior influence firms' granting of stock options to lower level employees. Thus, overall, my results provide mixed support for the general hypothesis that firms consider the costs of measuring behaviors and outcomes as they award equity-based compensation to lower level employees.

The remainder of this dissertation proceeds as follows. Section 2 discusses the related research. Section 3 develops the hypotheses to be tested. Section 4 defines the fraction of the firm annual stock option award, identifies my proxies for the hypothesized determinants of the fraction, discusses sample selection, and presents descriptive information on the data. Section 5 presents the results of the tests. Section 6 concludes.

2. Related Research

In this section, I review the research related to firms' use of options for CEOs and/or top employees, as well as the research related to the compensation contract components of divisional and/or business unit managers. I discuss the research related to the stock option grants to, or exercised by, lower level employees.

2.1 Related Research

Much of the related literature examines the association between stock options awards and contracting (agency) variables hypothesized to influence firms' use of options. These empirical studies are at the industry level (e.g. Smith and Watts, 1992), the firm level (e.g. Gaver and Gaver, 1993) and the manager level (e.g. Eaton and Rose, 1993), and examine firms' awards of stock options to CEOs, and/or the top five employees and/or board members. Some of the

hypothesized determinants considered in this research include monitoring costs, information asymmetry, reporting costs and regulation. Appendix A contains an overview of this literature.

A recent body of literature examines the role of specific components of compensation and/or the total compensation contracts of divisional/business unit/middle managers in the employee performance evaluation process, as well as the relationship between the structure of divisional/business unit managers' compensation contracts and firm characteristics (e.g. Baiman, Larcker and Rajan, 1995). This literature examines task allocation, compensation risk, type of metrics employed in evaluation, innovation and product and geographic diversification. A more extensive discussion is contained in Appendix A.

The body of literature that studies stock options for lower level employees is quite small. Huddart and Lang (1996) study the option exercise decisions of more than 50,000 employees (top and lower level) of 8 firms over a ten-year period. The focus of their tests is the possible determinants of employee exercise behavior, and so, the information presented on option grants is largely descriptive. This descriptive information on option grants is presented separately for each of the 8 companies in the study, but some general statements can be made. On average, options are an important part of compensation. For example, in 1992, the Black-Scholes value of the options granted ranged from \$1,500 to \$52,000 per optionee. The mean percentage of employees receiving options ranged from .8% to 55.2%, while the mean number of options granted per employee ranged from 297 to 4,348.

Core and Qian (2000) model the contract forms required to motivate two agents, an Innovator and a Producer, to produce and adopt risky projects. The Innovator is responsible for new project selection and can be thought of as the firm's CEO. The Producer is in charge of production, and can be thought of as all the other employees of the firm. Core and Qian show that, as the firm's growth opportunities become more risky, the Innovator's contract becomes more convex. The convexity of the contract is interpreted as the option-like portion of total compensation. Further, as the Innovator's contract becomes more convex, the Producer's contract also becomes more convex. The extent of the convexity in the Producer's contract depends upon the firm's labor capital mix. Specifically, the convexity of the Producer's contract should be greater when all the firm's growth opportunities are related to improvements in the marginal productivity of human capital than when all the firm's growth options are related to improvements in the productivity of physical capital. Thus, the prediction of their model is that when options are used more extensively for managers of the firm, options will likewise be used more extensively for lower level employees.²

Core and Guay (2000) examine determinants of the levels of non-executive option holdings, grants and exercises. With respect to grants of option incentives to non-executives, the central hypothesis of Core and Guay is that firms grant new options to correct deviations from target incentive levels. This

² Firms' labor-capital structures are likely to be similar within industries, and costly to alter. This suggests that the extent of the convexity of producers' contracts in firms in the same industry should be similar. However, in a study of firms' choices of flexible benefit plans, Barringer & Milkovich (1998) note that industry classification may be an oversimplification of the characterization of firms as labor or capital intensive.

hypothesis assumes that grants and exercises are simultaneously determined, and that the target level of option incentives is a function of firm size, monitoring difficulty, growth opportunities, decentralization and the importance of human capital. Firms with cash constraints, high capital needs, high costs of accessing capital markets and relatively greater interest in attracting less risk-averse workers are also hypothesized to substitute equity compensation for cash compensation. Core and Guay further suggest that firms with low marginal tax rates will use stock-based compensation more since options are less costly for firms with low marginal tax rates, and that firms award more options when recent performance is better. Their results do not support the concept of firms managing around target option incentive levels, but do provide support for the influence of cash constraints, high capital needs and high costs of accessing capital markets on the grants of options to non-executives.

3. Hypothesis Development

In this section, I present a general statement of the determinants of compensation for lower level employees, and my hypotheses with respect to possible determinants of the fraction of the annual option award granted to lower level employees.

3.1 General Statement

The nature, amount and structure of employee compensation, are, in the main, determined by the answers to three questions: (1) what does the firm want to accomplish? (2) who is available to accomplish those objectives?, and (3) how does the firm motivate those so available? Deriving insights from firms' behavior with respect to question (3) is the focus of this paper.

In the presence of incomplete information between principals (shareholders) and agents (lower level employees), principals must compare the cost of measuring behavior with the cost of measuring outcomes (Eisenhardt,

1989). This suggests the following general statement of the determinants of compensation for lower level employees, assuming that successful motivation of behaviors and/or outcomes results in higher adjusted share value:

$$\text{Compensation for lower level employees} = f [\text{Costs of measuring behaviors, Costs of measuring outcomes}] \quad [1]$$

Stock price aggregates information about the firm. Specifically with respect to employees, stock price aggregates information about the performance of all employees of the firm, not just the top employees. Firms likely use a variety of outcome-based performance measures, some of which may be sub-unit specific, or divisional specific, or employee-group specific, etc. However, stock price serves as outcome-based measure of the performance of all the employees of the firm. *Ceteris paribus*, when outcome-based information on lower level employees is available at a lower cost than information about employees' behaviors, one would expect firms to rely more on equity-based compensation. This suggests the following general statement of greater use of equity-based compensation for lower level employees, assuming that successful motivation of behaviors and/or outcomes results in higher share value:

$$\text{Greater use of equity-based compensation for lower level employees} = f [\text{Costs of measuring behaviors} > \text{Costs of measuring outcomes}] \quad [2]$$

Across firms, and within firms across employees, costs of measuring behaviors and costs of measuring outcomes will likely vary. I expect that the variation in the costs of measuring behaviors and outcomes across firms explains, in part, the variation observed in the fraction of firms' annual awards of stock options granted to lower level employees. This suggests the following

expansion of Statement [2] of greater use of equity-based compensation for lower level employees, assuming that successful motivation of behaviors and/or outcomes results in higher share value (with predicted direction of relation in parentheses):

***Fraction of annual stock option award granted to lower level employees =
f [Low costs of measuring behavior(-), High costs of measuring
behavior (+), Low costs of measuring outcomes (+), High costs of
measuring outcomes (-)]*** [3]

In the sub-sections that follow, I identify several circumstances under which the costs of measuring behaviors or outcomes could be low or high enough to influence the firm's grant of stock options to lower level employees. In particular, I develop hypotheses about costs of measuring behaviors or outcomes associated with firm decision hierarchies, the level and type of innovation opportunity set available to firms, costs of options to the firm, task programmability, joint income taxes and deadweight costs in the awards of stock options to this particular group of employees.

In order to develop my hypotheses, I first make several basic assumptions. I assume that shareholders want to maximize share value. For economic activities currently conducted by the firm, share value will be maximized when the firm is efficiently organized; i.e. the organizational structure allows the firm to earn the highest economic profits from the particular economic activities being conducted. Share value can also be increased when the firm pursues new economic activities that have the potential to increase firm cash flows above the required rate of return. The reduction and/or minimization of

agency costs figures prominently into both of those (non-exclusive) approaches to value maximization. I view all employees as agents of the firm, and available to accomplish the firm's objective. To achieve that objective, firms must motivate employees' specific behaviors and/or motivate employees to achieve specific outcomes. The benefit of successfully motivating behaviors and/or outcomes should be increased or maximized share value.

3.2 Costs of Measuring Behavior - Monitoring Costs

Jensen and Meckling (1976) define agency costs as the sum of the monitoring expenditures by the principal, plus the bonding expenditures by the agent, plus the residual loss. Monitoring means more than simply measuring or observing the behavior of the agent. It includes efforts on the part of the principal to control the agent's behavior through devices such as budget restrictions, compensation policies, operating rules, auditing, formal control systems and incentive compensation systems which serve to align the manager's interests with those of the principal. Bonding costs are the resources expended to guarantee the agent will limit his activities that reduce firm value. The residual loss is the reduction in the principal's welfare due the divergence of the interests of the principal and the agent, despite the expenditure of monitoring and bonding resources.

Fama and Jensen (1983a) suggest that the agency problems caused by the separation of the decision and risk-bearing functions observed in large open corporations are addressed by the separation of decision management from

decision control. Decision management consists of initiation and implementation, and decision control consists of ratification and monitoring. In a complex organization, valuable (costly to transfer across agents) specific knowledge is diffused among many internal agents. The diffusion of decision management is efficient (reduces agency costs) because initiation and implementation of decisions is in the hands of the agents with the valuable specific information. To then reduce the agency problems of diffuse decision management, decision control is separated from decision management and is likewise diffused throughout the organization as well. Fama and Jensen point to the survival of three major mechanisms as support for their hypothesis: decision hierarchies, mutual monitoring systems, and boards of directors.

Several inferences can be drawn from the Jensen and Meckling (1976) and Fama and Jensen (1983a) papers. First, firms are concerned with the agency costs of employees at all levels of the organization, and firm characteristics and policies reflect those concerns. Second, firms will use the lowest cost combinations of monitoring and bonding devices to control agency costs. Third, firms will use different agency control mechanisms for different agency problems, and the problems are functions of the various agents' roles in the firms. In other words, the degree to which the problems generate agency costs may vary across employees, and firms will respond in different ways for different employees. Fourth, firms' decision hierarchies play an important monitoring role, in that they provide information on the agents' actions.

The concept of the dispersion of knowledge among the set of individuals in a particular economic system is the backbone of the information processing theory of the firm. This theory models the firm as an organization faced with streams of data from its environment that must be assimilated and transformed into decisions. The specific features are: (1) the firm consists of separate agents, (2) the organizational structure is defined by the patterns of information exchange among the agents, and (3) the information processing capabilities of the agents are important (DeCanio and Watkins, 1998). Efficient information processing requirements and capabilities means the collection of the appropriate information, its movement in a timely fashion, and its transmission without distortion (Tushman and Nadler, 1978). Contingency theorists suggest that, as the firm responds to internal and external uncertainties, the information processing requirements and capabilities of the agents impact the evolution of the particular organizational form (Tushman and Nadler, 1978; Lawrence and Lorsch, 1967; Galbraith, 1973).

The inferences from the information processing theory of the firm are consistent with the agency cost theories discussed above. Information systems will be positively related to behavior based contracts and negatively related to outcome-based contracts (Eisenhardt, 1989). Budgeting systems, reporting procedures, internal audits, cost accounting procedures, operating rules and the like, are examples of the patterns of information exchange among the agents of the firm, and those patterns can also provide information about the agents' behavior (Holmstrom, 1979). By definition, a pattern implies repetition, which

allows for the formation, *ex ante*, of an expectation of behavior. When expected behavior is clearly defined, performance measurement, *ex post*, is easier and thus, less costly.

3.2.1 The Monitoring Costs Hypothesis

The potential impact on firm value of decisions at any particular level within the firm are at least equal to, and may be greater than, the potential impact on firm value of decisions at the level immediately below. The scope of decisions under the control of any one employee narrows as one moves from the top levels of the firm down to the bottom levels. Narrower scope of decisions means smaller potential impact on firm value. Thus, lower level employees have a narrower scope of decisions than top or senior management. The smaller the potential impact on firm value of the agent's decisions, the greater the constraints on the firm in expending firm resources on agency problems, and the more likely that firms will consider alternative monitoring devices as substitutes, rather than as complements. At any particular time, the organizational form observed for a particular firm reflects the agents' current information processing requirements and capabilities. At the same time, the organizational form, or firm hierarchy, can serve as a monitoring device because it provides low-cost information about the agents' behavior. A hierarchy can be characterized by both the number of levels of organizational subunits and the total number of organizational subunits. The greater the number of levels of subunits and the greater the total number of subunits, the more complex is the hierarchy. The more complex the hierarchy,

the greater the degree of monitoring. When considering how to most efficiently motivate lower level employees, given the share value effects of those agents' decisions, firms will take into account organizational mechanisms, such as decision hierarchies, that can also serve as monitoring devices. When the costs of measuring agents' behavior are low, as when the firm's hierarchy is complex, firms should reduce the use of outcome-based measures. Thus, the agency monitoring costs hypothesis, stated in alternative form, is:

H1: There is an inverse relation between the complexity of the firm hierarchy and the fraction of firm total stock options granted to lower level employees.

3.3 Costs of Measuring Behaviors – Task Programmability

A factor that directly impacts the costs of monitoring the agent's actions is task programmability (Eisenhardt, 1985, 1988, 1989; Gomez-Mejia and Balkin, 1992; Stroh, Brett, Baumann and Reilly, 1996). Task programmability refers to the degree to which the requisite behavior can be precisely defined. When an agent's task is highly programmable, it is relatively easy (low cost) to monitor the agent. Conversely, when an agent's task cannot be programmed, it is more difficult (high cost) to monitor the agent's behavior (Eisenhardt, 1985). Further, when a task is programmable, principals can specify *ex ante* the behaviors desired from the agent and reward the agent when the desired behavior is observed. This theory predicts that task programmability will be positively related to the use of behavior-based performance measures and negatively related to

the use of outcome-based performance measures (Eisenhardt, 1989). Stroh, Brett, Baumann and Reilly (1996) study the proportion of variable pay of middle-level managers and its relationship to task programmability, risk and length of the principal-agent relationship. They show that managers in highly programmable jobs received a lower proportion of their compensation in the form of variable pay than managers in less programmable jobs. Gomez-Mejia and Balkin (1992) apply the concept of task programmability in a study of the determinants of university faculty pay. Areas of expertise and research are idiosyncratic to individuals, and further, faculty typically have very few structured constraints on their time. Thus, task programmability is very low for university faculty. Gomez-Mejia and Balkin (1992) suggest that, since behavioral controls would be costly in this setting, the research productivity of university faculty, an outcome-based measure, is used as a performance evaluation mechanism.

One inference that can be drawn from the task programmability literature is that the composition (level and nature) of the package of monitoring devices utilized by the firm will vary across the agents, and will depend, in part, on the programmability of agents' tasks.

3.3.1 The Task Programmability Hypothesis

The scope of decisions under the control of any one employee narrows as one moves from the top levels of the firm down to the bottom levels. Narrower scope of decisions means greater task programmability. Thus, task programmability for lower level employees is greater than for top or senior

management within the organization. The greater the degree of task programmability, the easier (low cost) it is to monitor the actions of the employee. When the costs of measuring agents' behavior are low, as when the agents' task are highly programmable, firms should reduce the use of outcome-based measures. Thus, the task programmability hypothesis, stated in alternative form, is:

H2: There is an inverse relation between task programmability and the fraction of firm total stock options granted to lower level employees.

3.4 Costs of Measuring Behavior - The Level of the Innovation Opportunity Set

Myers (1977) characterizes the firm as a combination of assets in place and future growth opportunities, and suggests that managerial decisions have substantial value implications for high-growth firms. Holmstrom (1989) suggests that the agency costs associated with innovation are likely to be high because of the characteristics of innovation. In general, innovation projects are: (a) risky, (b) unpredictable, (c) long-term and multi-stage, (d) labor intensive and (f) idiosyncratic (Holmstrom, 1989, p. 309). These characteristics make contracting in conjunction with innovation particularly demanding.

Clinch (1991) suggests that R&D activity results in the employee having private information about new ideas. Without legal remedies such as non-competition contracts, the firm must offer incentive contracts to entice the

employee to remain with the firm, and thus, the firm can capitalize on the new ideas.

Based upon their industry study, Smith and Watts (1992) suggest that firms with greater investment opportunity sets (greater access to positive net present value projects) rely more heavily on incentive compensation structures than firms without such opportunities. Smith and Watts (1992) hypothesize that high growth firms suffer from information asymmetry because shareholders cannot observe the entire set of opportunities from which the manager may choose. In the presence of this asymmetry, such firms will rely heavily on incentive compensation structures to motivate the manager to make the optimal (share value maximizing) choice.

Bizjak, Brickley and Coles (1993) suggest that managers are endowed with private information ahead of the market. Although the market may know the likelihood that the manager faces a “good project,” the market only becomes as well informed as the manager when the cash flows from the project materialize. The manager’s incentives to manipulate the market’s inferences about the firm’s prospects through observable investment choices are particularly strong when the manager is likely to leave before the ultimate release of information to the market. Thus, shareholders will try to motivate optimal investment, as well as revelation about the value of the project, by structuring a compensation contract that balances an emphasis on current and future stock price performance.

Core and Qian (2000) model an all-equity firm with risk-neutral owners and two risk-averse agents. The Innovator is responsible for new project

selection (and thus can be thought of as the CEO). The Producer is in charge of production (and thus can be thought of as all of the firm's employees with no impact on project selection). Integration of a new project by the Producer (who previously only managed assets in place) introduces uncertainty into his marginal productivity. To motivate the Producer's high effort when confronted with two tasks, firm owners introduce convexity (interpreted as an option-like component) into the compensation contract before new project selection. The empirical prediction of their model is that firms with higher levels of growth options will use more stock options for CEOs and lower level employees.

3.4.1 The Level of Innovation Hypothesis

Firms maximize share value by undertaking risky, positive net present value projects; i.e. firms seek to create, develop or exploit growth opportunities. If the availability of a substantial innovation opportunity set presents unique agency issues (information asymmetry), and if this information asymmetry exists between shareholders and managers, then it very likely also exists between shareholders and lower level employees.

Growth opportunities have a positive impact on firm value in a two step fashion: (1) the market expects that only the "best" (highest positive net present value) projects will be selected and, (2) the market expects that the firm will do a good job integrating the selected projects into the existing regime. With respect to the first step, the identification and selection of projects from large and/or complex investment opportunity sets likely involve more than just the CEO or a

handful of top executives. Consider the process by which the firm selects positive net present value projects – the capital budgeting process. As part of that process, senior management and lower level employees acquire information about the range, timing, risk and estimated value of contemplated projects, and exercise discretion in choosing projects to pursue, both of which impact firm value. Further, the list of contemplated projects likely includes projects that the firm can self-develop as well as those the firm can acquire. Although senior management of the firm will typically choose the final project or projects to pursue, lower level employees have a significant role in generating the “short list” from which the choice is made. With respect to the second step, once project selections are made, integration of projects most definitely will involve the efforts of lower level employees. Senior management typically delegates responsibility for integration of new projects to employees at lower levels of the organization.

Whether firms are evaluating alternative growth options or have moved on to integrating selected projects, or are conducting both activities simultaneously (as is likely the case), for firms with significant growth opportunities, the costs of measuring the behaviors of the lower level employees could be quite costly, due to the characteristics of innovation projects and the inherent information complexities. In the presence of a significant innovation opportunity set, outcome-based measures of lower level employees’ performance should be preferred.

Thus, the level of innovation hypothesis, stated in alternative form, is:

H3: There is a positive relation between the level of the firm's innovation opportunity set and the fraction of firm total stock options granted to lower level employees.

3.5 Costs of Measuring Behavior – The Type of Innovation Strategy

Firms jointly choose the type of innovation project to pursue as well as the level of innovation investment (Utterback and Abernathy, 1975; Mansfield, 1981; Rosen, 1991; Yin and Zuscovitch, 1998). Utterback and Abernathy (1975) suggest that there is a dynamic and systematic relationship between a firm's ability to innovate and its competitive strategy and the state of its production processes. Evolution of a firm's production technologies may dictate changes in innovation strategies. Likewise, changes in the firm's competitive environment may dictate changes in the innovation strategy, and these strategy changes may, in turn, dictate changes in the firm's production processes. Innovation strategy at any particular time allows for the choice of innovation type and the choice of investment level. Empirical evidence presented by Mansfield (1981) indicates that large firms tend to carry on a disproportionately large portion of basic research and a disproportionately small portion of R&D aimed at new products and processes, where firm size is measured by firm sales.

The theoretical model developed by Rosen (1991) considers a duopoly setting where firms can choose among nonexclusive R&D projects (i.e., not a

patent race). Rosen first models a setting where firms can pursue only innovations that complement existing (“add-on”) technologies, and then models a setting where firms can pursue both “add-on” and “revolutionary” innovations. The Rosen model predicts that, relative to its rival, a large (low-cost) firm prefers add-on innovations rather than revolutionary innovations, and in general, prefers a safer innovation strategy than its smaller (high-cost) rival, where size is measured by market share. Rosen’s analysis shows that through its project choices, a firm can, to some extent, choose the type of innovation it wishes to produce as well as its location on the risk-return frontier.

Yin and Zuscovitch (1998) show that firms with large market share seek cost-differential (Ricardian) rents while small market share firms seek transitory innovation (Schumpeterian) profits. Large firms hold greater market share and can generate more profits for the same cost reduction as smaller rivals. Invention of a new substitute product depresses demand for the old, resulting in profit loss to both firms. Smaller firms feel this effect to a lesser extent, due to smaller market exposure. Thus, large firms look to incrementally improve existing technologies, termed process innovations, while small firms tend to pursue product innovations, creating surprise with new technologies.

