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STOCK OPTION COMPENSATION IN FINLAND: AN ANALYSIS OF ECONOMIC DETERMINANTS, CONTRACTING FREQUENCY, AND DESIGN

2003

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JEL Classification: G30; J33

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SHS intressebyrå IB (Oy Casa Security Ab), Helsingfors 2003

ISBN 951-555-806-9
ISSN 0357-4598

Stock option compensation in Finland: an analysis of economic determinants, contracting frequency, and design

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First draft: November 25, 2002; this draft: August 1, 2003

Abstract

This paper addresses several questions in the compensation literature by examining stock option compensation practices of Finnish firms. First, the results indicate that principal-agent theory succeeds quite well in predicting the use of stock options. Proxies for monitoring costs, growth opportunities, ownership structure, and risk are found to determine the use of incentives consistent with theory. Furthermore, the paper examines whether determinants of stock options targeted to top management differ from determinants of broad-based stock option plans. Some evidence is found that factors driving these two types of incentives differ. Second, the results reveal that systematic risk significantly increases the likelihood that firms adopt stock option plans, whereas total firm risk and unsystematic risk do not seem to affect this decision. Third, the results show that growth opportunities are related to time-dimensional contracting frequency, consistent with the argument that incentive levels deviate more rapidly from optimum in firms with high growth opportunities. Finally, the results suggest that vesting schedules are decreasing in financial leverage, and that contract maturity is decreasing in firm focus. In addition, both vesting schedules and contract maturity tend to be longer in firms involving state ownership.

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1. Introduction

The causes and consequences of stock option compensation continue to attract the interest of academics, practitioners, and regulators. The literature suggests that separation of ownership and control may cause self-interested managers to act in ways not beneficial to shareholders (see, e.g., Jensen and Meckling, 1976; Jensen, 1986, 1993). One way to mitigate agency costs is to tie managerial compensation to firm performance. The most rapidly growing form of executive remuneration tying managerial wealth to firm performance is stock option compensation. Albeit the wide body of theoretical and empirical research on the causes and consequences of this compensation form, a complete understanding of the phenomenon is still lacking.[1]

Theoretical models of executive compensation suggest that the level of equity incentives should be related to growth opportunities, i.e., compensation should be more closely tied to the stock price when the firm's investment opportunity set is larger, and the manager's effort has a stronger impact on shareholder value (see, e.g., Milgrom and Roberts, 1992). This prediction has gained strong support in empirical work.[2] The existing literature has primarily focused on stock option plans targeted to top executives, and largely ignored the analysis of stock option plans targeted to non-executive employees. Recently, however, the focus has shifted towards the analysis of determinants of stock option plans targeted to non-executive employees (Core and Guay, 2001; Ittner et al., 2002). Another aspect that recently has received increased attention in the literature is managerial valuation of equity incentives. Specifically, the value which managers and employees place on equity incentives can be quite different from their market value, due to inability of hedging firm-specific (unsystematic) risk.[3] Empirically, Jin (2002) finds that pay becomes less sensitive to performance as unsystematic risk increases, but finds no relation between systematic risk and pay-for-performance.

One of the most debated questions concerns the relation between equity incentives and firm performance. Morck et al. (1988) find that managerial equity ownership and firm performance is too low in many firms. Implicit in this notion is the assumption that adjustment costs of contracting are so great that firms cannot contract optimally; thereby some firms deliver inferior returns to shareholders. On the contrary, Demsetz and Lehn

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[1] See, e.g., Murphy (1999) for a general review of executive compensation. A more recent review on executive compensation and managerial incentives is provided by Core et al. (2002).

[2] For example, the findings of Smith and Watts (1992), Gaver and Gaver (1993), Mehran (1995), Guay (1999), Himmelberg et al. (1999), and Palia (2001) lend support to this prediction by documenting a positive relation between growth or investment opportunities and equity incentives.

[3] See, e.g., Lambert et al. (1991), Carpenter (1998), and Meulbroek (2001).

(1985) argue that when firms' ownership levels are optimally determined, there will be no relation between ownership and performance.[4] More recently, Core and Larcker (2002) relax some of the strong assumptions of the prior research. Combining the assumptions that firms optimize ownership levels when contracting (implying no relation between ownership and performance at optimum), and that contracting is not continuous due to adjustment costs of contracting, they predict that some firms are below optimum and that their performance may be improved by increasing ownership (incentive) levels.[5] Other aspects that remain largely unexplored to date relate to stock option contract design. Yermack (2001) specifies two research questions that remain uncovered in the literature, namely, i) the question why stock option vesting schedules are so short, given that employee retention is supposed to be a major goal of stock option compensation, and ii) what are the economic determinants that explain the cross-sectional diversity of vesting schedules.[6]

This paper contributes to the compensation literature in the following ways. First, the paper examines factors related to the use of stock option compensation over time. The likelihood of using stock options is found to be increasing in firm size and growth opportunities, consistent with the literature (see, e.g., Jensen and Meckling, 1976; Demsetz and Lehn, 1985; Milgrom and Roberts, 1992). Higher levels of cash compensation are found to be negatively related to the use of stock options, which may be interpreted as a substitution effect between cash compensation and stock options. Furthermore, ownership structure is found to be an important factor affecting the use of stock options, with ownership concentration reducing the likelihood of using stock options, whereas institutional ownership increases the likelihood. Although the compensation literature provides conflicting hypotheses regarding the relation between risk and incentives, the results of this paper point to a negative relation between risk and the likelihood of using stock options. Finally, stock options seem to be used more frequently in diversified firms, supporting the argument that the need of equity incentives is increasing in monitoring costs.

Some evidence is found that the determinants of stock option plans targeted to top management differ from the determinants of broad-based stock option plans. Most

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[4] Hence, by focusing on the equilibrium behavior of optimizing firms, one assumes that firms can continuously contract in the absence of adjustment costs.

[5] Consistent with this view, they find that mandatory increases in suboptimal equity ownership are associated with increases in subsequent firm performance.

importantly, the results indicate that the likelihood of using stock options targeted to top management is increasing in firm size, whereas the opposite is true in the case of broad-based plans. This observation is expected, since lower-level employees in large firms are less likely to be able to influence the stock price through their individual actions. In addition, the results suggest that the likelihood of broad-based plans is increasing in cash flow constraints, consistent with the notion that firms with cash flow constraints grant stock options to lower-level employees as a substitute for a lower capacity to pay cash compensation (Yermack, 1995; Core and Guay, 2001). Interestingly, the relation between growth opportunities and incentives becomes indistinct when stock option plans are classified as targeted to top management, or to a broader group of employees. In the case of top management stock options, the results fail to find any significant relation between growth opportunities and incentives. Furthermore, the relation becomes ambiguous in the case of broad-based stock option plans, depending on the measure of growth opportunities. Finally, the results suggest that focused firms are less likely to use stock options targeted to top management, consistent with the argument that monitoring of the manager's effort is more costly in diversified firms compared to focused firms.