Rosen (1991) also points out that the extent of agency problems on the ability to sell or license an innovation or innovative idea depends on the ability of both parties to measure the value-added of the innovation. Since value added is more difficult to measure for product innovation than for process innovations, process innovations come from established (large market share) firms.

3.5.1 The Type of Innovation Hypothesis

One inference from the literature on the product-process innovation choice is that firms' strategic choice of innovation type impacts the employee agency problems associated with the presence and pursuit of the innovation opportunity set. The process-product innovation choice has implications for the award of stock options to lower level employees because the information asymmetry problem is different under each innovation type. More specifically, the information asymmetry problem is with a different group of employees for each innovation type. Process innovations (incremental improvements to existing technologies) can reasonably be expected to come from those employees most familiar with the existing technologies – the lower level employees. Lower level employees have hands-on, day-to-day exposure to the firm's production processes and systems, and are in a position to recognize the "tweaks" that can be made in those processes and systems to increase economic profits. Conversely, ideas for radically new products tend to come from one individual or a very small group of individuals. The individual and/or the small group of individuals usually are the firm founders, or within the senior management tier of the firm, particularly when the product innovation is in the early stages of development. Under a process innovation strategy, the desired behavior of the lower level employees cannot be specified *ex ante*, so, behavior measurement becomes costly. This makes options more valuable in aligning incentives.

The type of innovation hypothesis, stated in alternative form, is:

H4: Firms engaged in process innovations will award more of the firm total stock option award to the lower level employees.

3.6 Costs of Measuring Outcomes - Firm Size

Smith and Watts (1992) suggest an association between firm size and the use of incentive compensation. Large firms enjoy economies of scale with respect to fixed costs (such as administration of an incentive compensation plan) and therefore, incentive plans should be observed more often in large firms. Smith and Watts acknowledge that size is endogenously determined, but at the same time, influenced by the investment opportunity set.

A number of articles in the financial and popular press, in discussing the use of broad-based stock option plans, describe stock options as “cheap” or “low-cost” without identifying the dimension on which that determination is being made.^{3, 4}

A recent study by Watson Wyatt Worldwide discusses the concept of “stock option overhang.”⁵ Stock option overhang is generally defined as the potential shareholder dilution from previously granted options plus options available for grant, expressed as a percentage of total shares outstanding. According to WestWard Pay Strategies, a compensation consulting firm,

³ See, for example, “The oomph of options,” *The Journal News*, 11/1/99, p. 1D.

⁴ The press may be referring to the financial reporting rules governing stock options, in that, under SFAS 123, no financial statement deduction is required for options at grant, exercise or sale.

⁵ *Investor Relations Business*, 2/15/99, p. 1.

overhang is the primary benchmark used by shareholders to measure their tolerance for the overall size of stock option programs. Thus, firms count as a cost the dilutive effects on shareholder returns of the potential exercise of outstanding stock options. Large firms generally have a larger and more diffuse ownership structure than do small firms (Demsetz and Lehn, 1985).⁶ From this perspective, the costs of dilution for large firms likely are lower than for smaller firms, thus making stock options cheaper to use for large firms.

3.6.1 The Size Hypothesis

If stock options are low cost for large firms, this could mean that the cost of measuring outcomes is low for large firms. If the cost of measuring outcomes is low, then large firms would tend to grant a larger percent of the firm total stock option award to the lower level employees. The smaller the potential impact on firm value of the agent's decisions, the greater the constraints on the firm in expending firm resources to control agency problems. When considering how to most efficiently motivate lower level employees, given the share value effects of those agents' decisions, firms will tend to use lower cost compensation mechanisms over higher cost compensation mechanisms.

The size hypothesis, stated in the alternative form, is:

⁶A seminar brochure from the American Compensation Association, for a seminar entitled "Transforming Employees into Owners," cites dilution as a factor in the determination of levels of stock option awards.

H5: There is a positive relation between firm size and the fraction of firm total stock option award granted to the lower level employees.

Large firms likely have larger numbers of employees. With large numbers of employees, the incentive effects of equity-based compensation may be reduced. The incentive effects of stock options may be reduced because the ability of each employee to impact share price is reduced. Alternatively, the incentive effects of stock options may be reduced because the contribution of each employee to increases in share price is difficult to measure. Further, Huddart (1994) suggests that the incentive effects of stock options for low-and mid-level employees should be small, because it is unlikely that the actions of those employees would have more than a negligible effect on stock price.

If the incentive or motivational effects of equity based compensation are reduced for firms with large numbers of employees, then stock options are costly for those firms. If large firms have large numbers of employees, then options are costly for large firms.

3.7 Costs of Measuring Outcomes – Income Taxes

The joint tax minimization hypothesis is suggested in Hite and Long (1982). Their hypothesis suggests that, in the context of compensation contracts, the minimization of the income tax effects of compensation instruments on both the employer and employee should drive the selection of the compensation instrument. Their study, centered on tax law changes from the

Tax Reform Act of 1969, documents that income tax considerations played an important role in explaining firms' switch from qualified stock options to non-qualified stock options during the 1970s, but could not explain variations in the types of non-qualified option plans introduced by firms. Austin, Gaver and Gaver (1998) test the joint tax minimization hypothesis by examining firms' choice between ISOs and NQOs during the early 1980s. They find that ISOs were the overwhelming choice for their sample of 337 firms. Their results are consistent with the joint tax minimization hypothesis only if executives hold the stock acquired through option exercise for long periods, or alternatively, if corporate tax effects are ignored when making the ISO-NQO choice.

Scholes and Wolfson (1992) suggest that a global contracting perspective is appropriate. Under this approach, both the tax and nontax considerations of all parties to a contract need to be addressed. In the compensation setting, this global contracting perspective approach means that the tax benefits and costs, to both the firm and the employee, of compensation instruments are one element in an analysis of total benefits and costs of compensation alternatives.

Two papers use the Scholes and Wolfson (1992) global contracting perspective (also known as multilateral tax planning) in an examination of the role of income taxes in firms' use of ISOs and NQOs. Matsunaga, Shevlin and Shores (1992) examine firms' trade-offs between the income tax benefits and financial reporting costs associated with the disqualifying dispositions of ISOs. Their results are consistent with the global contracting perspective, as they find that firms forgo disqualifying dispositions of ISOs (which produces net income tax

benefits) when the costs of reporting lower financial statement income are high. Balsam, Halperin and Mozes (1997) examine firms' trade-offs of the income tax costs of issuing ISOs post TRA86 with the expected benefits of tying employees to the firm. They find that firms with large investment opportunity sets incur income tax costs to use ISOs, because the expected benefit of tying executives to the firm are large for these firms.⁷

The great majority of the papers on option grants to managers and pay-for-performance sensitivities for managers control for the firm's marginal tax rate in the year of option grant, under the assumption that firms with lower marginal tax rates are more likely to use stock options for the managers.

3.7.1 The Income Tax Costs Hypothesis

I expect that joint income tax effects are one of the agency costs associated with stock option grants to lower level employees that firms consider. It is reasonable to think that firms and employees evaluate the costs and benefits of stock option compensation on a net-of-tax basis.⁸

Panel A of Figure 1 presents the tax effects of NQOs to firms and employees, when the sale of the stock (acquired upon the exercise) occurs at a date subsequent to the exercise date. As indicated, there are no tax effects to either the firm or the employee upon option grant. The exercise of the options

⁷ Huddart (1998) examines the response of option holders to proposed increases in income tax rates, and finds that economically significant income tax benefits, derived from acting ahead of probable income tax rate increases, as associated with an increase in option exercise frequency. I characterize his paper as an examination of the role of changes in expected income taxes on the exercise decisions of employees.

generates ordinary (wages) income to the employee, to the extent of the excess of the stock price at that time over the exercise price paid by the employee. The firm has a corresponding tax deduction for wages expense at the same time. Upon sale of the stock, the employee may realize a capital gain (loss) to the extent of the excess (deficit) of the stock price at sale (exercise) over the stock price at exercise (sale). Panel A incorporates the assumption that the stock acquired upon exercise is not subject to risk of forfeiture or restrictions upon transfer, a feature typically associated with options granted to top employees. As can be seen from Panel A, consideration of the joint tax consequences of an option grant necessarily involves predictions as to: (1) when the options will be exercised; (2) when the stock acquired under the option will be sold, (3) the tax rate of the firm at the exercise date and (4) the tax rates of the employee at both the exercise and stock sale dates. With this information in hand, firms can calculate the joint expected tax costs or benefits. I expect that, as part of overall firm tax planning, firms are able to make reasonable predictions as to all four of the items associated with the calculation of the joint tax effects of stock options.⁹

The empirical literature on employee exercise behavior, fairly consistently, indicates that employees exercise earlier than maturity (Huddart, 1994; Hemmer, Matsunaga and Shevlin, 1994). Risk aversion, stochastic liquidity needs, early acquisition of bad news about the firm and expectations of unfavorable tax law

⁸ The benefits to the firm can be quite significant. See, for example, "Cisco, Microsoft Get Income-Tax Break from Employee Stock Options," *Wall Street Journal*, 10/10/00, p. B8, and "Firms Face Options Pickle as Stocks Fall," *Wall Street Journal*, 10/16/00, p. C1.

⁹ Alternatively, it could reasonably be argued that firms do not consider taxes associated with the sale of stock acquired upon option exercise by the employee, when calculating the net of tax cost of options. Once the employees exercise options, they become shareholders.

changes are suggested motivators of early exercise by employees. Huddart and Lang (1996) study the exercise behavior of over 50,000 employees of 8 firms and find that many employees exercise the maximum permissible number of options soon after they vest. The evidence presented suggests that much of the exercise takes place well before option expiration, with recent stock price movements, remaining option term and proportion of grant remaining unexercised all associated with early exercise.

It should be noted that firms have a rich information set at their disposal when predicting employee exercise behavior – complete and detailed information on each employee's firm-specific wealth (e.g., annual salary, pension, benefits, firm sponsored savings plan accounts, prior exercise behavior, etc.). This private information about employees likely allows the firm to make predictions as to the income tax rate of the employee at option exercise, as well as when the employee might sell the stock. I assume that firms would use this same information when designing vesting schedules.

Empirical evidence on the sale of stock acquired through option exercise is limited. Although their data on the exercise decisions of more than 50,000 employees of 8 firms over ten years did not cover the disposition of stock acquired through option exercise, Huddart and Lang (1996) indicate that discussions with the data providers suggest that employees generally undertake a "cashless exercise." In a cashless exercise, the option exercise and immediate sale of stock are handled for the employee by a brokerage firm, with the brokerage firm delivering only the difference between the exercise price and the

sale price. The employer-firm may be part of the process of a cashless exercise, due to the fact that the difference between the exercise price and the stock market value on day of exercise is taxable compensation to the employee, reportable on W-2s issued by the firm and subject to withholding taxes . The firm typically withholds the income taxes on the compensation, remitting the exercise/sale proceeds, net of withheld income taxes, to the employee.

Anecdotal evidence on sales of stock acquired through option exercise may be a little easier to come by. *The Wall Street Journal* of 5/23/2000 reported on voice-vote passage of “The Wealth Through the Workplace Act” (H.R. 3462). This bill, sponsored by Rep. John Boehner (R-OH) creates a new type of employee option, a “Super Stock Option.” The proposed legislation would defer the taxation of the income realized upon exercise until the ultimate sale of the stock and change the rate at which such gain is taxed, from ordinary tax rates to capital gain rates. A press release posted to Rep. Boehner’s web page on 5/23/2000 contained the following statement:

“The IRS tax code currently forces many workers to “cash-out” immediately when they exercise their options, instead of holding onto their shares for the long-term and utilizing their true savings and wealth-building potential. This glitch in the IRS code mainly affects rank-and-file workers, who typically cash-out immediately to pay the income tax on the exercise of the shares.”

Panel B of Figure 1 presents the tax effects of NQOs to firms and employees under cashless exercise, or sale immediately following exercise. As in Panel A, there are no tax effects to either the firm or the employee upon option

grant. The exercise of the options generates ordinary (wages) income to the employee, to the extent of the excess of the stock price at that time over the exercise price paid ($P_x - X_P$) by the employee. The firm has a corresponding tax deduction for wages expense at the same time. Upon sale of the stock, however, the employee realizes no capital gain (loss) because there is no further appreciation in stock price over the exercise price. In other words, $P_s = P_x$; therefore, $P_s - P_x = 0$.

Scholes and Wolfson (1992) suggest that differences in firms' marginal tax rates ("MTR") over time leads firms to engage in tax arbitrage activities. In general, low marginal tax rate firms likely want to defer deductions to a year where the marginal tax rate might be higher, and to accelerate income into the current year, to some extent, to take advantage of low tax rates. Conversely, high marginal tax rate firms likely want to accelerate deductions and defer income. Scholes and Wolfson (1992) also suggest however, that, with respect to contracts between the firm and its employees, the tax effects of a particular compensation arrangement to both the firm and the employee should be considered. Thus, analysis of the role of taxes with respect to stock option based on firm marginal tax rates alone may not be sufficient. Figure 2 reflects the joint tax effects of NQOs for 4 firms, each in a different statutory income tax bracket and each with 5 employees, under the assumption of cashless exercise or sale immediately after exercise. I use corporate statutory rates in Figure 2, since firms' MTRs, current or expected, are unobservable. The five employees in each firm are also in different statutory income tax brackets; one each in the 39.6%,

36%, 31%, 28% and 15% brackets. The firm and employee statutory income tax rates are based approximately on tax law in effect during the years of this study, 1995 through 1997.¹⁰

Figure 2 indicates that the joint tax effects, in rates alone, are negative (joint taxes paid) across all firms with respect to the employees in the 39.6% and 36% brackets. With respect to those particular employees, across all firms, options are low cost in the sense that they defer the payment of joint taxes. This is because these employees (paying taxes on wages income) are always in higher brackets than the firms (taking deductions for wages expense) are. With respect to the employees in the remaining brackets (31%, 28%, 15%), the joint tax effects, in terms of rates, are positive (joint taxes saved) for high rate firms and negative (joint taxes paid) for low rate firms. With respect to these employees, options are high cost for high rate firms in the sense that they defer the realization of joint taxes saved. Options are low cost for low rate firms in the sense that they defer the payment of joint taxes paid. With respect to employees in the bottom three brackets in firms at the middle brackets, the results are mixed. The joint tax effects, in terms of dollars, will be affected by the number of employee-option holders expected in each bracket and the spread between the stock price at exercise and the exercise price. It is likely that the lower level employees tend to be in the bottom three brackets of the tax rate schedule.

¹⁰ With respect to the corporate statutory rate, I present the top bracket in Figure 2 as 35%. Appendix B contains the actual tax tables for both the corporate and individual income tax rates during the period 1995 through 1997.

When considering how to most efficiently motivate lower level employees, given the share value effects of those agents' decisions, firms will tend to use lower cost compensation mechanisms over higher cost compensation mechanisms. Firms with high expected income tax rates will tend to use options less for lower level employees, as options are costly, in that they defer the receipt of joint taxes saved. Firms with low expected tax rates will tend to use options more, as the options are low cost for them, in that they defer the payment of joint taxes due.

Thus, the tax costs hypothesis, stated in alternative form, is:

H5: There is an negative relation between the firm's expected income tax rate and the fraction of the firm total stock options granted to lower level employees.

3.8 Costs of Measuring Outcomes – Deadweight Losses

Theories in accounting, economics and finance recognize that the value of stock options to employees can be different from their cost to shareholders (Huddart, 1994; Hemmer, Matsunaga and Shevlin, 1994; Huddart and Lang, 1996; Hemmer, Matsunaga and Shevlin, 1996; Carpenter, 1998; Meulbrock, 2000). Risk aversion, employee wealth, liquidity needs and income taxes are some of the factors hypothesized to be associated with the reduction in value of the options for the employee.

Meulbrock (2000) measures the cost of options for the firm as the difference between the value of the option if it were issued in the market place

and the value of the option to the manager. With respect to determining the value of the options to the managers, Meulbrock (2000) focuses on the extent to which the employee's exposure to firm-specific risk reduces the value of the option to the employee. She calls this reduction in the value of the option to the employee (due to firm-specific risk exposure) the deadweight loss, and suggests that this loss increases as managerial wealth diversification declines.¹¹

Using all NYSE, AMEX and NASDAQ stocks, the Black-Scholes option pricing model, and assuming a 3 year vesting period and 10 year expiration, Meulbrock shows that an undiversified manager of a NYSE firm values his option compensation at an average of 70% of its cost to the firm. If that NYSE manager holds 75% of his wealth outside the firm, then he values his option compensation at an average of 88% of its cost to the firm. For an Internet based firm, the results are more striking. An undiversified manager of an Internet firm values his option compensation at 53% of its cost to the firm. If that manager can hold 75% of his assets in the market portfolio, then he values his option compensation at 68% of its cost to the firm.

¹¹ Meulbrock (2000) points out that further reductions in the value of the stock option to the employee can come from the form of the compensation. Stock options are but one form from an array of stock-based compensation instruments used by firms. The manager may prefer, and hence value, another type of stock-based instrument over the one they are required to hold by the compensation contract. Further, with respect to options, vesting periods and expiration dates can also impact the value of the option to the manager. Such possible reductions in value are not considered in this paper.

3.8.1 The Deadweight Loss Hypothesis

The value of stock options to lower level employees is likely different from the options' cost to the shareholders. The reduction in value of the options to the lower level employees is likely associated with the total capital of the lower level employees.

The total capital of lower level employees includes their human capital plus their financial capital. I adopt and modify Meulbrock's (2000) definition of deadweight loss, decomposing it into "deadweight financial capital loss" and "deadweight human capital loss". Thus, "deadweight financial capital loss" refers to the reduction in the value of the option to the lower level employee due to firm-specific risk exposure from the employee's financial capital. "Deadweight human capital loss" refers to the reduction in the value of the option to the lower level employee due to firm-specific risk exposure from the employee's human capital.

Lower level employees likely hold smaller financial portfolios than top employees do. Murphy (1998) shows that the average CEO salary and bonus in 1996 was approximately 75 times the average annual earnings of production workers. When considering CEO total realized pay, which includes cash pay, restricted stock, pay outs from long term pay programs and amounts realized upon option exercises, average CEO total realized pay in 1996 was approximately 200 times the average annual earnings of production workers. If the financial capital of the lower level employees is undiversifiable, then their exposure to firm-specific risk when receiving options is large. When the exposure to firm-specific risk is large, then the deadweight financial capital losses

are large. When the deadweight financial capital losses for lower level employees are large, stock options are costly for firms. If stock options are costly, then firms should reduce the use of this form of outcome based compensation for lower level employees.

Thus, the deadweight financial capital loss hypothesis, stated in alternative form, is:

H7A: There is an inverse relation between the fraction of the firm total stock option award granted to the lower level employees and the deadweight financial capital loss of those options.

A consistent finding in labor economics research is that the value, or stock, of human capital rises with experience, or tenure in the job market (Ben-Porath, 1967; Mincer, 1974; Becker, 1975). This general human capital model recognizes that human capital stock has three components: general skills, industry-specific skills and firm-specific skills. Neal (1995) studies wage losses and wage growth of displaced workers. He finds that industry-specific skills play a larger role than firm-specific skills in explaining the relationship between wages and tenure in new jobs. Specifically, workers who find new jobs in the same industry following displacement earn significantly greater returns to both pre-displacement experience and tenure than similar workers who find switch industries following displacement do. Parent (2000) studies the relationship between wages and tenure over the period 1979 to 1996 for workers who entered the work force in 1979. His results indicate that industry-specific skills

play a larger role than firm-specific skills in the wage growth processes of these individuals.

Shaw (1996) studies the role of risk aversion on the human capital investments of individuals. All human capital investments are risky because the returns to investing are subject to two types of uncertainty: uncertainty of unknown personal abilities, and uncertainty as to the firm's future payoff for these skills. She suggests that firm-specific investments are risky, since the skills are not transferable across firms, while general occupation skills and industry-specific skills are transferable, and hence, less risky. She also suggests that less skilled workers are less likely to invest in human capital than skilled workers are. Shaw (1996) finds that risk aversion decreases with education and that risk-averse workers have significantly lower returns to education, general experience and tenure.

If the value of the human capital of lower level employees is largely driven by industry-specific skills, then lower level employees are more likely to make human capital investments in those types of skills, *ceteris paribus*. In addition, lower level employees likely have lower levels of education than top employees. Therefore, lower level employees likely are more risk averse than top employees. If lower level employees are more risk averse, then lower level employees are more likely to invest in industry-specific skills and general occupation skills than firm-specific skills. If the value of the human capital of lower level employees is largely driven by industry-specific skills, then the greater the value the labor market places on the industry-specific skills, the less costly (lower wage losses

and loss of wage growth) it is for employees to diversify away from firm-specific risk. When lower level employees can, at low costs, diversify away from the firm, the lower their deadweight human capital losses are likely to be. When the deadweight human capital losses are small, stock options are less costly. If stock options are less costly, firms should increase the use of this form of outcome-based compensation for lower level employees.