In addition, the paper contributes to previous empirical work examining factors affecting the decision to introduce and revise stock option plans (Morgan and Poulsen, 2001; Pasternack, 2002a) by analyzing the effect of firm risk, decomposed into systematic and unsystematic components. The results reveal that systematic risk significantly increases the likelihood that firms adopt stock option plans, whereas total firm risk and unsystematic risk do not seem to be driving these decisions. Furthermore, the paper contributes to the literature by examining if factors proxying expected benefits and costs of contracting are related to the time-dimensional contracting frequency of firms. The results reveal that growth opportunities are an important determinant of firms' time-dimensional contracting frequency, consistent with the argument that ownership and incentive levels deviate more rapidly from optimal levels in firms possessing high growth opportunities.

Finally, the paper explores two issues largely ignored in the literature, namely, factors explaining the diversity in stock option vesting schedules and contract maturity. The results reveal a negative relation between financial leverage and the length of vesting periods (and vest to maturity ratios). This result lends support to a number of predictions

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[6] Kole (1997) studies in minor detail this latter question, attempting to find relations between stock option vesting schedules and firms' research and development (R&D) intensities, but the results fail to detect any robust relation.

in the literature. First, financial leverage may serve as a substitute for long-term equity incentives (see, e.g., Jensen, 1986, 1993). Furthermore, the benefits of long-term contracting are assumed to be greater in firms with high growth opportunities (Fudenberg et al., 1990). Hence, the result seems to be consistent with previous research showing that firms with high growth opportunities tend to have lower degrees of financial leverage (see, e.g., Smith and Watts, 1992). Finally, higher firm risk reduces the value that risk-averse and undiversified executives and employees place on equity-based compensation. To mitigate this reduction in value, firms may reduce restrictions on equity incentives, e.g., by shorter vesting. Assuming that greater use of debt is associated with higher risk, then the result that vesting periods are decreasing in financial leverage seems reasonable. Furthermore, the results reveal that both vesting schedules and contract maturity tend to be longer in state-owned firms. These observations are expected, since the labor retention motive for stock option compensation is predicted to be important in firms involving state ownership. In addition, the results show that contract maturity is shorter in focused firms. Treating firm focus as a proxy for monitoring costs (monitoring of the manager's effort is assumed to be more costly in diversified firms compared to focused firms), then the result is consistent with the assumption that the benefits of long-term contracting are increasing in the degree of monitoring costs.

The remainder of the paper is organized as follows. Section 2 describes the research hypotheses and methodology. Section 3 describes the data and the sample. The results are reported in Section 4, and finally, Section 5 concludes the paper.

2. Hypothesis development and research design

This section presents the hypotheses and research design of the paper. First, the section discusses economic determinants of equity incentives. Second, the section addresses the issue of firms' time-dimensional frequency of contracting. Third, the section analyzes the diversity of stock option vesting schedules and contract maturity. Finally, the section presents the empirical specifications utilized in the paper.

2.1. Economic determinants of equity incentives

According to principal-agent theory, it is the principal's ability to observe the agent's input or effort that determines the form of compensation. If the appropriate actions are known and observable, the optimal incentive contract pays the agent (manager) a fixed salary and penalizes him for suboptimal behavior. However, if

managerial actions are unobservable, tying managerial compensation to the productive outcomes (such as firm value) is necessary to induce the manager to behave optimally (Holmström, 1979). Lambert and Larcker (1987) examine empirical implications of principal-agent theory, and find greater use of stock-based compensation when the accounting measure of the firm's performance is characterized as noisy relative to the corresponding stock-based measure, and when a firm is in the early stages of investment as characterized by a high growth rate in assets and sales. Hence, managerial compensation is not expected to be tied to firm value, when accounting information provides a more reliable indicator of the manager's contribution to firm performance. In contrast, when a large portion of the firm's value is attained to growth opportunities where the opportunity set is large, or in other words, where the manager's effort has more effect on shareholder value, it is expected that equity incentives should be used more frequently.

Agency theory predicts that lower monitoring costs imply a higher firm value, other things equal. Jensen and Meckling (1976) argue that large firms are more difficult (costly) to monitor, which motivates higher equity incentives in large firms. Accordingly, Demsetz and Lehn (1985) hypothesize that the level of managerial equity holdings should be greater in larger firms.[7] Furthermore, it is reasonable to assume that monitoring costs is a function of firm structure, in addition to firm size. Empirical work has shown that firm diversification destroys value and results in the well-known diversification discount.[8] The dominant part of the explanations for the diversification discount suggests that agency costs can be expected to be higher in diversified firms, which in turn could be explained by the fact that monitoring of the manager's effort is more costly in diversified firms compared to focused firms. Hence, it is plausible to assume that the need for equity incentives is greater in diversified firms, to achieve incentive alignment between managers and shareholders.

Yermack (1995) hypothesized that firms with cash flow constraints use stock options to compensate for a lower level of cash compensation. In support of this argument, he found that firms with zero-dividends use greater option-based compensation. The arguments of Jensen (1986, 1993) imply that the disciplinary role of debt may reduce agency costs, which in turn implies that firms with high financial leverage have a lower need for equity incentives as a control mechanism. Furthermore,

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[7] Supporting this prediction, Baker and Hall (1998), and Himmelberg et al. (1999) found that the absolute value of equity incentives increase at a decreasing rate with firm size.
[8] See Lamont and Polk (2001) for a review of the causes and consequences of diversification.

John and John (1993) analyze the relation between firms' compensation policies and capital structure, and predict that highly levered firms will tie compensation less closely to the stock price, to motivate optimal managerial risk choices.[9] On the other hand, compensation in the form of stock options is motivated by the fact that they are expected to provide incentives to increase risk, and thus, bring managers' risk preferences closer to those of a representative investor. Supporting this argument, Mehran (1992) found that firms using stock options as a form of compensation also displayed higher financial leverage.

The effect of risk on the probability of using equity incentives is ambiguous. On the one hand, agency theory predicts that risk reduces the probability of using equity incentives, because managers tying their human capital to the performance of the firm are averse toward further increasing firm risk.[10] On the other hand, the value of stock options is an increasing function of risk, which should increase the manager's willingness to receive stock options as a form of compensation. However, more recent studies regarding the effect of risk on equity incentives has shown that the value that managers place on equity incentives may be very different from their market value, due to inability of hedging unsystematic risk (Lambert et al., 1991; Carpenter, 1998; Meulbroek, 2001; Jin, 2002). Hence, from the firm's perspective, granting equity incentives (stocks and stock options) involves what Meulbroek (2001) defines as the dead-weight loss, since the manager (employee) values equity incentives lower than the cost to the firm. In this respect, the manager (employee) may have an incentive to increase the systematic risk of the firm's stock to reduce the exposure to unsystematic (unhedgable) risk.[11]

The effect of ownership structure on equity incentives has been studied extensively. Mehran (1992) found an inverse relation between stock ownership of the CEO and the level of stock options used. Furthermore, a shareholder stands for the total personal cost of monitoring the manager, even if the benefits are shared with other shareholders proportional with their equity ownership. This suggests that large

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[9] The intuition of this argument is straightforward, i.e., if managers have strong incentives to increase the value of equity, creditors will demand higher risk premiums for providing capital (debt) for the fear that managers will pursue high-risk strategies transferring wealth from creditors to shareholders (asset substitution problem).

[10] Accordingly, Beatty and Zajac (1994) argue that firm risk reduces the probability of using stock options as a form of compensation.

[11] Jin (2002) shows theoretically that when the chief executive officer (CEO) cannot trade the market portfolio, optimal incentive levels decrease with the firm's unsystematic risk, but is ambiguously affected by the firm's systematic risk. On the other hand, when the CEO can trade the market portfolio, optimal incentive levels decrease with unsystematic risk but is not affected by systematic risk. Empirically, controlling for the level of systematic risk, Jin (2002) finds a negative relation between unsystematic risk and incentive levels. However, no significant relation could be documented between systematic risk and incentive levels.

shareholders may be more interested in monitoring the management, and hence, the need for equity incentives decreases in the degree of ownership concentration (Hoskinsson and Turk, 1990). Another important aspect to consider is the impact of institutional investors. Institutional investors are usually large sophisticated shareholders with a professional interest in developing the firm's governance and compensation structure. In empirical work, David et al. (1998) documented that the level of CEO compensation is lower for firms with a higher degree of institutional ownership, but on the contrary, that the CEOs in these firms receive a larger fraction of their compensation in the form equity incentives. An interesting institutional detail in Finland (unavailable for examination in the U.S.) is state ownership. The diverse interests and incentives caused by political dispersion imply that it is difficult to model the utility function of the state as a shareholder. Furthermore, it may be the case that bureaucracy in the decision-making process of state-owned firms implies that these firms cannot adapt equally smoothly as comparable non state-owned firms to sophisticated compensation structures.

Finally, an interesting question gaining increased attention in the literature is whether the determinants of equity incentives targeted to top management differ from the determinants of equity incentives targeted to non-executive employees. Core and Guay (2001) argue that for non-executive employees, it is less clear whether firms use options for incentive purposes, because the ability of lower-level employees to influence the stock price through their individual actions is limited. Furthermore, since employees, in general, are required to exercise their options at the time of departure from the firm (forcing suboptimal early exercise), firms use options to retain employees (Hale, 1998). As such, the fact that firms include vesting restrictions in their stock option plans implies that an important reason for this type of compensation is employee retention.[12]

2.2. Time-dimensional frequency of contracting

Why do some firms contract with stock options more frequently over time than others? This question can be analyzed in the framework of Core and Larcker (2002), who present a synthesis regarding the relation between ownership (incentives) and performance. They assume that firms choose optimal equity incentives when they contract (consistent with the literature predicting no relation between ownership and performance), but that transaction costs prohibit continuous re-contracting (consistent

[12] Alternatively, vesting restrictions may imply that firms are subject to significant contracting costs, inducing the firm to increase restrictions on equity incentives.

with the literature documenting a strong relation between ownership and performance). However, because contracting is not continuous, firms' ownership levels gradually deviate from the optimal level. As a result, they predict that firms that are below optimum can improve their performance by increasing ownership levels, and that a subset of these firms can benefit sufficiently from the increased performance that it is worthwhile for them to incur the re-contracting costs.

Hence, firms are expected to contract when the expected benefits are equal to or greater than the corresponding costs. In a time-dimensional context, this suggests that a high frequency of contracting is likely to be associated with high expected benefits and/or low costs. Candidates for expected contracting benefits and costs are similar to the determinants of equity incentives, however, interpreted in a dynamic context. First, in accordance with theoretical work of Milgrom and Roberts (1992), one assumes that expected contracting benefits are greater in firms with large growth opportunities. In a dynamic context, the fact that the firm is characterized by high growth opportunities suggests that ownership and incentive levels deviate more rapidly from optimal levels than in stable firms with low growth opportunities. Hence, one expects to find that firms with high growth opportunities have a higher contracting frequency. Furthermore, Ittner et al. (2002) argue that two potential benefits of equity incentives that have received relatively limited attention in prior studies are improving the attraction and retention of key employees. Accordingly, one may assume that firms characterized by a high degree of human capital are firms that contract frequently over time to manage their stock of human capital. These effects may also be greater in firms operating in industries characterized by high labor turnover (variability), which may find it necessary to frequently introduce new equity incentives to maintain compensation structures at optimal levels.

Finally, ownership structure may be related to contracting frequency. In Finland, prior to 1993, foreign ownership was restricted to 40% of the shares (and 20% of the votes) of a firm. Restrictions of foreign ownership were abolished from the beginning of 1993 with a few exceptions. Due to greater informational asymmetry, foreign investors are likely to favor firms that adopt and actively manage equity incentives (Pasternack, 2002a). Likewise, institutional investors are often large sophisticated shareholders, with incentives to develop and manage the firm's governance and compensation structure. Hence, one expects that firms with a high degree of foreign and institutional ownership are firms with a high contracting frequency.