Thus, the deadweight human capital loss hypothesis, stated in alternative form, is:

H7B: There is an inverse relation between the fraction of the firm total stock option award granted to the lower level employees and the deadweight human capital loss of those options.

4. Definition of Fraction, Selection of Proxies, Sample Selection and Data

In this section, I first discuss how I obtain the fraction of a firm's annual stock option grant to lower level employees. I then discuss my proxies for the hypothesized determinants of the fraction of the annual stock option award granted to the lower level employees. I discuss my sample selection and the derivation of the final sample for testing. I present descriptive statistics for the firms that comprise the Standard & Poor's ExecuComp (ver. 1999) database. I also present descriptive statistics for the final sample.

4.1 Definition and Identification of Proxies

4.1.1 Fraction of stock options granted to lower level employees

SEC rules adopted in 1992 require detailed disclosure, in the firm's annual proxy statement, of the components of executive compensation (including information on stock option awards) for the chief executive officer and the other four most highly compensated executive officers whose compensation for the previous fiscal year exceeds \$100,000 (base salary and bonus only). With respect to stock option awards, the disclosure rules require that the firm report, for the employees identified in the proxy statement ("proxy employees") the number of stock options awarded, as well as the percent such award represents of the total stock option grants to all employees. This means that option awards to non-employees, such as directors or consultants, should not be reflected in the calculation of the disclosed percent.

The fraction of stock options granted to lower level employees for a particular year is calculated as one minus the total fraction granted to the proxy employees for that year (I have converted percents to fractions). The total fraction granted to the proxy employees for a particular year is arrived at by summing the fraction that each proxy employee received as a fraction of the total granted to all employees for that year.

The Standard and Poor's ExecuComp (ver. 1999) database provides the following information for each firm, by proxy employee: title, rank, grant identification (for multiple grants in one year), presence of reload option, number of shares underlying current year option grant, the percent the option grant represented out of the total granted to all employees in the year, option expiration date, firm value method, the firm valuation of the option grant and the Black Scholes value of the option grant. Some firms report compensation details for the required individuals only, and other firms provide details on individuals for whom disclosure is not required. I accepted each firm's identification of proxy employees and infer that the rest are "lower level employees."

It should be noted that, when summing over firm-years to obtain the annual total fraction granted to proxy employees, there were instances where the annual fraction granted to proxy employees summed to greater than 1.00. There were also instances where the fraction granted to proxy employees summed to 0.00. Table 1 presents the frequency with which these two situations were encountered with respect to all firms in the ExecuComp database (1749 unique firms) and with respect to my sample of 500 firms. Proxy statements were examined for firms in the sample to detect coding errors for these firms; firms greater than 1.00, for obvious reasons, and firms with 0.00 to check whether the firm granted any options to any employees. Corrections were made when coding errors were detected.

4.1.2 Complexity of the firm hierarchy

In all firms, information is aggregated as it moves from the lowest level of the organization to the top level (vertical aggregation). As information is successively vertically aggregated, it likely contains more noise. Information quality is affected by time delays associated with moving the information through the organization, as well as the reduction in the information volume that must take place as it moves upwards to top management (Keren and Levhari, 1989; Geanakoplos and Milgrom, 1991; Mendelson and Pillai, 1999). Thus, information at any particular level of the organization contains more noise than the aggregated information at the level immediately below. In addition to vertical aggregation, information is also aggregated across the organization (horizontal aggregation). Information by individual sub-units spread horizontally across the firm each contain less noise than the aggregated information for the level as a whole. For firms that are diversified, the problem of noise in the aggregated information can be particularly acute. Aggregated information across diverse lines of business and/or geographical boundaries may contain so much noise as to make the summary information (i.e., firm earnings) uninformative for certain internal firm functions, such as performance evaluation. Diversified firms respond to this problem by designing internal management and control structures that provide information on the decision management and decision control activities within the firm. A reasonable assumption is that, the more diversified the firm is, the more likely it is that internal organizational subunits evolve for decision management and decision control. Thus, firms that are more diversified

will likely use options less for lower level employees than firms that are less diversified. I rely on a firm's industrial segment reporting as a reflection of the internal organization of the firm.¹²

To proxy for the complexity of the firm hierarchy, I use a Herfindahl-like index of firm diversification (Holthausen, Larcker and Sloan, 1995). Sales revenue across three-digit SIC codes is obtained for each firm from the Compustat Business Information files. The firm share of revenue for each segment is squared, and then these squared shares are summed across the firm. A Herfindahl index of zero (one) implies that the firm is completely diversified (undiversified). Firms with small Herfindahl indices (closer to zero, and hence, more complex hierarchies) will likely reduce their use of options for lower level employees. Firms with large Herfindahl indices (closer to 1, and hence, less complex hierarchies) will likely increase their use of options for lower level employees. Thus, the predicted sign for the coefficient on my proxy for complexity of the firm hierarchy is positive.

4.1.3 Task Programmability

My proxy for the task programmability of lower level employees is the extent to which the firm is unionized. Garen (1999) studies the relationship between job design, incentive systems and the influence of unions on job design and incentive systems. Garen argues that job design and incentive systems are

¹² My test period is firm-years 1995, 1996 and 1997; thus, the firms in my sample are reporting segment data under SFAS 14, Financial Reporting for Segments of a Business Enterprise (1974). SFAS 131, issued June, 1997, supersedes SFAS 14, and is applicable for fiscal years beginning after December 15, 1997.

closely linked. In particular, less flexible jobs are unlikely to have an incentive system linking pay to output and workers in less flexible jobs are less likely to be compensated with incentive pay or salaries. His results indicate that union workers tend to be in jobs with more repetitive work, more measurable criteria, less data analysis, less subjective criteria and less incentive and salary pay.

Firms are not required to provide data on the extent of union membership of the firm's employees. Following Holthausen, Larcker and Sloan (1995), I proxy for the extent of firm-specific percentage of employees covered by a collective bargaining agreement by using the industry percentage of workers covered by a collective bargaining agreement. From the Bureau of Labor Statistics, Office of Employment and Unemployment Statistics, Division of Labor Force Statistics, I obtain this data by year, by intermediate industry (2 digit SIC). In some instances, particularly within manufacturing industries, percentage of workers covered by a collective bargaining agreement was available on a 3 digit SIC basis. Firms with higher percentage of workers covered by a collective bargaining agreement likely have a higher degree of task programmability associated with the task employees perform for the firm, and thus, are likely to use less options for lower level employees than firms with a lower percentage of workers covered by a collective bargaining agreement. Thus, the predicted sign for the coefficient on my proxy for task programmability is negative.

4.1.4 Level of innovation opportunity set

A wide variety of accounting-based and market-based proxies for the firm's growth opportunity set (innovation opportunity set) have been utilized in the literature. Appendix C contains a summary table of those proxies and the papers with which they are associated.

Capital budget based information could be useful in evaluating the level of the firm's innovation opportunity set, as capital budgets are prepared to assist management in the selection of projects to pursue. Thus, capital budgets could provide information on a wider set of innovation opportunities (those available to the firm) than the set represented by the firm's expenditures, reported on the financial statement (those chosen by the firm). However, capital budgeting information is private to the firm. I wish to capture the sources of a firm's discretionary spending on growth opportunities; my proxy for the level of the firm's innovation opportunity set is: $[(\text{acquisitions expenditures} + \text{research \& development expenditures} + \text{capital expenditures}) / \text{total assets, beginning of year}]$. The predicted sign of the coefficient on my proxy for the level of the innovation opportunity set is positive.

4.1.5 Type of innovation opportunity set

My proxy for the type of innovation pursued by the firm is firm market share, consistent with the theoretical and empirical literature on the firm's choice of process versus product R&D. Firms with large market share are considered

more likely to be process innovators, and more likely to use options more for lower level employees. Firms with small market share are considered more likely to be product innovators and more likely to use options less for lower level employees. To derive market share, I use firm sales divided by industry sales, where industry classification is based on four-digit Compustat SIC codes. The predicted sign of the coefficient on my proxy for the type of innovation opportunity set is positive.

4.1.6 Firm size

A number of proxies for firm size have been utilized in the prior research, including assets, sales, market value, number of employees, etc. My proxy for firm size is the log (firm total assets, beginning of year). Due to the alternative arguments made above with respect to the expected relation between the fraction of the stock option award granted to lower level employees and firm size, the *ex ante* predicted sign of the coefficient on my proxy for firm size is uncertain.

4.1.7 Income Tax Costs

Graham (1996) investigates whether the simulated tax rate (Shevlin, 1990; Graham, 1996) is the best available proxy for the firm's marginal tax rate, and whether nine alternative tax rate variables could be used as reasonable alternatives for the simulated tax rate. The results of his analysis indicate that the statutory rate variable, the taxable income dummy variable and the trichotomous variable are all reasonable proxies for the marginal tax rate, in

addition to the simulated tax rate. Plesko (1999) examines the ability of financial statement measures of average and marginal tax rates to capture firms' tax attributes. His results suggest that easily constructed binary or other categorical variables can control for the effects of corporate taxes as easily as more complicated approaches to estimating marginal tax rates.

My proxy for the firm's marginal tax rate is the trichotomous tax variable of Graham (1996). The trichotomous variable is equal to (i) the top statutory rate if both the taxable income and nonNOL dummies are positive; (ii) one-half the top rate if either the taxable income or nonNOL dummy is positive while the other is zero, and (iii) zero otherwise. The taxable income dummy is assigned the value of the statutory rate for the top tax bracket if taxable income is positive and a value of zero otherwise. The nonNOL dummy is equal to the top statutory rate if the firm does not have any NOL carryforwards and is equal to zero otherwise. I assumed that the firm did not have any NOL carryforwards if the firm did not provide information about NOLs.

I choose the trichotomous tax variable for three reasons. First, the simulated tax rate variable requires forecasting 18 years of taxable income, a complex process. Second, sensitivity tests conducted by Graham indicate that the simulated and trichotomous variables are the best available proxies in both "easy" and "difficult" forecasting environments.¹³ Third, relying upon NOL carryforward data alone to construct a binary tax variable could be problematic,

¹³ Graham (1996) suggests that it is relatively easy to identify firms that have a very high expected marginal tax rate (fiscally sound) or those that have a very low expected marginal tax rate (rarely profitable). It is more difficult to identify firms with marginal tax rates that are not at either extreme.

as Graham (1996) reports that 15% of the NOL carryforward observations are missing for his sample. Kinney and Swanson (1993) estimate that over 11% of Compustat NOL carryforward data is incorrect either because Compustat incorrectly assigns the data as missing or Compustat has an incorrect amount for the item.

In order to conduct my tests, I treat all options granted by firms as nonqualified stock options ("NQOs") (as opposed to qualified options, otherwise known as incentive stock options ("ISOs")). The cited research in section 3.7 contain discussions of the characteristics of the two option types. I make this simplifying assumption for two reasons.

First, both Matsunaga, Shevlin and Shores (1992) and Balsam, Halperin and Mozes (1997) show that ISOs continue to be granted after the Tax Reform Act of 1986 ("TRA86"), but their frequency is reduced. Second, certain income tax rules associated with ISO plans likely act as economic constraints on levels of compensation, relative to NQO plans. For example, IRC Section 422 (d) (1) imposes a \$100,000 annual ceiling on the value of stock that can be acquired under newly vesting ISO options; options to acquire stock with a value at vesting date above this ceiling are treated as NQOs. Of course, the fact that the tax regime creates some disincentives for firms to issue ISOs to top employees does not mean that firms could not issue ISOs for lower level employees and NQOs for top employees. Nor does it mean that firms cannot issue both ISOs and NQOs to employees, top or lower level. Practically speaking however, the extent to which firms grant ISOs and NQOs is difficult to assess, as firms are not

required to disclose option plan type. While hand collecting data on end-of-year exercisable options for all employees, I observed that the disclosure that was provided concerned the types of options permitted under the plan, but did not extend to disclosure of option types granted by the firm.

The predicted sign on the coefficient on my proxy for firm income taxes is negative.

4.1.8 Deadweight Losses

Following my hypotheses with respect to deadweight financial capital and human capital losses, I identify separate proxies for employees' exposure to firm specific risk from their financial capital and from their human capital.

4.1.8a Deadweight financial capital losses

My proxy for deadweight financial capital losses is the level of the total diversifiable financial capital of lower level employees. The total diversifiable financial capital of lower level employees is unobservable. I proxy for the total diversifiable financial capital of the lower level employees with their diversifiable financial capital derived from the firm.

Table 2 identifies the likely sources of financial capital derived from the firm for lower level employees. Under the heading of employer funded retirement benefits, I include defined contribution plans, defined benefit plans and the employer match of employee 401K plan deferrals. Under the heading of employee funded retirement benefits, I include employee 401K plan deferrals and employee ESOP contributions. "Other post employment benefits" includes

medical benefits, etc. "Stock-based plans" includes stock options, restricted stock, stock appreciation rights, warrants, etc. Cash or deferred arrangements ("CODAs) are cafeteria plans offering a selection of benefits that employees can choose from.

I classify the sources of capital as diversifiable or undiversifiable based on whether the employee can or cannot diversify the particular capital away from firm-specific risk. In general, I assume the employee can diversify away from firm-specific risk if the capital has vested in the employee. I do not consider transaction costs in this classification. Salary is undiversifiable since employees typically draw salary from only one employer and draw it at intervals. The vested portion of retirement benefits, employer or employee funded, belong to the employee. Upon job change or termination, an employee can receive a distribution of vested balances for rollover into the retirement plan of the new employer or into an IRA account. Therefore, I classify vested employer and employee provided retirement benefits as diversifiable. Other post employment benefits typically are available to an employee only so long as employment continues (medical coverage, an exception to this general rule, continues for up to 18 months post-employment), and I classify these as undiversifiable. Stock-based plans typically have vesting schedules, with the employee controlling the vested portion. I classify the vested portion of stock-based compensation as diversifiable. Cash or deferred arrangements are "use it or lose it" plans, whereby the account balance reverts to the employer if not utilized by the employee by year-end. These I classify as undiversifiable.

I hand collect, from firm financial statements, data on the number of exercisable options outstanding at the end of the prior fiscal year, as well as exercise prices. From the total number of exercisable options outstanding at the prior year-end, I subtract the total exercisable options held by the proxy employees on the same date. This latter information I obtain from the Standard and Poor's ExecuComp (ver. 1999) database. The ExecuComp database includes information, by firm, for each of the employees covered in the proxy statement ("proxy employees"), and includes the proxy employee's name, title, rank, total of exercisable unexercised options, total unexercisable unexercised options, the dollar value of the in-the-money exercisable options and the dollar value of the in-the-money unexercisable options, at year end.

There are a number of problems associated with the hand-collected data on firm total exercisable options. First, for almost all firms, the total exercisable options reported in firm's financial statements includes not only the exercisable options held by all the employees, top and lower level, but also those held by directors and outside consultants.¹⁴ Thus, the number of total exercisable options at prior year-end for lower level employees is noisily measured, to the extent I cannot back out exercisable options held by directors and outside consultants. Second, my exercise price also contains noise. The disclosure requirements of SFAS 123, Accounting for Stock-Based Compensation, became effective for fiscal years beginning after December 15, 1995. Since my test

¹⁴ In only very few instances did I observe separate disclosure of the exercisable options held by directors. In no instances did I observe separate disclosure of the exercisable options held by outside consultants, despite footnote disclosure that options were granted to outsiders.

period is 1995 through 1997, I required data on exercisable options at year-ends before the SFAS 123 requirements were in place.

To collect this data for each firm, I began with the 1997 financial statement for each firm. Some firms reported information on option plans for a three-year period ending with the 1997 year; others reported one year of data only. In the former case, I reviewed two financial statements for a firm; in the latter, I reviewed four. I collected the information on the exercisable options at year-end and the exercise price information, adjusting the information to reflect stock splits, etc. through the 1997 year.

To obtain the value of the exercisable options held at the prior year-end by the lower level employees, I multiply the number of exercisable options held by the lower level employees at the end of the prior year by the difference between the exercise price and the price of the stock at the same date. When the exercise price exceeds the stock price ("underwater options"), the value of the exercisable options held by the lower level employees is set equal to zero.

In addition, I collect information on each firm's total vested accumulated pension benefit obligation at the end of the prior year. It should be noted that these figures include pension benefits for the top employees, and thus also introduce noise into my tests. Firm disclosure of 401k and ESOP accounts are not mandated, and disclosure is inconsistent across firms. Therefore, I limit data collection to firm total vested accumulated pension benefit obligations.

While both the dollar value of the exercisable options and the total vested accumulated pension benefits at year-end are sources of firm-specific financial

capital for lower level employees, there are important differences between the two. Exercisable options can be exercised immediately. Pension benefits are intended to be payable at retirement, and the time value of money is likely factored into the valuation of the pension benefits to the employee. With respect to exercisable options, the employee can either retain the shares acquired under the exercise, or sell them, in conjunction with their personal portfolio management strategy. Pension funds, while vested, are controlled by the fiduciary of the pension trust. The fiduciary makes the decisions as to how to invest pension trust funds. The employee can certainly alter the structure of the remainder of his/her personal portfolio in response to the fiduciary's investment decisions, but this may not be an optimal investing strategy for employees. Pension benefits are also payable, without penalty, to an employee, when the employee leaves the firm. The employee can usually roll-over the funds into an individual retirement account ("IRA") or into the pension plan of the new employer. Job change is costly. Further, while an IRA allows the employee to exercise investing control over the pension funds distributed, a roll-over to the new employer's pension plan puts the employee in the same position as he or she was with respect to the old employer; the plan fiduciary makes the investing decisions. Employees can receive a distribution of their vested pension benefits without changing jobs or retiring, but not without a significant cost. A distribution made to an employee before retirement and not on account of job change, a "premature distribution," subjects the distribution to a 10% penalty. This

premature withdrawal penalty likely is a significant cost to exercise investing control over vested pension benefits.

Since the costs associated with these two types of financial capital are likely different for lower level employees, I use the both of these proxies for the diversifiable financial capital of lower level employees separately in my tests.

Since large values of diversifiable wealth for lower level employees means lower deadweight financial capital costs for firms (and hence, greater use of options for lower level employees), the predicted sign on the coefficient on both my proxies for the deadweight financial capital cost is positive.

4.1.8b Deadweight Human Capital Losses

I proxy for the deadweight human capital losses with the average hourly earnings of production workers, by industries. The labor economics literature typically relies upon wages, or alternatively, education, as indicators of the value of human capital (e.g. Parent, 2000). The higher the average hourly industry earnings of lower level employees, the more valuable are their industry specific skills, and hence, the lower the deadweight human capital losses. I obtained data on industry specific average hourly earnings of production workers from the U.S. Bureau of Labor Statistics, *Employment and Earnings* reports, reported in the Statistical Abstract of the U.S. (Table 654 for 1995, Table 662 for 1996, Table 687 for 1997). These earnings are the annual averages of monthly figures for all full and part time employees who worked during, or received pay for, any part of the pay period including the 12th of the month. For mining and manufacturing, the data refer to production and related workers. For construction, the data refer

to employees engaged in actual construction work. For all other industries, the data refer to non-supervisory employees and working supervisors. The data are fairly consistently available on a 3-digit SIC basis, and I used 2-digit SIC earnings when 3-digit earnings were not available. As the hourly earnings of workers increases, deadweight human capital costs decrease, making options less costly for firms to use. Firms will likely use options to a greater extent under these circumstances. Under this argument, the predicted sign of the coefficient on my proxy for the deadweight human capital losses is positive.

There is a potential problem associated with the use of this particular proxy for human capital. Human resource professionals, when discussing firms' use of broad-based stock option plans, almost always indicate that firms use stock options for lower level employees to attract, retain and motivate employees. Core and Guay (2000) suggest that firms substitute stock options for cash compensation when the firms are subject to cash constraints. Taken together, this suggests that firms also use stock options to adjust levels of total pay. If firms do use stock options to adjust levels of total pay, then as cash pay rises, firms likely decrease the use of equity-based compensation for lower level employees. If my proxy for human capital, hourly wages of production workers, is serving as a proxy for the levels of total pay of lower level employees rather than the deadweight human capital losses, then the predicted sign of the coefficient on my proxy for deadweight human capital losses would be negative.

4.2 Sample Selection

From the ExecuComp database (ver. 1999), which provides information on 1749 unique firms, I randomly selected a sample of 500 firms. For these 500 firms, I calculate the fraction of option grants to lower level employees based on the information provided in ExecuComp for top employees for firm years ending in 1995, 1996 and 1997. Financial statement, including industry segment sales, and income tax data for at least one fiscal year for the period 1994 through 1997 must be available for retention in the study. Firm SIC codes must also allow for matching for industry sales, hourly wages of production workers and union affiliation. Information on exercisable options at year-end for top employees is hand collected from firm annual statements. Following Core and Guay (2000), I drop firm-years (and the years preceding) in which a pooling acquisition took place, as firms restate prior financial statements. Firm-years in which adjustments were made to options outstanding and/or exercisable due to mergers or spinoffs are also dropped. Firm-years were also dropped if information on exercisable options not disclosed. Firms were dropped from the sample if tracking stock was issued, the stock options were clearly identified as ISOs, options balances included options in subsidiaries, multiple classes of stock used, options vested at grant date or options information presented in a foreign currency.