2.3. The diversity of vesting schedules and contract maturity

The employee retention motive of stock option compensation has received increased attention in the literature. Kole (1997) argues that long-term contracts can encourage managers with specialized knowledge to remain with the firm.[13] Other aspects relevant in determining the length of compensation contracts relate to the uncertainty regarding the efficiency of managerial actions, and the timing of information arrival, which reduces this uncertainty (Kole, 1997). In firms possessing low growth opportunities, where managerial action mostly relates to the maintenance of assets in place, the value implications of managerial action are, in general, immediate in nature. On the other hand, in firms with high growth opportunities, the value implications of managerial action are often subject to persistent uncertainty. Hence, given that the value implications of managerial action are subject to a great deal of uncertainty, which is gradually resolved over time, this implies that long-term contracting is required to motivate managers to make appropriate long-term value enhancing decisions (Fudenberg et al., 1990). Thus, differences in the benefits of retaining managerial capital in the firm, combined with uncertainty about the appropriateness of managerial action and the length of time required to resolve that uncertainty implies cross-sectional variation from firm to firm in the benefits of long-term contracting. This line of argumentation drives Kole (1997) to hypothesize that for projects with long gestation periods or requiring specialized knowledge, stronger restrictions on equity incentives, such as longer vesting periods for stock options, are expected to be observed.

Capital structure may also interact with the design of equity-based compensation. Jensen (1986, 1993) argues that fixed payments associated with increasing the level of debt reduce the firm's free cash flow, and effectively limit the ability of the executive to use corporate resources in ways not beneficial to shareholders. Additionally, the use of debt results in external long-term monitoring by bondholders, other lenders, and bond rating agencies. In this respect, debt may serve as a substitute for long-term equity incentives, and suggests that greater levels of financial leverage may be associated with shorter vesting periods and duration of equity incentives.

Finally, because executives and employees are risk-averse and undiversified, they generally value equity-based compensation at less than the market value, as approximated by models such as Black and Scholes (1973) and Merton (1973). Hall (2002) argues that

the value to cost efficiency of equity-based pay is affected by factors such as in-the-moneyness, personal diversification, risk-aversion, firm risk, and vesting periods. Furthermore, Hall (2002) argues that a potential explanation for the observation that vesting periods tend to be quite short in practice is that executives favor short vesting since it makes compensation less risky to them. In this sense, it is plausible to assume that risky firms try to increase the value of equity-based compensation to risk-averse and undiversified executives and employees by, e.g., reducing vesting restrictions.

2.4. Empirical specifications

To investigate the first two research questions of the study, namely, i) factors related to the use of stock options over time, and ii) factors driving introductions and revisions of stock option plans, discrete decision models are estimated. The first model to be estimated is specified as follows:

$$\textit{Plan in effect}\ [1/0] = f\ [\textit{Size}\ (+),\ \textit{zero-dividends}\ (+),\ \textit{free cash flow}\ (-),\ \textit{leverage}\ (+/-),\ \textit{capital to sales}\ (-),\ \textit{investment}\ (+),\ \textit{Tobin's Q}\ (+),\ \textit{wages to labor}\ (+/-),\ \textit{labor variability}\ (+/-),\ \textit{ownership concentration}\ (-),\ \textit{institutional ownership}\ (+),\ \textit{state ownership}\ (+/-),\ \textit{risk}\ (+/-),\ \textit{focus}\ (-)]. \quad (1)$$

The dependent variable in equation (1) takes the value of one if the firm has a stock option plan in effect during a given year, and zero otherwise. The explanatory variables in equation (1) are chosen based on the previous discussion of economic determinants of equity incentives. See Appendix A for variable definitions.

The logarithm of sales is used to measure firm size. The expected relation between firm size and use of stock options is positive. To measure cash flow constraints, the specification includes an indicator variable for zero-dividends as in Yermack (1995), and a measure of free cash flow. The expected relation between zero-dividends and use of stock options is positive, and negative in the case of free cash flow. The ratio of long-term debt to assets is used to measure financial leverage. The expected relation between leverage and use of stock options is ambiguous, with a negative relation supporting the disciplinary role of debt as in Jensen (1986, 1993) and a reduction of expected agency costs of debt as in John and John (1993), and a positive relation being consistent with the

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[13] More specifically, when a manager possesses valuable experience that is costly to transfer, the departure can impose large costs on the firm through a loss of efficiency and the potential leakage of proprietary

expectation that stock options encourage managers to increase risk. The capital to sales ratio is used as a proxy for monitoring costs. A higher capital to sales ratio (lower monitoring costs) is expected to be associated with a lower probability for stock option usage. The investment to capital ratio and Tobin's Q are used to measure growth opportunities. A positive relation is expected between growth opportunities and the availability of stock options.

Two measures of labor dynamics are included in the model, namely, the wages to labor ratio and a measure of labor variability. The relation between wages to labor and the use of stock options is ambiguous. First, the wages to labor ratio may proxy for the degree of human capital, implying a positive relation between wages to labor and stock option compensation. Alternatively, firms may substitute cash compensation for stock options, which would suggest a negative relation. The expected relation between labor variability and stock options is, likewise, ambiguous. On the one hand, firms operating in environments characterized by high labor variability may find it necessary to grant equity incentives to attract and retain key employees. On the other hand, the bonding nature of stock option compensation may imply that these firms, in fact, exhibit lower degrees of labor variability.

Large shareholders are expected to be more interested in monitoring of the firm, and hence, a negative relation is expected between ownership concentration and use of stock options. Institutional shareholders are expected to be sophisticated investors with a devoted interest in developing corporate governance, implying a positive relation between institutional ownership and stock options. The case of state ownership is interesting. It is plausible to assume that in this set of firms, it is more difficult to adopt equity incentives creating substantial increases in pay-for-performance, due to political pressure and media attention. However, in Finland, state-owned firms have typically been large multinational firms with a high degree of institutional and foreign ownership, who usually favor equity incentives. Hence, the relation between state ownership and the use of stock options is ambiguous.

The effect of risk on the likelihood that the firm uses stock options as equity incentives is unclear. First, agency theory predicts that risk reduces the probability of using equity incentives as a form of compensation, because managers and employees are assumed to be averse toward risk. On the contrary, due to the fact that the value of stock options is an increasing function of risk, a positive relation between risk and the use of

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information.

stock options is plausible. However, recent work has shown that the value that managers and employees place on equity incentives may be quite different from their market value, due to inability of hedging unsystematic risk (Lambert et al., 1991; Carpenter, 1998; Meulbroek, 2001; Jin, 2002). In this light, the manager may have an incentive to increase the systematic risk of the firm's stock to reduce the exposure to unsystematic risk. Hence, the relation between risk and the use of stock options is investigated by including a measure of total firm risk, as well as total risk decomposed into systematic and unsystematic components. Finally, an indicator variable for firm focus is included to examine potential differences in the usage of stock options in focused and diversified firms. A negative relation between firm focus and the use of stock options is consistent with the argument that monitoring of the manager's effort is more difficult (costly) in diversified firms. To control for economy-wide factors that affect all firms equally, but vary over time, year indicator variables are included.