From the sample of 500 unique firms randomly selected from the compensation database, and the resulting total sample of 1500 firm-years, 307

firm-years were dropped due to unavailability of financial statement information. Ninety-seven firm-years were dropped due to missing industry segment sales data. Twenty-two firm-years could not be matched for industry sales. Three firm-years were dropped due to lack of hourly wage 2-digit SIC match. Fourteen firm-years were dropped due to lack of union affiliation 2-digit SIC match. One hundred twelve firm-years were dropped due to poolings. Fifty-three firm-years were dropped due to lack of disclosure of firm total exercisable options. Twenty-seven firm-years were dropped due to merger and/or spinoff adjustments. Fifty firm-years were dropped due to delistings, tracking stock, vesting at grant date, etc. Sixty-five firm-years were dropped due to missing and/or unreconcilable information on exercisable options for proxy employees. Four firm years were dropped due to missing end of year stock prices.

This process results in a final sample of 737 firm-years. Table 3 reflects this selection process.

4.3 Descriptive Statistics.

4.3.1 Descriptive Statistics on the Standard and Poor's ExecuComp (ver. 1999) database firms.

Panel A of Figure 3 reflects the mean fraction of the annual stock option award granted to lower level employees, for each year during the period 1992

through 1997, for all firms in the Standard & Poor's ExecuComp (ver. 1999) database.¹⁵

Panel A of Figure 3 indicates that the mean fraction of the annual stock option award for lower level employees has remained remarkably stable during that time period, at approximately .70. Panel B of Figure 3 reports the annual fraction of the stock option award granted to lower level employees at selected quintiles, for the same firms covered by Panel A. This table indicates that there is substantial variation across firms in the fraction of the annual stock option award granted to lower level employees, and that the distribution of the variation is fairly consistent over time. To determine the extent to which individual firms might be changing the fraction awarded to lower level employees, I calculate changes in the fraction both across time and across firms. A subset of the firms reported on in Figure 3 is used here, because, for the calculation of changes in the fraction, firms are required to be in the database every year for the period 1993 through 1997. This requirement reduces the dataset to 686 firms. Panel A of Figure 4 reflects the annual net mean change in the fraction for these firms, and by groups, when these firms are classified as increasing or decreasing the fraction from the prior year, for the period 1993-1997. Panel B provides the data, in table form, for the firms increasing the fraction over the prior year and for the firms decreasing the fraction over the prior year. Taken together, Panel A and Panel B indicate that the mean change by year for these firms is quite small, and

¹⁵ I have excluded firm-years for presenting Figures 3, 4 and 5 when the firm-year fraction granted to the top employees was greater than 1.00 or equal to 0.00. Please see Section 4.1.1 for my discussion of my calculation of the fraction granted to the top employees and my steps to correct results of greater than 1.00 and verify results equal to 0.00 for the firms in my sample.

that about half the firms increase the annual fraction from the prior year and about half decrease the annual fraction from the prior year, and by approximately the same amount. Of course, any given firm could increase the fraction in one year, and decrease it in the next. Figure 5 reflects the distribution of the mean net change by firm over the four-year period 1993-1997 by selected quintiles. Figure 5 indicates that the great majority of the firms changed the fraction of the annual options granted to lower level employees by a **net +/- .10, or less**, over the period 1993-1997.

Taken together, these figures and tables indicate a stability in the “structure” of firms’ grants of stock options to lower level employees over time, while indicating substantial cross-sectional variation when examining the fraction of the firm total stock option award granted to the lower level employees. This paper will attempt to provide evidence on the economic determinants of the cross-sectional variation in that structure.

4.3.2 Descriptive Statistics on Final Sample Firms.

Table 4 reports the distribution of my final sample of 737 firm-years by 1 digit SIC codes. The highest concentration of final sample firm-years (235 firm-years, 31.9% of sample) is in the durables manufacturing industry (SIC 3). The next highest concentration of firm-years (169 firm-years, 22.9% of sample) is in the nondurables manufacturing industry (SIC 2), followed by firm-years (112 firm-years, 15.2% of sample) in the wholesaling and retailing industries (SIC 5).

Table 5 provides descriptive statistics on the fraction of firm total options issued to lower level employees, and the hypothesized determinants, for the firm-years in the sample. The mean (median) of the fraction of firm total options issued to lower level employees (FRACT) is .699 (.740). The mean (median) value for the complexity of firm hierarchy (COMP), proxied for by a Herfindahl-like index, measured as the sum of the squared shares of firm revenue by 3-digit SIC codes, where zero (one) means the firm is completely diversified (undiversified), is .830 (1.00). The mean (median) of the ratio of firm spending on the innovation opportunity set to book value of assets is .127 (.100). The mean (median) market share, my proxy for type of innovation strategy, is .191 (.093). Mean (median) firm size, measured as log (beginning of year firm total assets, in millions) is 7.190 (6.953). The mean (median) value for task programmability, as proxied for by the estimated percent of firm employees covered by a collective bargaining agreement, on a 2-digit SIC basis, is 13.889% (12.00%). The mean (median) value of deadweight financial capital losses from exercisable options is 34.997 (4.654), in millions of dollars. The mean (median) value of deadweight financial capital losses from vested pension benefits, scaled by book value of assets, at prior year end, is .073 (.016). The mean (median) value of deadweight human capital loss, as proxied for by the hourly wages of production workers, on a 2-digit SIC basis, is \$13.734 (\$13.440).

In Table 6, I provide the mean values of the variables by industry group. Firms in business services granted, on average, .759 of the firm total annual option award to lower level employees, followed closely by firms in the durables

manufacturing and consumer services industries. Table 6 reports that the mean fraction of firm options granted to lower level employees, with the exception of the firms in the agriculture industry, clusters around .70. Firms in transportation and utilities and durables manufacturing had the lowest mean value for complexity, meaning they were more diversified than the firms in the remaining industries. Firms in the business services and consumer services industries had the highest ratio of innovation opportunity spending to book value of assets, while firms in the financial services industry had the lowest. Firms in the wholesale and retail and durables manufacturing industries had the largest values for innovation type, while firms in agriculture had the lowest. The largest firms were in the financial services industry, followed by firms in the transportation and utilities and nondurables manufacturing industries. Firms in the transportation and utilities industry also had the highest value for task programmability, as measured by the estimated extent of employees covered by a collective bargaining agreement, followed by firms in durables manufacturing. Firms in the nondurables manufacturing industry had the highest value for deadweight financial capital loss from exercisable options, followed by firms in the financial services industry. Firms in the durables manufacturing industry had the highest value for deadweight financial capital loss from vested pension benefits, followed by firms in the nondurables manufacturing industry. Firms in the transportation and utilities industry had the highest value for deadweight human capital loss, as proxied for by the hourly wages of production workers in the industry, followed closely by firms in business services.

Table 7 provides the mean value, in millions of dollars, of taxable income and net operating loss carryforwards, and number of firms classified by Graham's (1996) trichotomous tax variable, my proxy for the firm marginal tax rate, for the firms in the sample, by industry, where one digit SIC codes are used for industry classification. Firms in the business services industry had the largest mean value of taxable income, \$628.786 million, followed by firms in the nondurables manufacturing industry, \$498.987. Firms in the consumer services industry had the lowest mean value of taxable income, \$15.841 million. Firms in the nondurables manufacturing industry had the highest level of net operating loss carryforwards, \$101.902 million, followed by firms in the durables manufacturing industry, \$88.133 million. Approximately 70% of the firm-year observations were assigned a marginal tax rate of 35% and approximately 25% of the firm-year observations were assigned a marginal tax rate of 17.5%.

Panel A of Table 8 summarizes the number of firm-years for which the weighted average exercise price of exercisable options was disclosed (I refer to this as Method 1), as well as the alternatives used when such exercise price was not available, by industry, where one digit SIC codes are used for industry classification. Method 2 is the use of the mid-point of the disclosed range of exercise prices for the exercisable options at year-end. Method 3 is the use of the disclosed weighted average of the outstanding options at year-end. Method 4 is the use of the mid-point of the disclosed range of exercise prices for the outstanding options at year-end. Method 5 is the use of a combination of the disclosed weighted average exercise price and disclosed range of exercise

prices, for either exercisable options or outstanding options at year-end. Method 5 was necessary when the firm provided separate disclosure for separate plans, and used different disclosure for the reported plans with respect to end-of-year exercise prices. The weighted average exercise price of exercisable options was available for approximately 57% of the firm-year observations. The range of exercise prices of exercisable options was available for approximately 13% of the firm-year observations.

Table 8, Panel B provides the mean values, in millions of dollars, for my proxies for deadweight financial capital losses, the dollar value of the exercisable options of the lower level employees, and the vested portion of the over- and under-funded accumulated pension obligation reported by firms. With respect to the dollar value of the exercisable options of the lower level employees, I report the mean value, by industry, when the underwater options are included, and the mean value, by industry, when underwater options are set equal to zero. Options are “underwater” when the exercise price exceeds the stock price at year-end. When setting underwater options equal to zero, firms in the nondurables manufacturing industry had the highest level of value, \$46.847 million, followed closely by firms in the financial services industry, \$45.784 million. Firms in the transportation and utilities industry had the highest level of vested over-funded pension benefit obligation, \$1149.410 million, while firms in the durables manufacturing industry had the highest level of vested under-funded pension benefit obligation, \$536.795 million.

Table 9 provides the correlations among the variables. The Pearson correlation coefficients are below the diagonal and the Spearman correlation coefficients are above the diagonal. The number of observations ranges from 714 to 737.

With respect to the Pearson correlation coefficients, firm size is significantly positively correlated, at the 1% level, with the fraction of firm total annual options granted to lower level employees, consistent with the argument that when the costs of measuring outcomes is low, firms will use outcome-based measures more. Taxes is significantly positively correlated, at the 10% level, with the fraction of options granted to lower level employees, inconsistent with the argument that higher marginal tax rate firms use options less for lower level employees. The deadweight financial capital losses due to exercisable options and due to pension benefits, are significantly positively correlated, at the 1% and 10% level, respectively, with the fraction of options awarded to lower level employees, consistent with the argument that firms consider the costs of measuring outcomes when awarding options.

The complexity of firm hierarchy is significantly positively correlated, at the 1% level, with the level of the innovation opportunity set, consistent with the idea that less diverse firms spend more on the innovation opportunity set. The complexity of firm hierarchy is significantly negatively correlated, at the 1% level, with the type of the innovation opportunity set, consistent with the idea that firms with complex hierarchies tend to be process innovators. The complexity of firm hierarchy is significantly negatively correlated, at the 1% level, with firm size,

consistent with the idea that larger firms tend to have more complex hierarchies. The complexity of firm hierarchy is significantly negatively correlated, at the 1% level, with task programmability, consistent with the idea that firms with more complex hierarchies have a greater degree of task programmability. The complexity of firm hierarchy is also significantly negatively correlated, at the 1% level, with deadweight human capital costs, consistent with the idea that firms with more complex hierarchies have larger deadweight human capital costs.

The level of the innovation opportunity set is significantly negatively correlated, at the 1% level, with the type of innovation set, consistent with the argument that process innovators spend less on the innovation opportunity set. The level of the innovation opportunity set is significantly negatively correlated, at the 1% level, with firm size, consistent with the idea that large firms spend less on the innovation opportunity set. The level of the innovation opportunity set is significantly negatively correlated, at the 1% level, with firm income taxes, consistent with the idea that firms spending aggressively on innovation may not be generating taxable income. The level of the innovation opportunity set is significantly positively correlated, at the 1% level, with deadweight financial costs from pension benefits, consistent with the idea that firms facing large innovation opportunity sets have higher deadweight financial costs.

The type of innovation opportunity set is significantly positively correlated, at the 1% level, with firm size, consistent with the idea that large firms tend to be process innovators. The type of innovation opportunity set is significantly negatively correlated, at the 10% level, with task programmability, consistent with

the idea that process innovators have a lesser degree of task programmability for the employees.

Firm size is significantly positively correlated, at the 1% level, with firm income taxes, consistent with the idea that larger firms have higher marginal tax rates. Firm size is also significantly positively correlated, at the 1% level, with deadweight human capital costs both from exercisable options and pension benefits, consistent with the idea that options are less costly for larger firms.

Task programmability is significantly positively correlated, at the 1% level with deadweight human capital costs, consistent with the idea that greater task programmability have higher deadweight human capital costs.

The Spearman correlation coefficients reported are generally consistent with the Pearson correlation coefficients, with several additions. The fraction of firm total options granted to lower level employees is significantly positively correlated, at at least the 10% level, with the level of the innovation opportunity set, the type of innovation opportunity set, firm size and deadweight financial capital costs from exercisable options and vested pension benefits, consistent with the argument that firms evaluate the costs of measuring behaviors and outcomes when granting options to lower level employees. Deadweight financial capital losses from exercisable options is significantly positively correlated, at the 10% level, with both the level and type of innovation opportunity set, consistent with the argument that firms consider costs of measuring outcomes as they award stock options to lower level employees.

5. Tests and Results

In this section, I present the model statement, the regression statement, and the results of my test.

5.1 Model and Regression Statement

Based on my hypotheses above and Statement [3] presented above in Section 2, my model of the determinants of the fraction of firm total stock options granted to lower level employees is (with predicted relation in parentheses):

***Fraction of firm total stock option award granted to lower level employees =
f [Complexity of firm hierarchy (-), Task Programmability (-), Level of
innovation opportunity set (+), Type of innovation opportunity Set (+) ,
Firm size (?), Taxes (-), Deadweight Costs (-)] [4]***

Based on my predictions of the effects of the costs of measuring behavior (complexity of the firm hierarchy, the level and type of innovation opportunity set,

task programmability) and the costs of measuring outcomes (firm size, taxes, deadweight costs) on firm grants of stock options to lower level employees, I estimate the following regression:

$$\begin{aligned} \text{FRACT} = & \beta_0 + \beta_1 \text{COMP} + \beta_2 \text{IOSL} + \beta_3 \text{IOST} + \beta_4 \text{SIZE} + \beta_5 \text{TAX} + \\ & \beta_6 \text{PROG} + \beta_7 \text{DWFCE} + \beta_8 \text{DWFCP} + \beta_9 \text{DWHC} + \varepsilon \end{aligned} \quad (1)$$

where,

FRACT = the fraction of the firm total stock option award for the year granted to the lower level employees;

COMP = the complexity of the firm hierarchy, proxied for by a Herfindahl-like index of firm diversification, measured as the sum of the squared shares of firm revenue by 3 digit SIC codes, where zero (one) means the firm is completely diversified (undiversified);

IOSL = the level of the innovation opportunity set, proxied for by the sum of firm research & development expenditures, capital expenditures and acquisition expenditures, scaled by the book value of total assets at end of year;

IOST = the type of innovation opportunity set, proxied for by firm market share (firm sales divided by industry sales, based on 4 digit SIC code match);

SIZE = firm size, measured as log (beginning of year firm total assets, in millions of dollars);

- PROG** = task programmability, proxied for by estimated union affiliation, as obtained from the U.S. Bureau of Labor Statistics, where firm estimated union affiliation is approximated by the industry union affiliation;
- DWFCE**= the deadweight financial capital loss of options, proxied for by the value of the exercisable options at prior year-end;
- DWFCP**= the deadweight financial capital loss of options, proxied for by the vested accumulated pension benefit obligation, scaled by firm total assets, at prior year-end;
- DWHC** = the deadweight human capital loss of options, proxied for by the average hourly earnings of production workers, on a 3-digit SIC basis (2-digit SIC basis if 3-digit SIC basis not available), as obtained from the U.S. Department of Labor Statistics.

5.2 The Results

Table 8 reports the empirical tests of the model. The table contains the predicted sign of a coefficient, if there is a prediction, and therefore, significance tests are one-tailed for variables with a predicted sign and two-tailed otherwise.

The coefficient on the firm complexity proxy is positive and but not statistically significant at any meaningful level. This result suggests that low costs of measuring behavior are not a factor in awarding outcome-based compensation to lower level employees. The coefficient on the proxy for the

level of the innovation opportunity set is positive and statistically significant at the 1% level, providing support for the hypothesis that firms with high costs of measuring the behavior of lower level employees tend to use outcome-based instruments to a greater extent. The coefficient on the type of innovation opportunity is of the opposite sign, and therefore does not support the hypothesis that firms with high costs of measuring lower level employee behavior tend to use outcome-based instruments to a greater extent. The coefficient on firm size is significantly positive at the 1% level, suggesting that low costs of measuring outcomes means firms will use outcome-based instruments to a greater extent. The coefficient on the firm marginal tax rate is of the opposite sign, and therefore does not support the hypothesis that low costs of measuring outcomes leads firms to use options to a greater extent for lower level employees. The coefficient on task programmability is of the opposite sign, and therefore does not support the hypothesis that low costs of measuring behaviors leads firm to reduce their use of options for lower level employees. The coefficient on deadweight financial capital costs from exercisable options is positive and significant at the 1% level, providing support for the hypothesis that low costs of measuring outcomes leads firms to increase the use of options. The coefficient on deadweight financial capital costs from vested pension benefits is positive but not statistically significant. And finally, the coefficient on deadweight human capital costs is negative, but not statistically significant, and therefore does not support the hypothesis that low costs of measuring outcomes lead firms to greater use of options for lower level employees.

Overall, these results provide mixed support for the general hypothesis that, cross-sectionally, firms consider the costs of measuring behaviors and outcomes as they compensate lower level employees.

Rank regression results, unreported, provide evidence consistent with the ordinary least squares results reported in Table 10.

As a sensitivity check of the results, I next perform year-by-year, 1995 to 1997, regressions of Model (1). Table 11 reports the year-by-year results. In general, the results of the year-by-year regressions for 1995 and 1996 are consistent with the cross-sectional regression reported in Table 10. The coefficients on my proxies for the level of the innovation opportunity set, firm size and the deadweight financial capital losses from exercisable options are all significant at at least the 5% level. With respect to 1995, the coefficient on my proxy for deadweight human capital losses is negatively statistically significant, suggesting the firms use option grants to lower level employees to adjust levels of total pay. I interpret the results for 1995 and 1996 as providing mixed support for the general hypothesis that firms consider the costs of measuring behaviors and outcomes when awarding stock options to lower level employees. With respect to 1997, two changes from the results for 1995 and 1996 are worth mentioning. The 1997 regression results indicate that the coefficient on my proxy for the level of the innovation opportunity set is insignificant, perhaps indicating an shift in innovation spending by firms. The coefficient on my proxy for the level of the innovation opportunity set was reported as statistically significant in the cross sectional regressions and the 1995 and 1996 regressions. Interestingly,

the coefficient on my proxy for firm marginal taxes is significant at the 5% level in 1997, while it is statistically insignificant in the 1995 and 1996 regressions and the cross-sectional regression. Again, this may be indicative of an intertemporal shift in 1997. I discuss the importance of an intertemporal study in the Conclusion, Section 6.0, following.

A regression, unreported, using year dummies instead of year-by-year regressions, indicates no statistically significant difference across years.

If I think of the coefficients on the hypothesized determinants of the fraction of the annual stock option award granted to the lower level employees, as the weights, indicative of relative importance, that the firm places on each of my proxies for some of the firm's agency costs, my cross-sectional model constrains those weights to be constant across industries. The "industry effect" is well documented in the accounting, economics, finance, labor and organizational behavior literature. Industry membership has been shown to be associated with many features of the firm, including wage levels, capital structure, risk of business, leverage levels, tax rates, accounting reporting choices, etc. Thus, it is unlikely that firms in different industries place the same weight, in terms of relative importance, on the agency costs that I identify, as they allocate stock options to the lower level employees.

As a further sensitivity check, I perform industry regressions for SIC codes 2 through 6. The results of these regressions are reported in Table 12, Panels A through E. The results for the durables manufacturing regression (Panel A) are consistent with those reported from the cross-sectional regression; the level of

the innovation opportunity set, firm size and deadweight human capital losses from exercisable options are associated with the fraction of stock options awarded to the lower level employees. The results for the nondurables manufacturing regression (Panel B) indicate that the level of the innovation opportunity set, firm size and deadweight human capital losses are associated with the fraction of stock options awarded to the lower level employees. The results for the transportation and utilities regression (Panel C) indicate that the model has no explanatory power at all for firms in these industries; none of the coefficients are statistically significant and the R-square is relatively low. The results for the wholesale and retail industries (Panel D) indicate that firm size and deadweight human capital costs are associated with the fraction of the stock option award granted to lower level employees, but the relatively low adjusted R-square of 4.12% indicates that this model has relatively low explanatory power for the firms in this industry. The results for the financial services industry regression (Panel E) indicate that only the deadweight financial capital losses from exercisable options are associated with the stock option grants to lower level employees.

6. Summary and Conclusion

I provide evidence on whether firms compensate lower level employees in a manner consistent with the reduction of agency costs, by examining the relationship between stock option grants to lower level employees and proxies for firms' agency costs. Existing studies on the determinants of firms' stock option awards have generally focused on awards at the industry, firm, manager or director level. Thus, this paper contributes to our understanding of firms' compensation practices at lower levels of the organization.