Core and Guay (2001) argue that it is unclear whether the determinants of equity incentives presented in the literature apply to both top management and non-executive employees. To explore this, equation (1) is estimated separately for top management plans and broad-based stock option plans.[14]

To examine the second research question of the study, i.e., factors driving introductions and revisions of stock option plans, the following model is estimated:

$$\begin{aligned} \textit{Plan introduction}\ [1/0] = f\ [&\textit{Size}\ (+),\ \textit{zero-dividends}\ (+),\ \textit{free cash flow}\ (-),\ \textit{leverage}\ (+/-),\\ &\textit{capital to sales}\ (-),\ \textit{investment}\ (+),\ \textit{Tobin's Q}\ (+),\ \textit{wages to labor}\ (+/-),\ \textit{labor}\\ &\textit{variability}\ (+/-),\ \textit{ownership concentration}\ (-),\ \textit{institutional ownership}\ (+),\ \textit{risk}\ (+/-),\\ &\textit{focus}\ (-)]. \end{aligned} \tag{2}$$

As for equation (1), the analysis is conducted with a discrete decision model, where the dependent variable takes the value of one if the firm adopts a stock option plan during a given year, and zero otherwise. Stock options are, in general, granted at the firm's annual general meeting typically held in April-May. Hence, the independent variables in equation (2) are measured at the end of the previous year. The independent variables are

[14] In practice, firms may simultaneously have several stock option plans in effect, involving several separate stock option tranches. In the subsequent analysis, firm-year observations and corresponding stock option compensation schemes are classified as targeted to top management, if all stock option plans in effect during a given year are targeted solely to the top management of the firm. On the contrary, if the firm has at least one stock option plan in effect targeted also to non-executive employees, the firm's stock option compensation scheme is classified as broad-based.

identical as in equation (1), with the exception that state ownership is omitted.[15] In line with Pasternack (2002a), equation (2) is estimated in two different forms, against two control samples. First, equation (2) is estimated solely for stock option introductions, where firm-year observations after the introductions are omitted. Secondly, equation (2) is estimated including both introductions and re-contracting events (follow-up contracts). Furthermore, the analysis is carried out using two types of control samples, a clean control sample and an extended control sample. The clean control sample consists of firms that have not introduced stock options throughout the sample period (1987 – 2000), and where the extended control sample consists in addition to the firm-year observations of the clean control sample of the observations for firms preceding the first introduction of stock option plans.

To investigate the third research question of the study, i.e., factors related to the time-dimensional contracting frequency, the following model is estimated:

Time from plan = f [*Size* (+/-), *Tobin's Q* (-), *wages to labor* (+/-), *labor variability* (-), *institutional ownership* (-), *foreign ownership* (-), *ownership concentration* (+), *state ownership* (+), *focus* (+/-)]. (3)

The time-dimensional contracting frequency of the firm is specified as the time (in years) since the most recently introduced stock option plan, measured at the end of the firm's accounting period. Equation (3) is estimated using ordinary least squares (OLS) regressions, and with regressions using firm-averages of the variables (between effects).[16]

The independent variables in equation (3) include the logarithm of sales to control for firm size. The relation between firm size and contracting frequency (time from plan) is ambiguous. On the one hand, large firms may find it necessary to contract more frequently over time to ensure optimal incentives, i.e., expected benefits of contracting are increasing in firm size. On the other hand, it is plausible to assume that the direct costs of contracting are increasing in firm size, thereby reducing the firm's incentive to contract. Furthermore, equation (3) includes Tobin's Q to measure growth opportunities. Based on the previous discussion, it is expected that ownership and incentive levels

[15] Due to the chosen design of control samples in the estimation of equation (2), this variable is omitted to maintain maximum sample sizes. That is, because of the limited number of firm-year observations involving state ownership, some of the sub-samples did not exhibit variation in the dependent variable in the cases (firm-year observations) involving state ownership.

[16] OLS regression establishes a relation between the dependent and independent variables based on comparisons both within and across firms. The between effects regressions using firm averages of the dependent and independent variables considers only variation across the firms in the sample.

deviate more rapidly from optimum in firms possessing high growth opportunities, and hence, a negative relation is expected between growth opportunities and time from plan. The employee attraction and retention motives discussed in Ittner et al. (2002), suggest that firms with a high degree of human capital (proxied by wages to labor ratio) may find it necessary to contract frequently to manage their stock of human capital over time. However, firms may, in fact, be substituting cash compensation for stock options, which in this context would imply less frequent contracting with stock options. Thus, the relation between wages to labor and time from plan is unclear. Firms operating in environments characterized by high labor variability are expected to maintain an active compensation policy over time. Hence, a negative relation is predicted between the degree of labor variability and time from plan. Institutional and foreign owners are expected to be interested in developing corporate governance and compensation structures, which suggests a higher frequency of contracting in these firms. This implies a negative relation between time from plan and both institutional and foreign ownership.

To control for the effect of monitoring of large shareholders, ownership concentration is included in equation (3). A high degree of ownership concentration is expected to increase the threshold for the firm's contracting decision, and hence, one expects that ownership concentration reduces contracting frequency. State ownership is included to explore the possibility that the decision-making process in these firms regarding the design and implementation of stock option plans is slower (subject to a higher degree of friction and costs) than in firms without this type of ownership. Equation (3) also includes a measure of firm focus to facilitate the analysis whether focused firms contract more frequently than diversified firms. Benefits of contracting are expected to be greater in diversified firms, because monitoring of the manager's effort is assumed to be more costly in diversified firms compared to focused firms. On the other hand, the operational environment is expected to be more volatile in focused firms than in diversified firms, which hence, would induce focused firms to contract more frequently to optimize incentive levels to changes in the firm's environment. Therefore, the relation between firm focus and time from plan is ambiguous. Finally, equation (3) is estimated in the OLS specification using year indicator variables to control for possible economy-wide factors.

To explore the last research questions of the study, namely, the determinants of stock option vesting schedules and contract maturity, the following models are estimated:

Time to vest = *f* [*Tobin's Q* (+), *risk* (+/-), *leverage* (-), *wages to labor* (+), *focus* (+/-), *state ownership* (+), *top management plan* (+/-)], (4)

Time to maturity = *f* [*Tobin's Q* (+), *risk* (+), *leverage* (+/-), *wages to labor* (+), *focus* (+/-), *state ownership* (+), *top management plan* (+/-)]. (5)

The dependent variables in equations (4) and (5), i.e., the length of vesting period and contract duration are constructed in three ways, namely, i) the minimum time (in years) until stock options become vested (exercisable), and correspondingly, expire, ii) the tranche weighted average time to vest (and expiration), and iii) the maximum time to vest (expiration). As an additional test, the dependent variables are constructed as the vest to maturity ratio, e.g., where the minimum vest to maturity ratio is calculated as the ratio of the minimum time to vest to the minimum time to maturity. The analysis is carried out for new contracting events in the sample, a total of 125 stock option plans. As mentioned earlier, option plans are typically granted at the firm's annual general meeting, typically held in April-May, and thus, the independent variables are measured at the end of the previous year.

Tobin's *Q* is used to measure growth opportunities. It is reasonable to assume that the value implications of managerial action are subject to greater uncertainty (not immediately observable) in firms with high growth opportunities. Given that the value implications are uncertain, where the uncertainty is gradually resolved over time, this implies that long-term contracting is important to motivate managers to engage in appropriate long-term value enhancing decisions (Fudenberg et al., 1990). As a result, a positive relation is expected between growth opportunities and both vesting period and contract maturity. The variance of stock returns is used to measure firm risk. The relation between firm risk and vesting period length is ambiguous. First, firm risk may be interpreted as a proxy for growth opportunities, since firms with high growth opportunities are likely to be riskier than their low-growth counterparts. This suggests a positive relation between firm risk and time to vest. Second, higher firm risk reduces the value that risk-averse and undiversified executives and employees place on equity-based compensation. However, to mitigate this reduction in value, firms may alter the design of equity incentives, e.g., through shorter vesting and/or longer duration. Hence, this suggests a negative relation between firm risk and time to vest. On the contrary, both explanations imply a positive relation between risk and time to maturity.

If financial leverage serves as a substitute for long-term equity incentives, then it is plausible to expect a negative relation between the level of debt and both vesting period and contract duration. Financial leverage may also proxy for growth opportunities and firm risk. Capital structure theories suggest that firms with valuable growth opportunities should choose lower leverage.[17] Therefore, a negative relation between financial leverage and both time to vest and time to maturity supports the argument that long-term contracting is more beneficial in firms possessing high growth opportunities. However, the probability of financial distress (bankruptcy) is an increasing function of financial leverage. Since higher firm risk is assumed to reduce the value that executives and employees place on equity-based compensation, firms may strive to lessen the value reduction through shorter vesting and/or longer duration. All of the presented arguments suggest that vesting periods are decreasing in financial leverage. On the contrary, the relation between time to maturity and financial leverage is uncertain.

The wages to labor ratio is included to proxy for the degree of human capital. A positive relation is expected between wages to labor and both time to vest and time to maturity, since long-term contracting is assumed to be more valuable in firms with a greater degree of human capital. Firm focus is used to proxy for monitoring costs. Under the assumption that monitoring of the manager's effort is more costly in diversified firms compared to focused firms it is plausible to assume that diversified firms motivate managers to pursue long-term (not immediately observable) value enhancing strategies by increasing vesting periods and contract duration of equity incentives. Hence, a negative relation between firm focus and both time to vest and time to maturity is consistent with the notion that the benefits of long-term contracting are increasing in the degree of monitoring costs. Alternatively, firm focus may be interpreted as a proxy for knowledge specialization. Kole (1997) argues that firms requiring specialized knowledge (human capital) are optimally expected to include stronger restrictions on equity awards, such as longer vesting periods. The same reasoning applies for contract duration, i.e., firms requiring specialized knowledge are expected to benefit from increasing the total duration of equity incentives. Therefore, the relation between firm focus and both time to vest and time to maturity is ambiguous.

State-owned firms are expected to favor the labor retention motive of stock option compensation. Hence, a positive relation is expected between state ownership and both time to vest and time to maturity. Finally, a variable indicating whether the firm's stock

[17] In empirical work, Smith and Watts (1992) found a negative relation between financial leverage and

option plan is targeted to top management is included to examine whether vesting restrictions and contract maturities differ conditional on target group. As observed by Core and Guay (2001), it is unclear whether firms grant equity incentives to non-executive employees for incentive purposes, because the ability of lower-level employees to influence the stock price through their individual actions is limited. Hence, it is plausible to assume that broad-based stock option plans are introduced primarily due to labor retention motives, implying longer waits to exercise stock options. However, retaining managerial skill may be more important than retaining the skill of lower-level employees. As a result, the relation between the target group of equity incentives and vesting restrictions is subject to ambiguity. The same is true for total contract duration. To control for possible economy-wide factors, year indicator variables are included.

3. Sample characteristics

This section contains a description of the utilized data sources. Furthermore, the section discusses sample selection issues and general characteristics of the sample. Finally, the section presents a descriptive analysis of the data.

3.1. Data sources

The utilized stock option data are obtained from Alexander Corporate Finance Oy (ACF), consisting of complete information on all stock option plans for Finnish firms during the time period 1987 – 2000. The data contain information regarding the introduction date of stock option plans, the target group, vesting schedules, expiration dates, exercise prices, number of shares obtainable upon exercise of stock options, and whether stock options are subject to dividend protection and/or performance-vesting/indexing. Firm accounting data are obtained from the Research Institute of the Finnish Economy (ETLA). Stock return data are collected from the database of the Swedish School of Economics and Business Administration (SSEBA), consisting of firm total stock returns. Ownership data are collected from *Pörssitieto* manuals and from the Finnish Central Securities Depository (FCSD).[18]

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growth opportunities.

[18] See, e.g., Grinblatt and Keloharju (2001) for details on these data sources.

3.2. Sample selection and characteristics

The sample in this study consists of firms traded on the main list of the Helsinki Stock Exchange (HEX). The sample construction is initiated by merging the ETLA 1998, 1999, 2000, and 2001-files for publicly traded firms on the main list of HEX. The total sample coverage is for the time period 1986 – 2000. Banks and insurance companies are excluded from the sample. After this, the accounting data from ETLA is combined with stock returns from SSEBA. This sample construction procedure results in 653 firm-year observations involving 99 firms.

In Finland, Lohja Corporation introduced the first public executive stock option plan at the end of year 1987. By the year-end of 2000, a total of 230 stock option plans have been implemented in Finland. The total number of stock option plans included in the study is 152, approximately 66% of the total number of plans in Finland.[19] After matching the sample with the data regarding stock option compensation from ACF, it is noticed that 38 of the sample firms use stock option compensation throughout the sample period, 19 firms have not introduced stock options during the sample period, and 42 firms have introduced (and in a few cases ceased the usage of) stock options during the sample period. The total number of firm-year observations with stock option plans in effect is 348 (53%), involving 80 firms (38+42). The number of firm-year observations with no stock option plans in effect is 305 (47%), involving 61 firms (19+42). Table 1 presents the general characteristics of the sample.