My results provide mixed support for the general hypothesis that firms are motivated in a predictable way by agency costs of measuring behaviors and outcomes as they award stock options to lower level employees. Specifically, I predict that large innovation opportunity sets and a process innovation strategy are associated with high costs of measuring behavior, and firms with these characteristics will use equity-based compensation more for lower level

employees. Further, I predict that large firms have low costs of measuring outcomes, and will therefore, tend to use equity-based compensation more. I also predict that firms with high marginal tax rates and high deadweight human capital and financial capital costs have high costs of measuring outcomes, and will, therefore, tend to use equity-based compensation less. And finally, I predict that firms with complex hierarchies and high task programmability have low costs of measuring behavior, and will therefore tend to use equity-based compensation less.

Specifically, I find that, in the cross section, high costs of measuring behaviors, high costs of measuring outcomes and low costs of measuring outcomes are associated with firms' awards of stock options to lower level employees. I do not find support for the hypotheses that, in the cross section, low costs of measuring behaviors are associated with firms' awards of stock options to lower level employees. Taken together, these results provide mixed support for the general hypothesis that firms consider agency costs when awarding equity-based compensation to lower level employees.

There are many possible extensions to this work. My definition of lower level employees creates a class of employees unlikely to be homogenous with respect to risk aversion, wealth, human capital investment, education, job requirements, etc. I can think of the coefficients on the hypothesized determinants of the fraction of the annual stock option award granted to the lower level employees as the weights, indicative of relative importance, that the firm places on each of these categories of the firm's agency costs. Because it is

unlikely that these agency costs would be the same, or even similar, across all the employees in the group I have identified as lower level employees, it is also unlikely that the weights, or relative importance to the firm, would be the same across these employees. My model, in effect, constrains these weights to be constant across employees. Data as to the distribution of option grants within firms would be extremely useful in an extension of this research, to explore the possible differential weighting of agency cost considerations across employees, across firms.

Core and Qian (2000) show that the convexity of the compensation contract of a non-top employee is related to the convexity of the contract of the top employee. Further, they show that the convexity of the non-top employee's contract should be greater when all the firm's growth opportunities are related to improvements in the marginal productivity of human capital than when all the firm's growth opportunities are related to improvements in the productivity of physical capital. Barringer and Milkovich (1998) point out that industry classification may be an oversimplification of the characterization of a firm as labor or capital intensive. My model does not address the characterization of the firm as either a firm for which the investment opportunities are related to improvements in human capital productivity, or one where such opportunities are related to improvements in the productivity of physical capital. An extension of this research could examine the Core and Qian (2000) suggestion that the relative importance of human versus physical capital impacts firm's compensation strategies.

There are other possibilities for extensions of this research, in addition to addressing the issues raised immediately above. Agency and contracting theory could suggest additional possible circumstances where costs of measuring behaviors or outcomes could be sufficiently low or high so as to have an effect on the grant of stock options to lower level employees. For example, shareholder-managers are in a position to directly acquire information about the behavior of the lower level employees. This information can be more timely and less noisy than the information contained in quarterly reports to shareholders. Perhaps in the presence of higher managerial ownership, the costs of measuring behavior of lower level employees might be reduced. Much has been said in the financial and general press about the likelihood that this “phenomenon” of granting stock options to rank and file employees is simply a sign of the times; the good stock market times, that is. An intertemporal analysis could explore this suggestion and could also consider the impact of economic events and/or conditions, such as downsizing, tight labor markets, mergers, etc. on firms’ awards of stock options to lower level employees. Research focused on specific industries could provide insights as to how the nature of the firm’s operating environment impacts the compensation strategies employed. Economic characteristics of lower level employees, such as risk-taking, could be incorporated, as part of an analysis that considers how the firm’s compensation strategy possibly attracts a “certain” type of worker. The relation between changes in the firm’s innovation strategy (level and type) and option grants to lower level employees might be a fruitful area. Firms in developing and mature industries may have significantly different

considerations as they devise compensation contracts for lower level employees. Detailed information on firm's hierarchies and decision control and management systems could improve the power of the tests. The relation between the compensation contracts of the top employees and the lower level employees could be explored.

FIGURE 1

Tax Effects to firm and employee at exercise and sale of Nonqualified Stock Options

Panel A – With sale of stock at a date subsequent to exercise date

	GRANT	EXERCISE	SALE
FIRM [taxes saved]	no effect	$TC (P_x - XP)$	no effect
EMPLOYEE [taxes paid]	no effect	$TO (P_x - XP)$	$TG (P_s - P_x)$

Panel B – With cashless exercise or sale at exercise (i.e. immediately following exercise)

	GRANT	EXERCISE and SALE	
FIRM [taxes saved]	no effect	$TC (P_x - XP)$	
EMPLOYEE [taxes paid]	no effect	$TO (P_x - XP)$	

where:

TC	=	Corporate income tax rate;
P_x	=	Stock price at exercise date;
XP	=	Exercise price;
TO	=	Individual income tax rate;
TG	=	Individual capital gains tax rate;
PS	=	Stock price at exercise date.

FIGURE 2
Joint Taxes Saved [Paid], in Rates, at Exercise of
Non-Qualified Stock Options

FIRM	A					B				
FIRM STATUTORY RATE (%)	35					25				
EMPLOYEE	A1	A2	A3	A4	A5	B1	B2	B3	B4	B5
EMPLOYEE STATUTORY RATE (%)	39.6	36	31	28	15	39.6	36	31	28	15
JOINT TAXES SAVED [PAID] (%)	[4.6]	[1]	4	7	20	[14.6]	[11]	[6]	[3]	10
FIRM	C					D				
FIRM STATUTORY RATE (%)	15					0				
EMPLOYEE	A1	A2	A3	A4	A5	B1	B2	B3	B4	B5
EMPLOYEE STATUTORY RATE (%)	39.6	36	31	28	15	39.6	36	31	28	15
JOINT TAXES SAVED [PAID] (%)	[24.6]	[21]	[16]	[13]	0	[39.6]	[36]	[31]	[28]	[15]

FIGURE 3
Panel A – Mean Fraction of Annual Option Grant to Lower Level Employees,
All firms in ExecuComp database (ver. 1999), Years 1992 to 1997

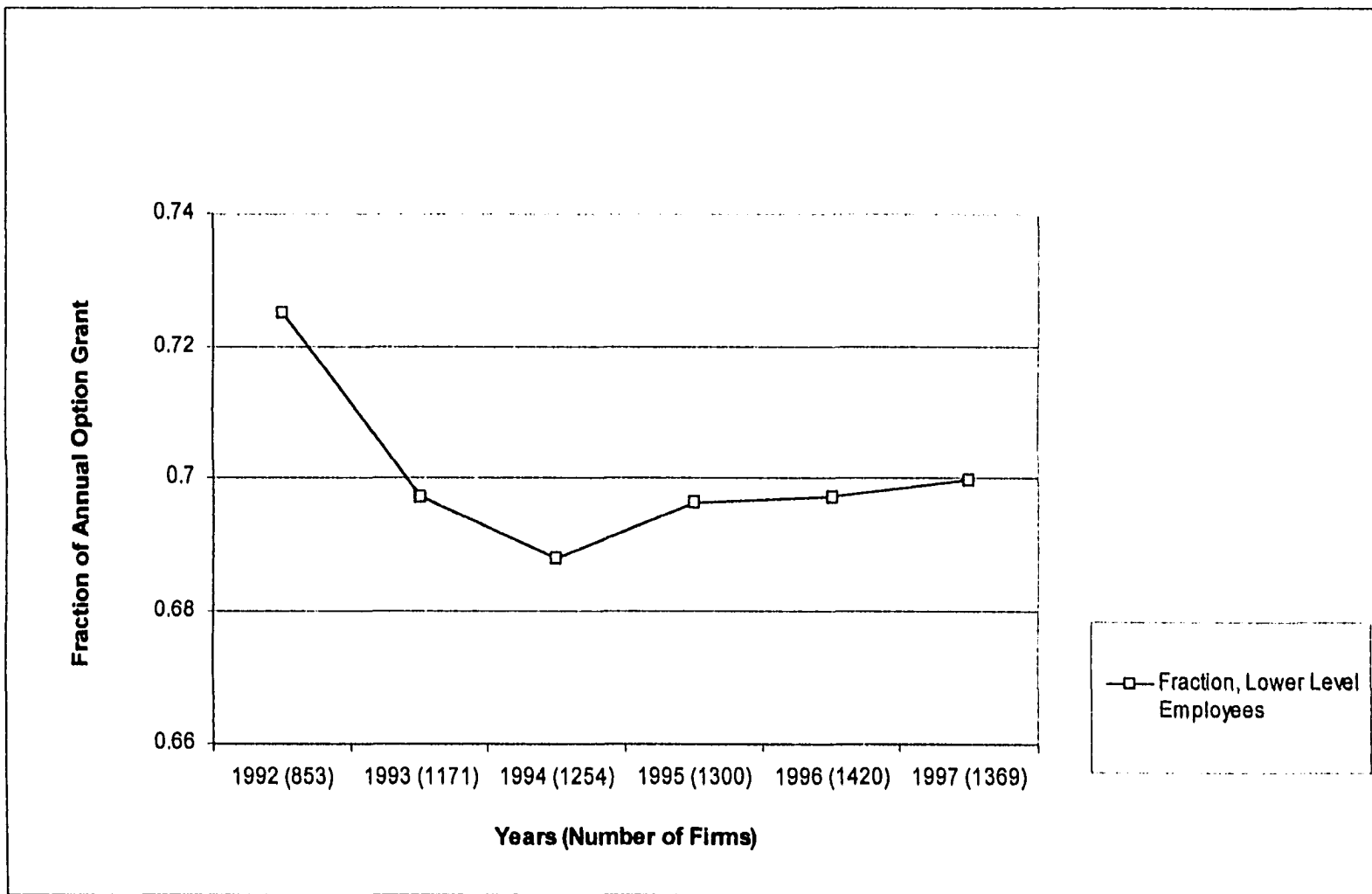


FIGURE 3

(Continued)

Panel B – Fraction of Annual Option Grant to Lower Level Employees, All firms in ExecuComp database (ver. 1999), Years 1992 to 1997, Selected Quintiles

YEAR	NUMBER OF FIRMS	5%	25%	MEDIAN	75%	95%
1992	853	.268	.628	.784	.881	.962
1993	1171	.267	.577	.750	.855	.950
1994	1254	.269	.570	.737	.850	.950
1995	1300	.297	.587	.743	.850	.983
1996	1420	.279	.581	.745	.857	.951
1997	1369	.288	.593	.747	.850	.951

FIGURE 4

Panel A: Net Mean Change in annual fraction of options granted to Lower Level Employees, Positive Mean Change for firms increasing fraction over prior year, and Negative Mean Change for firms decreasing fraction over prior year, firms granting options every year, 1993 through 1997, firms in ExecuComp database (ver. 1999).

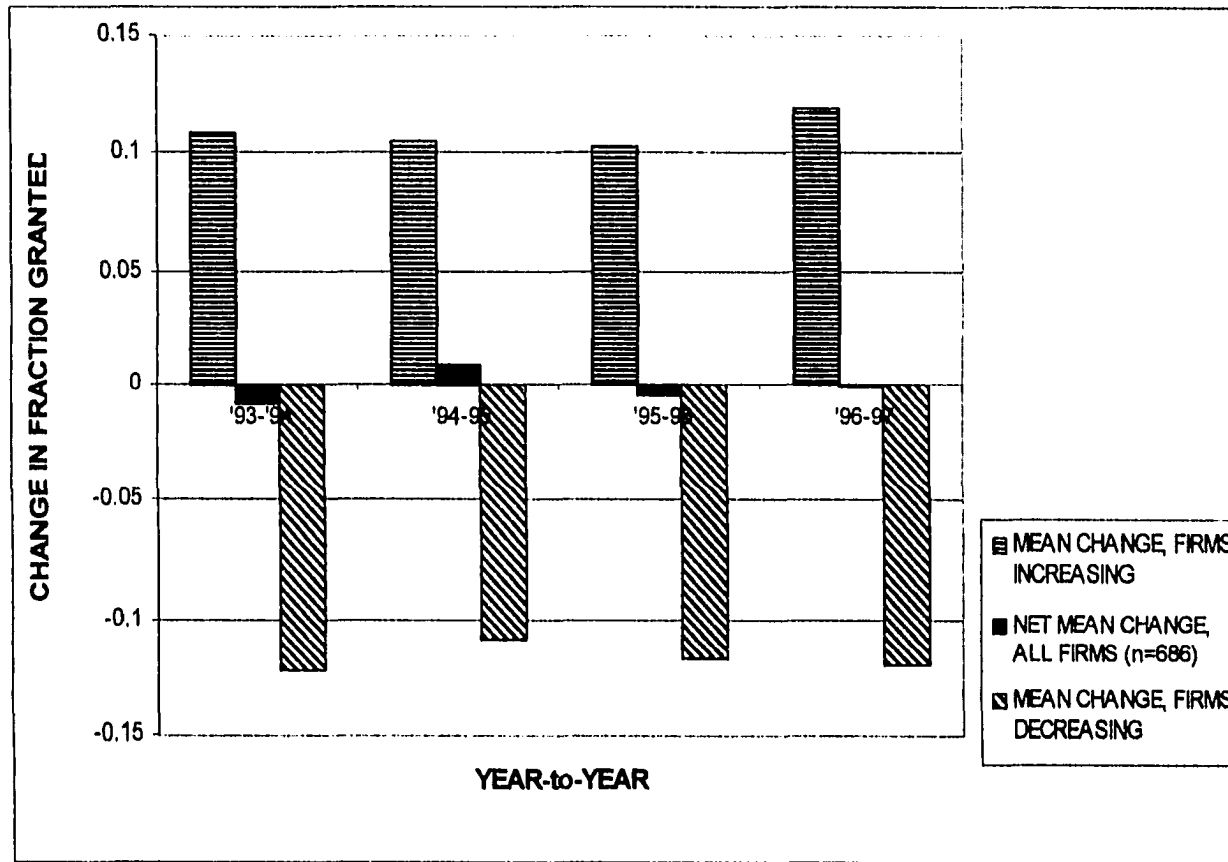


FIGURE 4
(continued)

Panel B: Mean positive and negative changes in fraction for firms increasing over prior year and firms decreasing over prior year

	1993-1994		1994-1995		1995-1996		1996-1997	
NUMBER OF FIRMS AND MEAN CHANGE	Number	Mean Change	Number	Mean Change	Number	Mean Change	Number	Mean Change
FIRMS INCREASING	339	.1087	374	.1053	350	.1031	347	.1189
FIRMS DECREASING	347	-.1223	312	-.1086	336	-.1168	345	-.1195
TOTAL FIRMS	686		686		686		686	

FIGURE 5

Mean net change by firm over the period 1993-1997, firms in ExecuComp database (ver. 1999) for all years 1993 through 1997, selected quintiles.

Number of Firms	5%	25%	Median	75%	95%
686	-.0936	-.0237	0.00	.0225	.0775

TABLE 1

Firms in ExecuComp (ver. 1999) database and sample with possible miscoding or reported fraction of annual total options grant to top employees.

For the period 1995-1997, number of firms (% of total) reported fraction to top employees:	All firms in ExecuComp	Outside Sample	Sample Firms
greater than 1.00 for one or more firm years	97 (5.55%)	71 (5.68%)	26 (5.20%)
equal to 0.00 for one or more firm years	12 (.69%)	11 (.88%)	1 (.20%)
equal to 1.00 for one or more firm years	31 (1.77%)	23 (1.84%)	8 (1.60%)
greater than 1.00 for one firm year and equal to 1.00 for another firm year	4 (.23%)	3 (.24%)	1 (.20%)
equal to 0.00 for one firm year and equal to 1.00 for another firm year	1 (.06%)	1 (.08%)	0 (0.00%)
all others	1064 (91.71%)	1140 (91.27%)	464 (92.80%)
Totals	1749 (100.00%)	1249 (100.00%)	500 (100.00%)

TABLE 2

**Financial capital of lower level employees
derived from the firm**

SOURCES OF FINANCIAL CAPITAL	UNDIVERSIFIABLE	DIVERSIFIABLE
Salary, bonus, etc.	X	
Employer funded retirement benefits, non-vested portion	X	
Employer funded retirement benefits, vested portion		X
Employee funded retirement benefits		X
Other post employment benefits	X	
Stock-based plans non-vested portion	X	
Stock-based plans, vested portion		X
Cash or Deferred Arrangements	X	

TABLE 3

Derivation of firm-years in final sample

DESCRIPTION	1995	1996	1997
Randomly selected sample	500	500	500
Less firm-years:			
without financial statement information	-97	-84	-126
without industry segment information	-36	-36	-25
without industry sales match	-3	-4	-24
without tax data	-	-	-
without hourly wage 2-digit SIC match	-1	-2	-
without union affiliation 2-digit SIC match	<u>0</u>	<u>-2</u>	<u>-12</u>
Subtotal	363	372	313
dropped due to pooling	-54	-39	-19
dropped due to no disclosure of firm total exercisable options	-20	-21	-12
dropped due to merger and/or spinoff adjustments	-11	-9	-7
dropped due to delisting, tracking stock, vesting at grant data, etc.	-24	-13	-13
dropped due to missing and/or unreconciliable data on exercisable options for proxy employees	-30	-32	-3
dropped due to missing end-of-year stock price	<u>-2</u>	<u>-2</u>	<u>0</u>
TOTAL BY YEAR	<u>222</u>	<u>256</u>	<u>259</u>
TOTAL FIRM-YEARS			<u>737</u>

TABLE 4

Distribution of sample firm-years by primary SIC codes

ONE-DIGIT SIC CODE	INDUSTRY DESCRIPTION	NUMBER OF FIRM-YEARS IN FINAL SAMPLE	FRACTION OF SAMPLE FIRM-YEARS
(1)	Agriculture, Metal extraction, Construction	41	0.056
(2)	Manufacturing - nondurables	169	0.229
(3)	Manufacturing - durables	235	0.319
(4)	Transportation and utilities	55	0.075
(5)	Wholesalers and retailers	112	0.152
(6)	Financial services	74	0.100
(7)	Business services	40	0.054
(8)	Consumer services	<u>11</u>	<u>0.015</u>
	TOTALS	<u>737</u>	<u>1.000</u>

(a) Firms must satisfy the following requirements for inclusion in the sample:

- (i) Financial statement data available;
- (ii) Segment sales data available;
- (iii) Total industry sales match;
- (iv) Two-digit SIC hourly wage data match;
- (v) Two-digit SIC union affiliation match;
- (vi) Proxy statement data available;
- (vii) Data available to calculate prior year end dollar value of exercisable options for firm and proxy employees.

TABLE 5

Descriptive statistics on the fraction of firm total options granted to lower level employees, the complexity of firm hierarchy, the level of the innovation opportunity set, the type of innovation opportunity set, firm size, task programmability, the deadweight financial capital losses from exercisable options and vested pension benefits, and the deadweight human capital costs.

VARIABLE	MEAN	MINIMUM	FIRST QUARTILE	MEDIAN	THIRD QUARTILE	MAXIMUM	N
FRACT	0.699	0.000	0.600	0.740	0.856	1.000	737
COMP	0.830	0.205	0.614	1.000	1.000	1.000	736
IOSL	0.127	-0.063	0.055	0.100	0.172	0.798	717
IOST	0.191	0.000	0.022	0.093	0.285	1.000	733
SIZE	7.190	3.088	5.871	6.953	8.327	12.479	737
PROG	13.889	0.600	6.500	12.000	17.600	45.800	737
DWFCE	34.997	0.000	0.530	4.654	20.889	1969.775	737
DWFCP	0.073	0.000	0.000	0.016	0.110	0.961	737
DWHC	13.734	5.590	12.030	13.440	15.850	23.160	736

TABLE 5 (continued)

FRACT	=	The fraction of the firm total options granted to the lower level employees. For each firm, the total of the fraction of firm options granted to the employees named in the firm's proxy statement was subtracted from 1.00 to derive the fraction of firm options granted to the lower level employees;
COMP	=	Firm complexity, proxied for by a Herfindahl-like index, measured as the sum of the squared shares of firm revenue by 3 digit SIC codes, where zero (one) means the firm is completely diversified (undiversified);
IOSL	=	The level of the innovation opportunity set, calculated as the sum of research & development expenditures, capital expenditures and acquisition expenditures, scaled by end of year book value of assets. If data was missing for one of the components, the level of the innovation opportunity set was calculated as the sum of the remaining component(s).
IOST	=	The type of innovation opportunity set, calculated as the firm sales divided by industry sales, where sales are matched under 4-digit SIC codes;
SIZE	=	Firm size, measured as log (beginning of year firm total assets, in millions of dollars);
PROG	=	Task programmability, proxied for by the extent of employee unionization, as estimated from the industry union affiliation, on a 2-digit SIC code (3-digit, if available) basis;
DWFCE	=	Deadweight financial capital losses from exercisable options, measured as the dollar value of the exercisable options of the lower level employees at prior year-end;
DWFCP	=	Deadweight financial capital losses from pensions, measured as the vested portion of the over and under funded accumulated pension benefit obligation reported by the firm, scaled by book value of assets, at prior year end;
DWHC	=	Deadweight human capital costs, proxied for the 2-digit SIC (3-digit, if available) hourly earnings of production workers.

TABLE 6

Mean values for fraction of firm total options granted to lower level employees, the complexity of firm hierarchy, the level of the innovation opportunity set, the type of innovation opportunity set, firm size, task programmability, the deadweight financial capital losses from exercisable gains and vested pension benefits, and the deadweight human capital costs, by industry, where one digit SIC codes used for industry classification.