[Insert Table 1 here]

A total of 125 new contracting events (stock option introductions and follow-up contracts) appear in the sample. Of these 125 stock option plans, 90 were introduced solely to top management, whereas 35 were introduced to a broader group in the firm.[20] Of the 125 stock option plans introduced during the sample period, 49% involved dividend protection. In the contracting sample (348 observations), approximately 75% of the firm-year observations involve stock option plans targeted exclusively to top management. Furthermore, approximately 38% of the firm-year observations involve

[19] The fact that not all of the 230 stock option plans are involved in the sample is explained by the fact that a large number of stock option plans have been introduced in the latter part of the 1990s by firms traded on the other lists of the HEX (non-main listed firms). Furthermore, the financial statement information collected by ETLA is based on the 500 largest firms in Finland, which implies that a number of small firms traded on the main list of HEX do not appear in the sample.

[20] The first broad-based stock option plan was introduced in 1994 in the current sample.

stock option plans with dividend protection.[21] In addition, Table 1 presents the timing of stock option introductions and follow-up contracts during the sample period. As the table shows, contracting activity has increased rapidly in the latter part of the 1990s. Anecdotic evidence suggests that this phenomenon may be explained by factors such as the abolishment of restrictions concerning foreign ownership in 1993, joining the European Monetary Union (EMU), accompanied by the introduction of the euro in 1999, and the favorable development of market valuations in the late 1990s.

3.3. Descriptive statistics

Table 2 provides a descriptive analysis of the sample. Panel A reports descriptive statistics for the full sample (653 observations), whereas Panel B divides the sample into the contracting sample (348 observations) and the non-contracting sample (305 observations).

[Insert Table 2 here]

Several interesting observations can be made from the examination of Panel B in Table 2. As expected, firms that use stock options tend to be higher valued (based on Tobin's *Q*). In contrast to the findings of Mehran (1992), firms that use stock options display lower ratios of financial leverage. The contracting sample displays significantly higher average values for dividends to assets and wages to labor. In previous studies based on U.S. data, negative relations have been documented between dividends and executive stock options (Lambert et al., 1989; Fenn and Liang, 2001). A suggested reason for this phenomenon is the fact that executive stock options have usually not been dividend protected in the U.S.[22] In Finland, Liljeblom and Pasternack (2002) find a positive relation between dividend distributions and the scope of stock option plans, when stock options are dividend protected.

The average values for labor growth and operating cash flow to assets are significantly higher in the contracting sample compared to the non-contracting sample. These observations support the labor attraction and retention motives for stock options

[21] The firm's annual stock option scheme is classified as dividend protected, if at least one of the stock option plans are subject to dividend protection.

[22] According to Murphy (1999), only 1% of CEO stock options in the U.S. have offered dividend protection. In Finland, dividend protection has become increasingly popular in the latter part of the 1990s. The first stock option plan with dividend protection was introduced in Finland in 1997, and after 1997 approximately 70% of stock option plans have offered dividend protection.

(see, e.g., Ittner et al., 2002), and increased profitability due to the incentive alignment effect of equity incentives. Firms in the contracting sample tend to be larger, based on the measure of sales. Furthermore, ownership concentration is lower in the contracting sample, consistent with the argument that firms with a lack of monitoring by large shareholders may need to introduce equity incentives as a control mechanism (Hoskinsson and Turk, 1990).

Inspection of the average values for the risk measures reveals interesting facts. First, in accordance with previous empirical work (see, e.g., Shin and Stulz, 2000), unsystematic risk is much larger than systematic risk. Furthermore, the average values for total and unsystematic risk are significantly lower in the contracting sample compared to the non-contracting sample, whereas the measure of systematic risk is significantly higher, on average. Several studies in the U.S. have documented a positive relation between stock option granting and subsequent firm volatility (see, e.g., DeFusco et al., 1990). However, in accordance with the more recent literature regarding the disutility of unsystematic risk caused by personal hedging restrictions, the results may indicate that firms (managers), in fact, may try to alter the risk composition of the firm, i.e., by increasing systematic (hedgable) risk and reducing unsystematic (unhedgable) risk.[23]

Panel B of Table 2 also displays summary statistics for foreign ownership and stock option contracting frequency for the contracting sample. Data on foreign ownership is only available from October 1993 onwards, and hence, does not cover the entire contracting sample (318 of 348 observations). The average value of foreign ownership is 0.248, whereas the average value of contracting frequency (defined as the time in years since the last contracting event) is 1.997.

4. Empirical results

The empirical results of the paper are reported and discussed in this section. First, the section analyzes the relation between firm characteristics and the use of stock option plans. Second, the section provides estimation results on factors driving the introduction and revisions of stock option plans. Third, estimation results regarding factors associated with firms' time-dimensional contracting frequency are reported. Finally, the section

[23] This phenomenon has been documented by Campbell and Wasley (1999) in their well-known case study of equity incentives and managerial performance in Ralston Purina Company (J. Financial Econom. 51 (1999) 195–217). Specifically, they find that Ralston's unsystematic risk decreased significantly in the period (19 quarters) following the introduction of incentive contracts, compared to the period (19 quarters) preceding the introduction.

presents results concerning determinants of stock option vesting schedules and contract maturity.

4.1. What determines the use of stock option compensation?

Table 3 presents estimation results from probit models predicting the use of stock options. Panel A reports estimation results for unclassified stock option plans, Panel B reports results for top management stock option plans, whereas Panel C presents results predicting the use of broad-based stock option plans. All specifications are estimated in two forms, first, including a measure of total risk, and secondly, with risk decomposed into systematic and unsystematic components.