INDUSTRY DESCRIPTION	# OF FIRM-YEARS	FRACT	COMP	IOSL	IOST	SIZE	PROG	DWFCE	DWFCP	DWHC
Agriculture, Metals, etc.	41	0.564	0.854	0.170	0.068	6.384	16.027	5.221	0.009	15.013
Manufacturing - nondurables	169	0.670	0.798	0.120	0.174	7.158	15.660	46.847	0.081	14.453
Manufacturing - durables	235	0.722	0.809	0.155	0.221	6.893	17.606	32.814	0.129	13.811
Transportation and utilities	55	0.676	0.750	0.102	0.108	7.204	29.431	13.62	0.071	16.741
Wholesalers and retailers	112	0.702	0.889	0.103	0.267	7.101	6.559	37.983	0.037	10.167
Financial services	74	0.683	0.848	0.032	0.152	9.213	2.722	45.784	0.007	12.843
Business services	40	0.759	0.931	0.176	0.207	6.770	4.128	37.107	0.012	16.656
Consumer services	<u>11</u>	0.718	0.999	0.178	0.155	5.794	6.900	6.769	0.006	12.946
TOTAL FIRM-YEARS	<u>737</u>									

TABLE 6 (continued)

FRACT	=	The fraction of the firm total options granted to the lower level employees. For each firm, the total of the fraction of firm options granted to the employees named in the firm's proxy statement was subtracted from 1.00 to derive the fraction of firm options granted to the lower level employees;
COMP	=	Firm complexity, proxied for by a Herfindahl-like index, measured as the sum of the squared shares of firm revenue by 3 digit SIC codes, where zero (one) means the firm is completely diversified (undiversified);
IOSL	=	The level of the innovation opportunity set, calculated as the sum of research & development expenditures, capital expenditures and acquisition expenditures, scaled by end of year book value of assets. If data was missing for one of the components, the level of the innovation opportunity set was calculated as the sum of the remaining component(s).
IOST	=	The type of innovation opportunity set, calculated as the firm sales divided by industry sales, where sales are matched under 4-digit SIC codes;
SIZE	=	Firm size, measured as log (beginning of year firm total assets, in millions of dollars);
PROG	=	Task programmability, proxied for by the extent of employee unionization, as estimated from the industry union affiliation, on a 2-digit SIC code (3-digit, if available) basis;
DWFCE	=	Deadweight financial capital losses from exercisable options, measured as the dollar value of the exercisable options of the lower level employees at prior year-end;
DWFCP	=	Deadweight financial capital losses from pensions, measured as the vested portion of the over and under funded accumulated pension benefit obligation reported by the firm, scaled by book value of assets, at prior year end;
DWHC	=	Deadweight human capital costs, proxied for the 2-digit SIC (3-digit, if available) hourly earnings of production workers.

TABLE 7

Mean value, in millions of dollars, of taxable income and net operating loss carryforwards, and number of firm-years classified by Graham's (1996) trichotomous tax variable, by industry, where one digit SIC codes used for industry classification.

INDUSTRY DESCRIPTION	# OF FIRM-YEARS	TAXABLE INCOME (in \$ millions)	OPERATING LOSS CARRYFORWARD (in \$ millions)	TAX VARIABLE SET TO:		
				0.000 (# firm-years)	0.175 (# firm-years)	0.350 (# firm-years)
Agriculture, Metal Extraction, etc.	41	45.032	36.804	6	14	21
Manufacturing - nondurables	169	498.987	101.902	5	51	113
Manufacturing - durables	235	262.631	88.133	15	58	162
Transportation and utilities	55	86.753	5.270	2	24	29
Wholesalers and retailers	112	209.304	32.832	6	16	91
Financial services	74	401.384	25.436	6	6	62
Business services	40	628.786	12.173	2	13	25
Consumer services	<u>11</u>	15.841	36.300	<u>3</u>	<u>2</u>	<u>6</u>
TOTAL FIRM-YEARS	<u>737</u>			<u>45</u>	<u>184</u>	<u>509</u>

TABLE 7 (continued)

where:

- (i) Taxable income is estimated following Graham (1996);
- (ii) The firm's net operating loss carryforward equals the net operating loss reported by Compustat, except when the net operating loss carryforward is reported as missing, in which case the net operating loss carryforward is set equal to zero;
- (iii) The trichotomous tax variable is: (a) set equal to 0 if estimated taxable income is negative and the firm reports a net operating loss carryforward, (b) set equal to one-half the top statutory rate (35% in sample period) if estimated taxable income is positive (negative) and a net operating loss carryforward is (not) reported, and (c) set equal to the top statutory rate when the taxable income is estimated as positive and no net operating loss carryforward is reported.

**TABLE 8
PANEL A**

Number of firm-years for which weighted average exercise price of exercisable options at year end available (Method 1), and when not available, alternatives (Methods 2 through 5) used, by industry, where one digit SIC code used for industry classification.

INDUSTRY DESCRIPTION	# OF FIRM- YEARS	METHOD 1 weighted average exercise price of exercisable options	METHOD 2 mid-point of range of exercise price of exercisable options	METHOD 3 weighted average exercise price of options outstanding	METHOD 4 mid-point of range of exercise price of outstanding options	METHOD 5 combination of exercise price and mid-point range
Agriculture, Metal Extraction, etc.	41	25	8	4	4	0
Manufacturing - nondurables	169	101	26	21	18	3
Manufacturing - durables	235	148	30	41	14	2
Transportation and utilities	55	31	7	13	4	0
Wholesalers and retailers	112	49	14	25	24	0
Financial services	74	37	8	17	12	0
Business services	40	25	1	5	9	0
Consumer services	<u>11</u>	<u>7</u>	<u>2</u>	<u>2</u>	<u>0</u>	<u>0</u>
TOTAL FIRM-YEARS	<u>737</u>	<u>423</u>	<u>96</u>	<u>128</u>	<u>85</u>	<u>5</u>

**TABLE 8
Panel B**

Mean value, in millions of dollars, of the year-end total dollar value of the exercisable options of the lower level employees, when including options "underwater" and when setting the underwater options equal to zero, and, of the year-end total of the vested portions of the over- and under-funded pension benefit obligation reported by the firm, by industry, where one digit SIC codes used for industry classification.

INDUSTRY DESCRIPTION	# OF FIRM-YEARS	DOLLAR VALUE OF EXERCISABLE OPTIONS FOR LOWER LEVEL EMPLOYEES WHEN:		VESTED ACCUMULATED PENSION BENEFIT OVERFUNDED	VESTED ACCUMULATED PENSION BENEFIT UNDERFUNDED
		Underwater options included	Underwater options set equal to zero		
Agriculture, Metal Extraction, etc.	41	5.063	5.221	35.437	32.949
Manufacturing - nondurables	169	44.072	46.847	473.875	160.817
Manufacturing - durables	235	32.224	32.814	1104.730	536.795
Transportation and utilities	55	13.127	13.620	1149.410	5.059
Wholesalers and retailers	112	36.594	37.983	349.604	111.948
Financial services	74	45.099	45.784	392.879	32.686
Business services	40	34.494	37.107	51.767	159.450
Consumer services	<u>11</u>	4.024	6.769	15.647	0.000
TOTAL FIRM-YEARS	<u>737</u>				

TABLE 8
Panel B (continued)

Where:

- (i) Underwater options are options for which the end of year stock price is lower than the weighted average exercise price of the option.

TABLE 9

Correlations among the variables
 Pearson Correlation Coefficients below the diagonal, Spearman Correlation Coefficients above the diagonal (p-values in parentheses)

VARIABLE	FRACT	COMP	IOSL	IOST	SIZE	TAXES	PROG	DWFCE	DWFCP	DWHC
FRACT	1.000	0.023 (.531)	0.072 (.055)	0.114 (.002)	0.259 (.0001)	0.046 (.210)	-0.050 (.172)	0.314 (.0001)	0.074 (.044)	-0.048 (.195)
COMP	-0.003 (.939)	1.000	0.149 (.0001)	-0.167 (.0001)	-0.210 (.0001)	0.037 (.323)	-0.228 (.0001)	0.021 (.569)	-0.361 (.0001)	-0.167 (.0001)
IOSL	0.029 (.444)	0.121 (.001)	1.000	-0.208 (.0001)	-0.318 (.0001)	-0.089 (.017)	0.100 (.007)	0.073 (.051)	-0.095 (.011)	0.013 (.727)
IOST	0.059 (.107)	-0.194 (.0001)	-0.137 (.0002)	1.000	0.429 (.0001)	0.051 (.167)	-0.033 (.371)	0.239 (.0001)	0.313 (.0001)	-0.206 (.0001)
SIZE	0.241 (.0001)	-0.196 (.0001)	-0.343 (.0001)	0.292 (.0001)	1.000	0.072 (.050)	-0.039 (.283)	0.468 (.0001)	0.424 (.0001)	0.089 (.015)
TAXES	0.065 (.077)	-0.002 (.949)	-0.096 (.0099)	0.038 (.299)	0.094 (.011)	1.000	-0.147 (.0001)	0.129 (.0004)	0.006 (.878)	-0.138 (.0002)
PROG	-0.009 (.811)	-0.222 (.0001)	-0.043 (.249)	-0.064 (.080)	0.051 (.168)	-0.099 (.007)	1.000	-0.151 (.0001)	0.342 (.0001)	0.405 (.0001)
DWFCE	0.187 (.0001)	0.043 (.242)	0.051 (.177)	0.048 (.189)	0.269 (.0001)	0.092 (.012)	-0.058 (.116)	1.000	0.175 (.0001)	-0.028 (.444)
DWFCP	0.062 (.095)	-0.265 (.0001)	-0.067 (.073)	0.180 (.0001)	0.211 (.0001)	-0.057 (.123)	0.379 (.0001)	0.054 (.145)	1.000	0.183 (.0001)
DWHC	-0.026 (.474)	-0.163 (.0001)	0.028 (.453)	-0.119 (.001)	0.073 (.048)	-0.128 (.0005)	0.445 (.0001)	-0.014 (.700)	0.180 (.0001)	1.000

TABLE 9 (continued)

FRACT	=	The fraction of the firm total options granted to the lower level employees. For each firm, the total of the fraction of firm options granted to the employees named in the firm's proxy statement was subtracted from 1.00 to derive the fraction of firm options granted to the lower level employees;
COMP	=	Firm complexity, proxied for by a Herfindahl-like index, measured as the sum of the squared shares of firm revenue by 3 digit SIC codes, where zero (one) means the firm is completely diversified (undiversified);
IOSL	=	The level of the innovation opportunity set, calculated as the sum of research & development expenditures, capital expenditures and acquisition expenditures, scaled by end of year book value of assets. If data was missing for one of the components, the level of the innovation opportunity set was calculated as the sum of the remaining component(s).
IOST	=	The type of innovation opportunity set, calculated as the firm sales divided by industry sales, where sales are matched under 4-digit SIC codes;
SIZE	=	Firm size, measured as log (beginning of year firm total assets, in millions of dollars);
PROG	=	Task programmability, proxied for by the extent of employee unionization, as estimated from the industry union affiliation, on a 2-digit SIC code (3-digit, if available) basis;
DWFCE	=	Deadweight financial capital losses from exercisable options, measured as the dollar value of the exercisable options of the lower level employees at prior year-end;
DWFCP	=	Deadweight financial capital losses from pensions, measured as the vested portion of the over and under funded accumulated pension benefit obligation reported by the firm, scaled by book value of assets, at prior year end;
DWHC	=	Deadweight human capital costs, proxied for the 2-digit SIC (3-digit, if available) hourly earnings of production workers.

TABLE 10

Ordinary Least Squares (OLS) regression results showing the relation between the fraction of firm total stock options granted to lower level employees and the hypothesized determinants.

Model (1)

$$\text{FRACT} = \beta_0 + \beta_1\text{COMP} + \beta_2\text{IOSL} + \beta_3\text{IOST} + \beta_4\text{SIZE} + \beta_5\text{TRITAX} + \beta_6\text{PROG} + \beta_7\text{DWFCE} + \beta_8\text{DWFCP} + \beta_9\text{DWHC} + \epsilon$$

(t-statistics in parentheses)

EXPLANATORY VARIABLES		EXPECTED SIGN	RESULT	
Intercept			0.438	(6.92)
<i>Complexity of firm hierarchy hypothesis</i> Herfindahl-like index of diversification	COMP	+	0.033	(1.03)
<i>Level of innovation opportunity set hypothesis</i> Innovation spending	IOSL	+	0.209	(2.84) ***
<i>Type of innovation opportunity set hypothesis</i> Product or process innovator	IOST	+	-0.021	(-.62)
<i>Firm size hypothesis</i> Firm assets	SIZE	+ / -	0.032	(5.96) ***
<i>Income Tax Costs Hypothesis</i> Firm marginal tax rates	TAXES	-	0.086	(1.23)
<i>Task Programmability Hypothesis</i> Unionization of firm employees	PROG	-	-0.00003	(-.04)
<i>Deadweight Losses Hypothesis</i> Financial capital - exercisable options, end of prior year	DWFCE	+	0.0002	(2.58) ***
Financial capital - vested pension benefits, end of prior year	DWFCP	+	0.044	(.64)
Human Capital	DWHC	+ / -	-0.004	(-1.41)
Adjusted R-square			7.76%	
N			712	

TABLE 10
(continued)

*** (** , *)		Significant at the 1% (5%, 10%) level; one-tailed if the sign of the coefficient is predicted; two-tailed otherwise.
FRACT	=	The fraction of the firm total options granted to the lower level employees. For each firm, the total of the fraction of firm options granted to the employees named in the firm's proxy statement was subtracted from 1.00 to derive the fraction of firm options granted to the lower level employees;
COMP	=	Firm complexity, proxied for by a Herfindahl-like index, measured as the sum of the squared shares of firm revenue by 3 digit SIC codes, where zero (one) means the firm is completely diversified (undiversified);
IOSL	=	The level of the innovation opportunity set, calculated as the sum of research & development expenditures, capital expenditures and acquisition expenditures, scaled by end of year book value of assets. If data was missing for one of the components, the level of the innovation opportunity set was calculated as the sum of the remaining component(s).
IOST	=	The type of innovation opportunity set, calculated as the firm sales divided by industry sales, where sales are matched under 4-digit SIC codes;
SIZE	=	Firm size, measured as log (end of prior year firm assets, in millions of dollars);
TAXES	=	The firm's expected marginal tax rate, proxied for by Graham's trichotomous tax variable;
PROG	=	Task programmability, proxied for by the extent of employee unionization, as estimated from the industry union affiliation, on a 2-digit SIC code (3-digit, if available) basis;
DWFCE	=	Deadweight financial capital losses from exercisable options, measured as the dollar value of the exercisable options of the lower level employees at prior year-end;
DWFCP	=	Deadweight financial capital losses from pensions, measured as the vested portion of the over- and under-funded accumulated pension benefit obligation reported by the firm, scaled by book value of assets, at prior year end;
DWHC	=	Deadweight human capital costs, proxied for the 2-digit SIC (3-digit, if available) hourly earnings of production workers.

TABLE 11
Ordinary Least Squares (OLS) regression results showing the relation between the fraction of firm total stock options granted to lower level employees and the hypothesized determinants, by year. (t statistics in parentheses)

EXPLANATORY VARIABLES		EXPECTED SIGN	1995		1996		1997				
Intercept			0.534	(4.67)	0.379	(3.03)	0.476	(4.84)			
<i>Complexity hypothesis</i>	COMP										
Firm diversification		+	-0.036	(-.63)	0.061	(1.02)	0.042	(.82)			
<i>Innovation level hypothesis</i>	IOSL										
Innovation spending		+	0.295	(1.95)	**	0.293	(2.17)	**	0.086	(.82)	
<i>Innovation type hypothesis</i>	IOST										
Product or process Innovator		+	-0.086	(-1.54)		0.071	(1.12)		-0.039	(-.70)	
<i>Firm size hypothesis</i>	SIZE										
Firm assets		+ / -	0.027	(2.79)	***	0.024	(2.25)	**	0.041	(4.75)	***
<i>Income taxes hypothesis</i>	TAXES										
Firm marginal tax rates		-	0.194	(1.56)		0.251	(2.01)		-0.233	(-2.01)	**
<i>Task programmability hypothesis</i>	PROG										
Unionization of employees		-	0.0007	(.48)		-0.0003	(-.18)		0.0004	(.32)	
<i>Deadweight losses hypothesis</i>											
Financial capital - options	DWFCE	+	0.0006	(1.84)	**	0.0003	(1.89)	**	0.0001	(1.83)	**
Financial capital - pensions	DWFCP	+	0.135	(1.10)		0.002	(.02)		-0.021	(-.20)	
Human capital	DWHC	+ / -	-0.008	(-1.69)	*	-0.001	(-.31)		-0.003	(.93)	
Adjusted R-square			8.60%			6.73%			10.66%		
N			215			245			252		

TABLE 11
Continued

*** (**, *)		Significant at the 1% (5%, 10%) level; one-tailed if the sign of the coefficient is predicted; two-tailed otherwise.
FRACT	=	The fraction of the firm total options granted to the lower level employees. For each firm, the total of the fraction of firm options granted to the employees named in the firm's proxy statement was subtracted from 1.00 to derive the fraction of firm options granted to the lower level employees;
COMP	=	Firm complexity, proxied for by a Herfindahl-like index, measured as the sum of the squared shares of firm revenue by 3 digit SIC codes, where zero (one) means the firm is completely diversified (undiversified);
IOSL	=	The level of the innovation opportunity set, calculated as the sum of research & development expenditures, capital expenditures and acquisition expenditures, scaled by end of year book value of assets. If data was missing for one of the components, the level of the innovation opportunity set was calculated as the sum of the remaining component(s).
IOST	=	The type of innovation opportunity set, calculated as the firm sales divided by industry sales, where sales are matched under 4-digit SIC codes;
SIZE	=	Firm size, measured as log (end of prior year firm assets, in millions of dollars);
TAXES	=	The firm's expected marginal tax rate, proxied for by Graham's trichotomous tax variable;
PROG	=	Task programmability, proxied for by the extent of employee unionization, as estimated from the industry union affiliation, on a 2-digit SIC code (3-digit, if available) basis;
DWFCE	=	Deadweight financial capital losses from exercisable options, measured as the dollar value of the exercisable options of the lower level employees at prior year-end;
DWFPC	=	Deadweight financial capital losses from pensions, measured as the vested portion of the over- and under-funded accumulated pension benefit obligation reported by the firm, scaled by book value of assets, at prior year end;
DWHC	=	Deadweight human capital costs, proxied for the 2-digit SIC (3-digit, if available) hourly earnings of production workers.

TABLE 12
Ordinary Least Squares (OLS) regression results showing the relation
between the fraction of firm total stock options granted to lower level
employees and the hypothesized determinants, for selected industries (t
statistics in parenthesis)

PANEL A – Durables Manufacturing SIC 2

EXPLANATORY VARIABLES		EXPECTED SIGN	RESULT	
Intercept			0.295 (2.16)	
<i>Complexity hypothesis</i>	COMP		0.011	
Firm diversification		+	(.17)	
<i>Innovation level hypothesis</i>	IOSL		0.291	*
Innovation spending		+	(1.59)	
<i>Innovation type hypothesis</i>	IOST		0.049	
Product or process innovator		+	(.55)	
<i>Firm size hypothesis</i>	SIZE		0.045	***
Firm assets		+ / -	(3.01)	
<i>Income taxes hypothesis</i>	TAXES		0.187	
Firm marginal tax rates		-	(1.11)	
<i>Task programmability hypothesis</i>	PROG		0.0005	
Unionization of employees		-	(.23)	
<i>Deadweight losses hypothesis</i>				
Financial capital - options	DWFCE	+	0.0001	*
			(1.45)	
Financial capital - pensions	DWFCP	+	0.024	
			(.12)	
Human capital	DWHC	+ / -	-0.003	
			(-.53)	
Adjusted R-square			14.91%	
N			168	

TABLE 12
Continued

PANEL B –Nondurables Manufacturing SIC 3

EXPLANATORY VARIABLES		EXPECTED SIGN	RESULT	
Intercept			0.575 (4.91)	
<i>Complexity hypothesis</i>	COMP		0.021	
Firm diversification		+	(.43)	
<i>Innovation level hypothesis</i>	IOSL		0.296	***
Innovation spending		+	(2.64)	
<i>Innovation type hypothesis</i>	IOST		-0.122	
Product or process innovator		+	(-2.26)	
<i>Firm size hypothesis</i>	SIZE		0.049	***
Firm assets		+ / -	(4.59)	
<i>Income taxes hypothesis</i>	TAXES		0.148	
Firm marginal tax rates		-	(1.33)	
<i>Task programmability hypothesis</i>	PROG		0.0005	
Unionization of employees		-	(.34)	
<i>Deadweight losses hypothesis</i>				
Financial capital - options	DWFCE	+	0.0001 (.78)	
Financial capital - pensions	DWFCP	+	-0.015 (-.19)	
Human capital	DWHC	+ / -	-0.021 (-2.90)	***
Adjusted R-square			13.48%	
N			234	

TABLE 12
Continued

PANEL C – Transportation and Utilities SIC 4

EXPLANATORY VARIABLES		EXPECTED SIGN	RESULT
Intercept			0.74 (1.60)
<i>Complexity hypothesis</i> Firm diversification	COMP	+	0.108 (.81)
<i>Innovation level hypothesis</i> Innovation spending	IOSL	+	-0.621 (-1.42)
<i>Innovation type hypothesis</i> Product or process innovator	IOST	+	-0.209 (-.93)
<i>Firm size hypothesis</i> Firm assets	SIZE	+ / -	-0.027 (1.27)
<i>Income taxes hypothesis</i> Firm marginal tax rates	TAXES	-	0.026 (.11)
<i>Task programmability hypothesis</i> Unionization of employees	PROG	-	-0.004 (-.29)
<i>Deadweight losses hypothesis</i> Financial capital - options	DWFCE	+	0.0003 (.54)
Financial capital - pensions	DWFCP	+	0.292 (.74)
Human capital	DWHC	+ / -	-0.01 (-.68)
Adjusted R-square			9.45%
N			55

TABLE 12
Continued

Panel D – Wholesale and Retail SIC 5

EXPLANATORY VARIABLES		EXPECTED SIGN	RESULT	
Intercept			0.708 (2.13)	
<i>Complexity hypothesis</i> Firm diversification	COMP	+	-0.067 (-.54)	
<i>Innovation level hypothesis</i> Innovation spending	IOSL	+	0.158 (.62)	
<i>Innovation type hypothesis</i> Product or process innovator	IOST	+	0.009 (.09)	
<i>Firm size hypothesis</i> Firm assets	SIZE	+ / -	0.034 (2.30)	**
<i>Income taxes hypothesis</i> Firm marginal tax rates	TAXES	-	0.006 (.03)	
<i>Task programmability hypothesis</i> Unionization of employees	PROG	-	-0.003 (-.09)	
<i>Deadweight losses hypothesis</i> Financial capital - options	DWFCE	+	0.00002 (.15)	
Financial capital - pensions	DWFCP	+	-0.296 (-1.05)	
Human capital	DWHC	+ / -	-0.018 (-1.92)	*
Adjusted R-square			4.12%	
N			109	

TABLE 12
Continued

Panel E – Financial Services SIC 6

EXPLANATORY VARIABLES		EXPECTED SIGN	RESULT	
Intercept			0.529 (1.99)	
<i>Complexity hypothesis</i> Firm diversification	COMP	+	0.078 (.64)	
<i>Innovation level hypothesis</i> Innovation spending	IOSL	+	-0.265 (-.82)	
<i>Innovation type hypothesis</i> Product or process innovator	IOST	+	0.02 (.11)	
<i>Firm size hypothesis</i> Firm assets	SIZE	+ / -	-0.016 (.92)	
<i>Income taxes hypothesis</i> Firm marginal tax rates	TAXES	-	-0.126 (-.36)	
<i>Task programmability hypothesis</i> Unionization of employees	PROG	-	-0.013 (-.19)	
<i>Deadweight losses hypothesis</i> Financial capital - options	DWFCE	+	0.0005 (1.84)	**
Financial capital - pensions	DWFCP	+	1.21 (.62)	
Human capital	DWHC	+ / -	-0.001 (-.05)	
Adjusted R-square			9.69%	
N			55	

TABLE 12
Continued

*** (**, *)		Significant at the 1% (5%, 10%) level; one-tailed if the sign of the coefficient is predicted; two-tailed otherwise.
FRACT	=	The fraction of the firm total options granted to the lower level employees. For each firm, the total of the fraction of firm options granted to the employees named in the firm's proxy statement was subtracted from 1.00 to derive the fraction of firm options granted to the lower level employees;
COMP	=	Firm complexity, proxied for by a Herfindahl-like index, measured as the sum of the squared shares of firm revenue by 3 digit SIC codes, where zero (one) means the firm is completely diversified (undiversified);
IOSL	=	The level of the innovation opportunity set, calculated as the sum of research & development expenditures, capital expenditures and acquisition expenditures, scaled by end of year book value of assets. If data was missing for one of the components, the level of the innovation opportunity set was calculated as the sum of the remaining component(s).
IOST	=	The type of innovation opportunity set, calculated as the firm sales divided by industry sales, where sales are matched under 4-digit SIC codes;
SIZE	=	Firm size, measured as log (end of prior year firm assets, in millions of dollars);
TAXES	=	The firm's expected marginal tax rate, proxied for by Graham's trichotomous tax variable;
PROG	=	Task programmability, proxied for by the extent of employee unionization, as estimated from the industry union affiliation, on a 2-digit SIC code (3-digit, if available) basis;
DWFCE	=	Deadweight financial capital losses from exercisable options, measured as the dollar value of the exercisable options of the lower level employees at prior year-end;
DWFCP	=	Deadweight financial capital losses from pensions, measured as the vested portion of the over- and under-funded accumulated pension benefit obligation reported by the firm, scaled by book value of assets, at prior year end;
DWHC	=	Deadweight human capital costs, proxied for the 2-digit SIC (3-digit, if available) hourly earnings of production workers.

Appendix A

A. 1 A review of the agency costs literature

A.1.1 Introduction

Jensen and Meckling (1976) analyze the agency costs generated by the contractual arrangements between the owner of the firm and the top management of the firm. Agency costs arise because the desires of the agent conflict with those of the principal, it is difficult or costly for the principal to verify what the agent is doing, and the agent and principal have different attitudes towards risk. Under the agency contract, the agent performs a service for the principal, and this necessarily involves delegation of some decision-making authority to the agent. Utility maximization theory suggests that the agent will not always act in the principal's best interests. However, by establishing appropriate incentives for the agent and by incurring costs to monitor the agent, the principal can limit (but not eliminate) divergences from his interests.

Jensen and Meckling define agency costs as the sum of the monitoring expenditures by the principal, the bonding expenditures by the agent, and the residual loss. In their analysis, the term monitoring means more than just measuring or observing the behavior of the agent. Monitoring also includes efforts on the part of the principal to control the behavior of the agent through devices such as budget restrictions, compensation policies, operating rules, auditing, formal control systems, and the establishment of incentive compensation systems which serve to more closely identify the manager's

interests with those of the principal. Bonding costs, resources expended to guarantee that the agent will limit his activities that reduce firm value, can take the form of contractual guarantees to have the financial statements audited, explicit bonding against manager malfeasance, and contractual limitations on the agent's decision making power. The residual loss is the reduction in the principal's welfare due to the divergence of the interests of the agent and the principal interest, despite the expenditure of monitoring and bonding resources. The magnitude of agency costs is expected to vary across firms, and will be a function of a host of factors. These include: (1) the tastes of managers, (2) the manager's ability to satisfy his own preferences rather than maximize firm value during the decision making process, (3) the costs of monitoring and bonding, which in turn depend on the inherent complexity and geographical dispersion of operations, (4) the costs of measuring and evaluating the manager's performance, (5) the costs of devising and utilizing a compensation structure that aligns the manager's interests with those of the principal, (6) the costs of devising and enforcing specific behavioral rules and policies, (7) the market for managers, including the cost to replace the manager, and (8) the market for the firm itself.

A large portion of the financial accounting, economics and finance literature examining the association between stock option awards and the agency and contracting variables hypothesized to influence firms' use of options has focused on a particular agent (CEO) or a small group of agents (top executives or management team). However, employees other than the top manager or management team are agents of the shareholders as well, and agency theory

can be applied to gain insight into the performance evaluation and compensation practices of firms with respect to lower level employees. Indeed, Eisenhardt (1989) suggests that it is appropriate to use agency theory to examine internal compensation structures, and Indjejikian (1999) calls for the extension of agency research into lower levels of organizations.

A.1.2 Organizational Form

A.1.2.a Decision Management and Control

Fama and Jensen (1983a) define an “open corporation” as one where the stockholders are not required to have any role other than that of residual claimants, and where those residual claims are alienable without restriction and allow for unrestricted risk sharing. The open corporation is typified by the common stocks of large corporations. The central hypothesis of Fama and Jensen (1983a) is that the separation of decision and risk bearing functions observed in large open corporations survives for two reasons: there are benefits to the specialization of those functions, and, the agency problems caused by the separation of the decision and risk bearing functions are addressed by the separation of decision management from decision control. Fama and Jensen break down the organization’s decision making process into four steps: (1) initiation – generation of proposals for resource utilization and structuring of contracts; (2) ratification – choice of the decision initiatives to be implemented; (3) implementation – execution of ratified decisions; and (4) monitoring – measurement of the performance of decision agents and implementation of

rewards. Decision management consists of initiation and implementation, and decision control consists of ratification and monitoring. In a complex organization, valuable (costly to transfer across agents) specific knowledge is diffused among many internal agents. This diffusion of decision management is efficient (reduces agency costs) because initiation and implementation of decisions is in the hands of the agents with the valuable specific information. To then reduce the agency problems of diffuse decision management, decision control is separated from decision management and is likewise diffused throughout the organization as well, to track the decision management. Fama and Jensen find support for their hypothesis in the survival of three major mechanisms for diffusing and separating the management and control of decisions: decision hierarchies, mutual monitoring systems, and boards of directors. The hierarchical partitioning observed in large open corporations makes it difficult for decision agents to take actions that benefit themselves over ones that maximize firm value, while the less formal mutual monitoring among agents provides low-cost information as the agents seek to maximize the value of their human capital. The decision rights exercised by boards of directors over the decisions of top-managers ensure the separation of decision management and decision control even at the top level of the organization.

Fama and Jensen (1983b) address the special features of the residual claims of various forms of organizations (open corporations, proprietorships, partnerships and closed corporations, including professional partnerships, financial mutuals and nonprofits). They suggest that the organizational form that

survives in an particular activity is the one where the costs and benefits of the residual claim structure plus the costs to control the agency problems generated by the particular residual claim structure allow the organization to provide the product at a cost lower than alternative organizational forms. Thus, the large open corporate form is likely to survive “ . . . when there are large economies of scale in production that (i) can be realized only with a complex decision hierarchy that makes use of specialized decision skills throughout the organization, (ii) generate large aggregate risks to be borne by residual claimants, and (iii) demand large amounts of wealth from residual claimants to purchase risky assets and to bond the payoffs promised to a wide range of agents in the organization.” The expected high agency costs of the large open corporation obviously offset the benefits of the diffuse ownership, but these costs can be controlled, to some extent, by decision structures that separate the management and control of decisions.

A.1.2.b Information Processing

In his discussion of the search for a rational economic order, Hayek points out that the total societal knowledge from which any economic calculus proceeds is not “given” to a single mind, and never can be (Hayek, 1945, p. 519). In other words, Hayek sees the problem not as one of allocation of resources but rather the efficient utilization of knowledge “not given to anyone in its totality.” He characterizes all economic activity as planning; that is, the complex inter-related decisions about the allocation of available resources. “The various ways in which

the knowledge on which people base their plans is communicated to them is the crucial problem for any theory explaining the economic process. And the problem of what is the best way of utilizing knowledge initially dispersed among all the people is at least one of the main problems of economic policy – or of designing an efficient economic system.” (Hayek, 1945, p. 520).

The concept of the dispersion of knowledge among the set of individuals in a particular economic system is the backbone of the information processing theory of the firm. Mendelson and Pillai (1999) attribute the formation of the information-processing model of the firm to the “Carnegie School.” This theory models the firm as an organization faced with streams of data from the environment that must be assimilated and transformed into tangible decisions. Thus, it is a theory of organizational design. The salient features of the firm under this theory are: (1) the firm consists of separate agents, (2) the firm is defined by the pattern of information exchange among the agents (i.e., the organizational structure is tied to and dependent upon information flows), and (3) the information processing capabilities of the agents are important (DeCanio and Watkins, 1998). Because information processing is costly and the rationality of the decision-makers is bounded, organizations use filtering, complexity-reducing procedures and strategies that reduce information-processing requirements and overload (Mendelson and Pillai, 1999). Contingency theorists suggest that, as the firm responds to both internal and external uncertainties, the information processing requirements and capabilities of the agents significantly impact the evolution of the particular organizational form (Tushman and Nadler, 1978;

Lawrence and Lorsch, 1967; Galbraith, 1973). Mendelson and Pillai (1999) define the "information age" organization as one that is (1) de-centralized, with decision rights co-located with the information necessary to make a decision, (2) characterized by information practices that promote awareness of externally and internally generated information, and (3) part of a network structure, in which the firm concentrates on its core business, outsourcing non-core activities to other members of the network. And because decentralization permits quicker and more efficient decision making in intense information environments, utilization of incentives that align the interests of the agents with the firm's overall objective is critical.

A.1.2.c Transaction Cost Economics

Transaction costs economics is also a theory of organizational design, but one which has as its focus efficient institutional arrangements for organizing and carrying out economic activities (Williamson, 1976, 1985, 1991). Under this theory, firms compare the costs of performing tasks within the organization (hierarchical mode) to those of conducting those same transactions outside the organization (market mode). Some organizations do both (hybrid mode). Williamson suggests that a different form of contract law supports each form of governance. Classical contract law supports the market mode, while the hybrid mode is supported by neoclassical contract law and the excuse doctrine. The implicit contract law of the hierarchical mode is known as forbearance law. This means that internal disputes within the firm do not have a forum in the courts,

and the parties to the dispute must resolve their differences internally. Hierarchies serve this function of internal dispute resolution. Williamson distinguishes the different modes on two more attributes: (1) instruments – incentives and administrative controls, and (2) performance – adaptation in two forms. Williamson characterizes internal incentives in the hierarchical mode as “flat or low-powered,” which is to say that, changes in effort expended have little or no immediate effect on compensation. Williamson also suggests that (1) hierarchy is buttressed by the differential efficacy of administrative controls within firms, as compared with between firms, and (2) incentive intensity within firms is sometimes deliberately suppressed, as when incentive intensity gets in the way of bilateral adaptability. In that case, weaker incentive intensity supported by added administrative controls (monitoring and career rewards and penalties) may be optimal (Williamson, 1991, p. 280).

A.1.3 Task Programmability

One factor that directly impacts the costs of monitoring the agent's actions is task programmability (Eisenhardt, 1989). Task programmability refers to the degree to which the requisite behavior can be precisely defined. When an agent's task is highly programmable, it is relatively easy (low cost) to monitor the agent. Conversely, when an agent's task cannot be programmed, it is more difficult (high cost) to monitor the agent's behavior. When a task is programmable, principals can specify *ex ante* the behaviors desired from the agent and reward the agent when the desired behavior is observed. Task

programmability will be positively related to the use of behavior-based performance measures and negatively related to the use of outcome-based performance measures (Eisenhardt, 1989).

Gomez-Mejia and Balkin (1992) use the agency theory perspective to test 12 hypotheses on the determinants of faculty pay. They point out that much of prior research has focused on bilateral relations between top executives (as agents) and firm owners (as principals), and that behavioral processes within firms have been ignored. Their study of the compensation of 353 management professors examines the role of outcome measures (publication in top-tier journals), teaching performance and institutional characteristics in the level of compensation received by the professors. The principals in the university setting are the university's board of regents (policy making) and officials (policy execution) and these principals face a classical agency problem. Direct monitoring of faculty is extremely costly because areas of expertise and research interests are idiosyncratic to individuals, few constraints are placed on faculty members' time (other than time spent teaching) and tenure and multiyear appointments provide substantial freedom for faculty. In short, a faculty position is highly nonprogrammable. The empirical results support a relation between compensation and outcome measures of performance (top-tier publications), and more broadly, suggest that agency theory can be meaningfully used to analyze internal control relationships between allocators (principals) and those receiving allocations (agents).

Stroh, Brett, Baumann and Reilly (1996) consider the relationship between the use of variable pay incentives for middle managers and task programmability, risk and the length of the agent-principal relationship. The mail survey requested compensation package details from middle managers, and resulted in a sample of 670 middle manager-year responses from 17 different Fortune 500 companies for 1987 and 1988. Their results suggest that organizations with high levels of task programmability use variable pay less. Further, organizations with high levels of uncertainty (e.g. downsizing, merger, sale, spin-off, leveraged buyout, acquisition, attempted take-over, etc.), tend to increase the variable pay components of managers' compensation packages, without increasing the overall level of the compensation. And, the expectation of a long-term agency relationship is negatively associated with the use of variable pay incentives, consistent with the idea that more information is available about the manager as tenure increases.

A.1.4 Information Asymmetry Costs

A.1.4.a Innovation Opportunity Set

Myers (1977) characterizes the firm as the combination of assets in place and future growth opportunities, and suggests that managerial decisions have substantial value implications for high-growth firms. Smith and Watts (1992) hypothesize that high growth firms suffer from information asymmetry because shareholders cannot observe the entire set of opportunities from which the manager may choose. In the presence of this asymmetry, such firms will rely

heavily on incentive compensation structures to provide motivation to the manager to make the optimal choices. With their *industry* study, Smith and Watts provide evidence consistent with this hypothesis. A series of *firm* studies generally support this proposition (Gaver and Gaver, 1993; Matsunaga, 1995; Kole, 1997).

Holmstrom (1989) discusses the most efficient forms for organizing innovative activity in the private sector, and offers two reasons why large firms might (rationally) innovate less. The external reason has to do with the firm's reputation in the capital market and caution in taking risks. The internal reason has to do with the integration of production and marketing objectives within one firm, and the resulting weakness in the performance measure. This weakness in the performance measure leads the firm to utilize other mechanisms (rigid rules and less discretion) to ensure the required behavior, which in turn, restrict experimentation and screen out inventive personalities.

It is not only the level of the innovation opportunity set that is important, but also the type of innovation opportunity pursued. Firms separately choose the type of innovation project to pursue as well as the level of innovation investment (Utterback and Abernathy, 1975; Mansfield, 1981; Rosen, 1991; Yin and Zuscovitch, 1998).

Utterback and Abernathy (1975) argue, and find empirically, that there is a dynamic and systematic relationship between a firm's ability to innovate and its competitive strategy and the state of its production processes. In particular, in different stages of production development, different innovation strategies for the

same firm will be required. Changes in the competitive environment within which the firm operates may also dictate changes in the innovation strategy, with production process changes required accommodating the change in the innovation strategy. The evidence presented by Mansfield (1981) indicates that large firms tend to carry on a disproportionately large portion of basic research and a disproportionately small proportion of R&D aimed at new products and processes, where firm size is measured by firm sales.

Under Rosen's (1991) model, firms evaluate alternative innovation opportunities along the following dimensions: the innovation type, the particular risk-return characteristics, and the investment level required for the opportunity. Thus, firms can choose innovation opportunities that bring about modifications to existing technology (process innovation), or create new technologies (product innovation) altogether. The firm's choice will depend upon its market position and its existing technology. Process innovations are typically incremental to existing technologies, while product innovations are radical, breaking new ground. The model predicts that large ("low-cost") firms will pursue process innovation while small ("high-cost") firms will pursue product innovation, where size is measured by market share. When considering both risk and scale, the low-cost firm has an incentive to invest more than the high-cost rival because it gets a larger absolute return per dollar of investment, while the high-cost firm prefers a riskier project, since small innovations are worth relatively less to it than to the low-cost firm. Rosen also points out that the extent of agency problems on the ability to sell or license an innovation or innovative idea depends on the

ability of both parties to measure the value-added of the innovation. Since value added is more difficult to measure for product innovation than for process innovations, process innovations come from established firms.

Yin and Zuscovitch (1998) present a model that predicts that large firms seek cost-differential (Ricardian) rents while small firms seek transitory innovation (Schumpeterian) profits, where size is defined as by Rosen (1991) (i.e., market share). Specifically, the static model finds that large firms tend to pursue process R&D, incrementally improving existing technologies, while small firms tend to pursue product innovations, creating surprise with new technologies. Thus, large firms dominate the existing product market, post innovation, while the small firms dominate the market for new products.

A number of empirical studies have examined the relation between firm size, industry membership and choice of product or process innovation. Pavitt, Robson and Townsend (1987) find that large U.K. firms are associated with process innovation while small U.K. firms are associated with product innovation, where innovation is measured by the commercial success of a technical innovation and size is measured by the proportion of the innovation output of a firm to the industry funded R&D. Cohen and Klepper (1996) find evidence of the same relation, when size is measured by market share and innovation by percentage of process innovation patents obtained by the firm. In their view, large firms have a greater incentive to pursue all types of innovation, but this incentive is relatively greater for types of innovation that depend more heavily upon existing output for their exploitation.

A.2 Related Research

The prior financial accounting, economics and finance literature examining the association between stock option awards and the agency and contracting variables hypothesized to influence firms' use of options conducted the studies at the industry level (Smith and Watts, 1992), the firm level (Gaver and Gaver, 1993, 1995; Matsunaga, 1995; Kole, 1997) and the manager level (Eaton and Rose, 1993; Mehran, 1995; Yermack, 1995; Baber, Janakiraman and Kang, 1996; Bryan, Hwang and Lilien, 2000). In considering the association, the manager level studies examined firms' option awards to CEOs and/or top five employees and/or board members. Of the industry and firm level studies, three (Smith and Watts, 1992; Gaver and Gaver, 1993; Kole, 1997) considered the presence/absence of an option plan, and one (Matsunaga, 1995) examined the total value of the options granted by firms.

A recent body of financial accounting, managerial accounting and economics literature has examined the role of specific components of compensation and the total compensation contracts of divisional or business unit managers of firms in the employee performance evaluation process, as well as the relationship between divisional or business unit managers' compensation contracts and firm characteristics. Baiman, Larcker and Rajan (1995) study the allocation of tasks to, and the imposition of compensation risk on, business unit managers of decentralized firms. They find that the compensation risk imposed on the manager tends to increase with relative expertise at the parent level and the relative importance of the business unit, while task allocation is a decreasing

function of these two factors. Keating (1997) examines the determinants of the relative use of three metrics in divisional managers' performance evaluations: firm stock price, firm accounting metrics (firm earnings, firm return on equity) and division accounting metrics (division earnings, return on investment). He finds that, while the three metrics all play a role in the evaluation of division managers, division accounting metrics are usually the most important. Holthausen, Larcker and Sloan (1995) consider the role of divisional compensation contracts as a determinant of innovation, and find moderate evidence that increases in the percentage of long-term compensation in the divisional executive's compensation contract have a positive impact on subsequent innovation. Bushman, Indjejikian and Smith (1995) find that, for annual bonus and long term compensation plans, the use of aggregate performance measures for business unit managers is positively associated with interindustry and intergeographic sales, and negatively associated with product line and geographic diversification. Stroh, Brett, Baumann and Riley (1996) find that for middle managers, the percentage of total pay that is variable compensation is inversely related to agent task programmability and the length of the agency relationship, and positively related to organizational uncertainty. A mail survey of 50 middle managers from each of 20 Fortune 500 firms was used to obtain the data.

APPENDIX B

Corporate and Individual Income Tax Rates during test period, 1995 through 1997

B.1 Corporate Income Tax Rates, years ending in 1995, 1996 and 1997

CORPORATE INCOME TAX RATES YEARS ENDING IN 1995, 1996 AND 1997

IF TAXABLE INCOME IS OVER:	BUT NOT OVER:	TAX IS:	PLUS	OF THE AMOUNT OVER:
\$0	\$50,000	-	15%	\$0
\$50,000	\$75,000	\$7,500	25%	\$50,000
\$75,000	\$100,000	\$13,750	34%	\$75,000
\$100,000	\$335,000	\$22,250	39%	\$100,000
\$335,000	\$10,000,000	\$113,900	34%	\$335,000
\$10,000,000	\$15,000,000	\$3,400,000	35%	\$10,000,000
\$15,000,000	\$18,333,333	\$5,150,000	38%	\$15,000,000
\$18,333,333	-	-	35%	\$0

B.2 Individual Income Tax Rates (Married filing jointly), 1995, 1996 and 1997

INDIVIDUAL INCOME TAX RATES 1995 MARRIED, FILING JOINTLY

IF TAXABLE INCOME IS OVER:	BUT NOT OVER:	TAX IS:	PLUS	OF THE AMOUNT OVER:
\$0	\$39,000	\$0	15%	\$0
\$39,000	\$94,250	\$5,850	28%	\$39,000
\$94,250	\$143,600	\$21,320	31%	\$94,250
\$143,600	\$256,500	\$36,619	36%	\$143,600
\$256,500	-	\$77,263	39.6%	\$256,500

INDIVIDUAL INCOME TAX RATES 1996 MARRIED, FILING JOINTLY

IF TAXABLE INCOME IS OVER:	BUT NOT OVER:	TAX IS:	PLUS	OF THE AMOUNT OVER:
\$0	\$40,100	\$0	15%	\$0
\$40,100	\$96,900	\$6,015	28%	\$40,100
\$96,900	\$147,700	\$21,919	31%	\$96,900
\$147,700	\$263,750	\$37,667	36%	\$147,700
\$263,750	-	\$79,445	39.6%	\$263,750

**INDIVIDUAL INCOME TAX RATES
1997
MARRIED, FILING JOINTLY**

IF TAXABLE INCOME IS OVER:	BUT NOT OVER:	TAX IS:	PLUS	OF THE AMOUNT OVER:
\$0	\$41,200	\$0	15%	\$0
\$41,200	\$99,600	\$6,180	28%	\$41,200
\$99,600	\$151,750	\$22,532	31%	\$99,600
\$151,750	\$271,050	\$38,699	36%	\$151,750
\$271,050 -		\$81,647	39.6%	\$271,050

Appendix C

C.1 A review of the literature with respect to proxies for the innovation opportunity set

A wide variety of proxies for the level of the investment opportunity set have been utilized in the extant research. These measures can be categorized as *accounting based* or *market based*. Solely from the perspective of the investment opportunity set, the accounting based measures can be viewed as capturing firms' historical investments in growth options, while the market based measures can be viewed as the market's evaluation of the cash flow implications of those historical investments.

The following table, prepared and updated from a discussion in Gaver and Gaver (1993), identifies some of the variables used in the literature to proxy for the investment/innovation opportunity set:

PROXY VARIABLE

(Book value, assets) / (Total firm value)

Market value, equity) / (Book value, equity)

(Market value, equity + book value, debt +
book value, preferred stock) / (Book value, assets)

(Market value, equity + book value, debt) /
(Book value, assets)

(Market value, equity) / (Book value, assets)

(Earnings) / (Price)

R&D expenditures

(R&D expenditures) / (Total assets)

(R&D expenditures) / (Sales)

Variance of revenue

Variance of rate of return

Variance in cash flows

Tobin's Q =[Book value, assets + (market value,
common stock - book value, common stock)] /
(Book value, assets)

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Smith and Watts (1992)

Chung and Charoenwong (1991)
Collins and Kothari (1989)
Lewellen, Loderer and Martin (1987)

Matsunaga (1995)

Bizjak, Brickley and Coles (1993)

Kole (1997)

Smith and Watts (1992)
Chung and Charoenwong (1991)
Kester (1984)

Bizjak, Brickley and Coles (1993)

Kole (1997)
Matsunaga (1995)

Skinner (1993)
MacKie-Mason (1995)

Christie (1989)

Smith and Watts (1992)

Chung and Charoenwong (1991)
Kester (1984)

Yermack (1995)

Smith and Watts (1992) point out that, because the investment opportunity set is unobservable, it is unlikely that it can be measured accurately by any single empirical proxy. Recognizing this difficulty, several researchers have employed factor analysis to derive a composite measure of the investment opportunity set in an attempt to reduce the measurement error [Gaver and Gaver, 1993; Baber, Janakiraman and Kang, 1996].

REFERENCES

- Austin, J.R., J.J. Gaver, and K.M. Gaver. The Choice of Incentive Stock Options vs. Nonqualified Options: A Marginal Tax Rate Perspective. *The Journal of the American Taxation Association* 20-2: 1-21.
- Baber, W.R., S.N. Janakiraman, and S. Kang. 1996. Investment opportunities and the structure of executive compensation. *Journal of Accounting and Economics* 21: 297-318.
- Baiman, S., D.F. Larcker, and M.V. Rajan. 1995. Organizational Design for Business Units. *Journal of Accounting Research* 33: 205-228
- Balsam, S., R. Halperin and H.A. Mozes. 1997. Tax Costs and Nontax Benefits: The Case of Incentive Stock Options. *Journal of the American Taxation Association* 19-2: 19-37.
- Becker, G.S. 1962. Investments in Human Capital: A Theoretical Analysis. *Journal of Political Economy* 70: S9- S49.
- Becker, G.S. 1975. Human Capital (2nd edition). University of Chicago Press: Chicago, IL.
- Ben-Porath, Y. 1967. The Production of Human Capital and the Life Cycle of Earnings. *Journal of Political Economy* 75: 352-365.
- Bizjak, J.M., J.A. Brickley, and J.L. Coles. 1993. Stock-based incentive compensation and investment behavior. *Journal of Accounting and Economics* 16: 349-372.
- Bryan, S., L. Hwang, and S. Lilien. 2000. CEO Stock-Based Compensation: An Empirical Analysis of Incentive-Intensity, Relative Mix, and Economic Determinants. *Journal of Business* 73: 661-693.
- Bushman, R.M., R.J. Indjejikian and A. Smith. 1995. Aggregate Performance Measures in Business Unit Manager Compensation: The role of Intrafirm Interdependencies. *Journal of Accounting Research* 33: 101-128.
- Cardinal, L.B. and T.C. Opler. 1995. Corporate diversification and innovative efficiency: An empirical study. *Journal of Accounting and Economics* 19: 365-381.
- Carpenter, J. N. 1998. The exercise and valuation of stock options. *Journal of Financial Economics* 48: 127-158.

- Christie, A., M. Joye and R. Watts. 1989. Organization of the firm: Theory and evidence. Working paper (University of Rochester).
- Chung, K. and C. Charoenwong. 1991. Investment options, assets in place and the risk of stock. *Financial Management* 20: 21-33.
- Clinch, G. 1991. Employee Compensation and Firms' Research and Development Activity. *Journal of Accounting Research* 29-1: 59-78.
- Cohen, W.M. and S. Klepper. 1996. Firm Size and the Nature of Innovation Within Industries: The Case of Process and Product R&D. *The Review of Economics and Statistics* 78: 232-243.
- Collins, D.W. and S.P. Kothari. 1989. An analysis of intertemporal and cross-sectional determinants of earnings response coefficients. *Journal of Accounting and Economics* 11:143-181.
- Comment, R. and G. Jarrell. 1995. Corporate Focus and Stock Returns. *Journal of Financial Economics* 37: 67-87.
- Core, J. and W. Guay. 2000. Stock Option Plans for Non-Executive Employees. Working paper. (The Wharton School, University of Pennsylvania).
- Core, J. and J. Qian. 2000. Option-like Contracts for Innovation and Production. Working paper. (The Wharton School, University of Pennsylvania).
- DeCanio, S.J. and S.E. Watkins. 1998. Information processing and organization structure. *Journal of Economic Behavior & Organizations* 36: 275-294.
- Dechow, P.M., A.P. Hutton, and R.G. Sloan. 1996. Economic consequences of accounting for stock-based compensation. *Journal of Accounting Research* 34 :(Supplement), 1-20.
- Demsetz, H. and K. Lehn. 1985. The Structure of Corporate Ownership: Causes and Consequences. *Journal of Political Economy* 93: 1155-1177.
- Eaton, J. and H.S. Rosen. 1983. Agency, delayed compensation, and the structure of executive remuneration. *Journal of Finance* 38: 1489-1505.
- The Economist*. "Innovation in Industry." February 20-26, 1999. Survey Section.
- The Economist*. "The trouble with stock options." August 7-13, 1999, p. 13.
- The Economist*. "Share Options." August 7-13, 1999, p. 18-20.

- Eisenhardt, K.M. 1985. Organizational Control: Organizational and economic approaches. *Management Science* 31: 134-149.
- Eisenhardt, K.M. 1988. Agency-and Institutional-Theory Explanations: The Case of Retail Sales Compensation. *Academy of Management Journal* 31: 488-511.
- Eisenhardt, K.M. 1989. Agency Theory: An Assessment and Review. *Academy of Management Review* 14: 57-74.
- Fama, E. and M.C. Jensen. 1983a. Separation of ownership and control. *Journal of Law and Economics* 26: 301-325.
- Fama, E. and M.C. Jensen. 1983b. Agency Problems and Residual Claims. *Journal of Law and Economics* 26: 327-349.
- Financial Accounting Standards Board (FASB). *Statement of Financial Accounting Standards No. 14, Financial Reporting for Segments of a Business Enterprise*. Stamford, CT: FASB. 1974.
- Financial Accounting Standards Board (FASB). *Statement of Financial Accounting Standards No. 123, Accounting for Stock-Based Compensation*. Stamford, CT: FASB. 1995.
- Galbraith, J., 1973, *Designing Complex Organizations*, Addison-Wesley.
- Garen, J. 1999. Unions, Incentive Systems, and Job Design. *Journal of Labor Research* 20-4: 499-603.
- Gaver, J.J. and K.M. Gaver. 1993. Additional evidence on the association between the investment opportunity set and corporate financing, dividend and compensation policies. *Journal of Accounting and Economics* 16: 125-160.
- Gaver, J.J. and K.M. Gaver. 1995. Compensation policy and the investment opportunity set. *Financial Management* (Spring): 19-32.
- Geanakoplos, J. and P. Milgrom. 1991. A theory of hierarchies based on limited managerial attention. *Journal of the Japanese and International Economies* 5: 205-225.
- Gomez-Mejia, L.R. and D. B. Balkin. 1992. Determinants of faculty pay: an agency theory perspective. *Academy of Management Journal* 35: 921-955.
- Graham, J.R. 1996. Proxies for the corporate marginal tax rate. *Journal of Financial Economics* 42: 187-221.

- Hayek, F.A. 1945. The Use of Knowledge in Society. *The American Economic Review* 35-4: 519-530.
- Hemmer, T., S. Matsunaga and T. Shevlin. 1994. Estimating the "Fair Value" of Employee Stock Options with Expected Early Exercise. *Accounting Horizons* 8-4: 23-42.
- Hemmer, T., S. Matsunaga and T. Shevlin. 1996. The influence of risk diversification on the early exercise of employee stock options by executive officers. *Journal of Accounting and Economics* 21: 45-68.
- Hite, G.L. and M.S. Long. 1982. Taxes and Executive Stock Options. *Journal of Accounting and Economics* 4:3-15.
- Holmstrom, B.A. 1979. Moral Hazard and Observability. *The Rand Journal of Economics* 10: 74-91.
- Holmstrom, B.A. 1989. Agency Costs and Innovation. *Journal of Economic Behavior and Organization* 12: 305-327.
- Holthausen, R.W., D.F. Larcker, and R.G. Sloan. 1995. Business unit innovation and the structure of executive compensation. *Journal of Accounting and Economics* 19: 279-313.
- Huddart, S. 1994. Employee Stock Options. *Journal of Accounting and Economics* 18: 207-231.
- Huddart, S. 1998. Tax Planning and the Exercise of Employee Stock Options. *Contemporary Accounting Research* 15-2: 203-16.
- Huddart, S., and M. Lang. 1996. Employee stock options exercises: An empirical analysis. *Journal of Accounting and Economics* 21:5-43.
- Indjejikian, R.J. 1999. Performance Evaluation and Compensation Research: An Agency Perspective. *Accounting Horizons* 13: 147-157.
- Jacquemin, A. and C. Berry. 1979. Entropy Measure of Diversification and Corporate Growth. *The Journal of Industrial Economics* 27: 359-369.
- Jensen, M.C. and W. Meckling. 1976. Theory of the firm: Managerial behavior, agency costs and ownership structure. *Journal of Financial Economics* 3: 305-360.
- Jensen, M.C. and K.J. Murphy. 1990. Performance pay and top-management incentives. *Journal of Political Economy* 2: 225-264.

- Keating, A.S. 1997. Determinants of divisional performance evaluation practices. *Journal of Accounting and Economics* 24: 243-273.
- Keren, J. and D. Levhari. 1989. Decentralization, aggregation, control loss and costs in a hierarchical model of the firm. *Journal of Economic Behavior and Organization* 11: 213-236.
- Kester, W.C. 1984. Today's options for tomorrow's growth. *Harvard Business Review* March-April: 153-160.
- Kester, W.C. 1986. An options approach to corporate finance. Ch. 5 in: E.I. Altman, ed., *handbook of corporate finance* (Wiley, New York, NY) 3-35.
- Kinney, M and E. Swanson. 1993. The accuracy and adequacy of tax data in Compustat. *The Journal of the American Taxation Association* 15: 121-135.
- Kole S. 1991. An investigation of the bundling of compensation plans. Working paper. (University of Rochester, Rochester, NY).
- Kole, S. 1997. The complexity of compensation contracts. *Journal of Financial Economics* 43: 79-104.
- KPMG Peat Marwick LLP. 1997 *KPMG Peat Marwick LLP Executive Compensation Survey in Information, Communication and Entertainment Companies*. San Francisco, CA: KPMG. 1997.
- Lawrence, P.R. and J.W. Lorsch. 1967. *Organization and Environment*. Harvard Business School Press, Boston, MA.
- Lewellen, W.G., C. Loderer, and K. Martin. 1987. Executive compensation and executive incentive problems: An empirical evidence. *Journal of Accounting and Economics* 9: 287-310.
- Mac-Kie-Mason, J.K. 1990. Do taxes affect corporate financing decisions? *Journal of Finance* 45: 1471-1493.
- Mansfield, E. 1981. Composition of R and D Expenditures: Relationship to Size of Firm, Concentration, and Innovative Output. *The Review of Economics and Statistics* 63: 610-615.
- Matsunaga, S.R. 1995. The effects of financial reporting costs on the use of employee stock options. *The Accounting Review* 70: 1-26.
- Matsunaga, S., T. Shevlin and D. Shores. 1992. Disqualifying Dispositions of Incentive Stock Options: Tax Benefits versus Financial Reporting Costs. *Journal of Accounting Research* 30:37-68.

- Mehran, H. 1995. Executive compensation structure, ownership, and firm performance. *Journal of Financial Economics* 38: 163-184.
- Mendelson, H. and R.R. Pillai. 1999. Information Age organizations, dynamics and performance. *Journal of Economic Behavior & Organizations* 38: 253-281.
- Meulbroek, L.K. 2000. The Efficiency of Equity-Linked Compensation: Understanding the Full Cost of Awarding Executive Stock Options. Working Paper (Harvard Business School).
- Mincer, J. 1974. *Schooling, Experience and Earnings*. Columbia University Press, New York.
- Murphy, K.J. 1998. Executive Compensation. Working Paper (University of Southern California).
- Myers, S.C. 1977. Determinants of corporate borrowing. *Journal of Financial Economics* 5: 147-175.
- Neal, D. 1995. Industry-specific human capital: Evidence from displaced workers. *Journal of Labor Economics* 13: 653-678.
- Palepu, K. 1985. Diversification Strategy, Profit Performance and the Entropy Measure. *Strategic Management Journal* 6: 239-255.
- Parent, D. 2000. Industry-specific capital and the wage profile: Evidence from the National Longitudinal Survey of Youth and the Panel Study of Income Dynamics. *Journal of Labor Economics* 18: 306-323.
- Pavitt, K., M. Robson, M. and J. Townsend. 1987. The Size Distribution of Innovating Firms in the U.K.: 1945-1983. *The Journal of Industrial Economics* 35: 297-316.
- Plesko, G.A. 1999. An Evaluation of Alternative Measures of Corporate Tax Rates. Working Paper (Massachusetts Institute of Technology).
- Rosen, R.J. 1991. Research and development with asymmetric firm sizes. *RAND Journal of Economics* 22: 411-429.
- Scholes, M.S. and M.A. Wolfson. 1992. *Taxes and Business Strategy: A Planning Approach*. Englewood Cliffs, NJ: Prentice Hall.
- Shaw, K.L. 1996. An Empirical Analysis of Risk Aversion and Income Growth. *Journal of Labor Economics* 14: 626-654.

Shevlin, T. 1990. Estimating corporate marginal tax rates with asymmetric tax treatment of gains and losses. *Journal of the American Taxation Association* 12: 51-67.

Skinner, D. J. 1993. Asset structure, financing policy and accounting choice: Preliminary evidence. *Journal of Accounting and Economics* 16: 407-455.

Smith, C. and R.L. Watts. 1992. The investment opportunity set and corporate financing, dividend, and compensation policies. *Journal of Financial Economics* 32: 263-292.

Stroh, L.K., J.M. Brett, J.P. Baumann and A.H. Riley. 1996. Agency theory and variable pay compensation strategies. *Academy of Management Journal* 39:751-767.

The Journal News. "The oomph of options." November 1, 1999, p. 1D.

The New York Times. "More Fired Workers Are Suing for Stock Options." Sunday, November 21, 1999. Money and Business Section, p. 11.

Tushman, M.L. and D.A. Nadler. 1978. Information Processing as an Integrating Concept in Organization Design. *Academy of Management Review*, July: 613-624.

Utterback, J.M. and W.J. Abernathy. 1975. A Dynamic Model of Process and Product Innovation. *Omega* 3: 639-656.

Wall Street Journal. "Corporate Coffers Gush With Currency of an Opulent Age." August 10, 1998, p. B1, B4.

Wall Street Journal. "Two Friends Hunting for Gold in Silicon Valley." August 10, 1998, p. B1, B4.

Wall Street Journal. "At Microsoft, a War Smolders Between Haves and Have-Nots." August 10, 1998, p. B1, B5.

Wall Street Journal. "Stock Options Spur New Disputes Over Child Support." March 17, 1999, p. B1, B4.

Wall Street Journal. "CBS Is Replacing Its Pension Program With Cash-Balance Plan, Stock Options." March 24, 1999, p. B10.

Wall Street Journal. "Cisco, Microsoft Get Income Tax Break from Employee Stock Options." October 10, 2000, p. B8.

Wall Street Journal. "Firms Face Options Pickle as Stocks Fall." October 15, 2000, p. C1.

Williamson, O.E. 1975. *Markets and Hierarchies*. New York: Free Press

Williamson, O.E. 1985. *The Economic Institutions of Capitalism*. New York: Free Press.

Williamson, O.E. 1991. Comparative Economic Organization: The Analysis of Discrete Structural Alternatives. *Administrative Science Quarterly* 36: 269-296.

Yermack, D. 1995. Do corporations award CEO stock options effectively? *Journal of Financial Economics* 39: 237-269.

Yin, X. and E. Zuscovitch. 1998. Is firm size conducive to R&D choice? A strategic analysis of product and process innovations. *Journal of Economic Behavior & Organizations* 35: 243-262.