[Insert Table 3 here]

The results in Panel A of Table 3 suggest that predictions of principal-agent theory are quite adequate in predicting the use of stock options. First, the results indicate that large firms tend to use stock options, in accordance with predictions of Jensen and Meckling (1976), who argue that monitoring difficulty is increasing in firm size. Furthermore, the results suggest that the likelihood of using stock option compensation is increasing in Tobin's *Q*, which is consistent with previous evidence in the literature. The results suggest that a higher ratio of wages to labor reduces the likelihood of using stock option compensation. This observation is consistent with a substitution effect between cash compensation and stock options. In accordance with expectations, a higher degree of ownership concentration reduces the probability of using stock options, whereas institutional ownership increases this probability. Supporting the predictions of Beatty and Zajac (1994), higher firm (total) risk reduces the probability of using stock options as a form of compensation. However, when total risk is decomposed into systematic and unsystematic components, the results reveal that unsystematic risk is the driving force in this relation, with the coefficient of systematic risk being positive (not significant) and with the coefficient of unsystematic risk being negative and significant. Finally, the probability of stock option usage is significantly lower in focused firms, consistent with the argument that monitoring of the manager's effort is more difficult in diversified firms compared to focused firms, and hence, increases the need of incentives in diversified firms.

Panel B reports estimation results for the probability of using stock options targeted to top management. The results suggest that the likelihood of top management stock

option plans is increasing in firm size, consistent with the argument that firm size is a proxy for monitoring difficulty. Furthermore, the results lend support to a positive relation between the level of free cash flow and the likelihood of using stock options targeted to top management. Interestingly, the results fail to find a significant relation between Tobin's *Q* and the use of top management stock options, whereas several previous studies have documented significant positive relations between growth opportunities and executive equity incentives. The coefficients of the wages to labor ratio are negative and significant. This observation is also interesting, since if cash compensation serves as a substitute for stock options, then one would expect that the substitution effect would be stronger in the case of broad-based stock option plans. In line with expectations, a higher degree of ownership concentration reduces the likelihood of using stock options targeted to top management, whereas institutional ownership increases the likelihood. Finally, the results suggest that the probability of top management stock options is decreasing in firm focus.

In Panel C, the results indicate that the likelihood of broad-based stock option plans is decreasing in firm size. This is expected, since lower-level employees in large firms are less likely to be able to influence the stock price through their individual actions (Core and Guay, 2001). The results suggest that the likelihood of broad-based stock option plans is decreasing in the level of free cash flow. Hence, the result may be interpreted as the fact that firms with cash flow constraints grant stock options also to non-executive employees as a substitute for a lower capacity to pay cash compensation (Yermack, 1995; Core and Guay, 2001). Furthermore, the results show that the probability of broad-based stock option plans is decreasing in the level of investment, and increasing in Tobin's *Q*. The interpretation of these observations are difficult, if both investment intensity and Tobin's *Q* are taken as proxies for growth opportunities. The coefficients of ownership concentration are negative, however, only marginally significant (at the 10% level) in specification [I] of Panel C. Moreover, the coefficients of institutional ownership are positive, and in contrast, significant at the 1% level. State ownership seems to reduce the likelihood of using broad-based stock option plans. The Finnish State has traditionally been involved as an owner in a number of large Finnish firms, and hence, the negative relation is consistent with the size effect discussed previously. Finally, the results in Panel C suggest that unsystematic risk reduces the likelihood of using broad-based stock option plans.

4.2. Factors driving the introduction and revisions of stock option plans

Table 4 reports estimation results from probit models predicting introductions and revisions of stock option plans. Panel A reports estimation results against a clean control sample, i.e., firms that have not introduced stock options during the sample period, whereas Panel B reports estimation results against the full control sample, which involves in addition to the firms that have not introduced stock options also the years before a firm introduces stock options.

[Insert Table 4 here]

Examination of the table reveals evidence of the hypothesized positive relation between growth opportunities and equity incentives as in, e.g., Milgrom and Roberts (1992). The coefficient of Tobin's *Q* is positive and statistically significant in all specifications. Some evidence is found that higher labor variability drives the firm to adopt stock option plans, which lends support to the labor attraction and retention motive discussed by Ittner et al. (2002).

As expected, higher ownership concentration reduces the probability of adopting stock option plans, whereas the opposite holds true for institutional ownership. Finally, total firm risk and unsystematic risk do not seem to be related to the adoption of stock option plans. On the contrary, systematic risk seems to be related to contracting, with the coefficients of systematic risk being positive and statistically significant in all specifications.

4.3. Factors associated with contracting frequency

Table 5 reports estimation results regarding determinants of contracting frequency. Panel A presents results for the full contracting sample (348 observations), whereas Panel B reports results for the narrower contracting sample including foreign ownership (318 observations).[24] Estimations are conducted using OLS and regressions using firm-averages of the variables (between effects).

[Insert Table 5 here]

[24] The full contracting sample (348 observations) contains firm-year observations from the full time period under investigation, i.e., 1987 – 2000, whereas the narrower contracting sample (318 observations) contains

In line with expectations, the results show that firms with high growth opportunities tend to have a higher contracting frequency. The coefficients for Tobin's *Q* are negative and statistically significant in all estimated specifications. The results tend to be stronger in the OLS specifications (significant at the 1% level in both models). Hence, these results may be interpreted as the fact that in firms possessing high growth opportunities, incentive levels deviate more rapidly from optimum, causing the firm to contract more frequently over time. The coefficients for the wages to labor ratio are negative throughout the specifications, and statistically significant in the OLS regressions. This observation lends support to the notion that firms with a higher degree of human capital (proxied by the wages to labor ratio) need to contract more frequently to manage their stock of human capital over time.

The coefficients for state ownership are negative, and statistically significant in Panel B (at the 10% levels in both OLS and BE). This observation is rather interesting, if one assumes that contracting is more costly in firms involving state ownership. Finally, the coefficients for firm focus are negative in all specifications (significant at the 5% level for OLS in Panel A, and significant at the 10% level for BE in Panel B). This observation may also be interpreted in light of deviations from optimal incentive levels, i.e., focused firms may in a similar manner as firms with high growth opportunities be firms where optimal incentive levels shift more rapidly over time, causing firms to contract frequently.

4.4. Determinants of vesting schedules and contract maturity

Table 6 presents descriptive statistics for stock option vesting schedules, contract maturities, and vest to maturity ratios. Panel A reports statistics for all new contracting events in the sample (125 observations), whereas Panel B divides the sample into top management plans (90 observations) and broad-based plans (35 observations). Panel C divides the sample into contracts for firms possessing high growth opportunities (58 observations) and low growth opportunities (67 observations). Firms are classified as having high growth opportunities if the lagged value of Tobin's *Q* exceeds the corresponding sample annual median value.[25] In Panel A, the mean value for the

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firm-year observations from the time period 1993 – 2000. This is due to the fact that data on foreign ownership provided by the FCSD has only been available from October 1993 onwards.

[25] In 22 out of 125 observations, data on lagged explanatory variables are absent in the sample. To secure a reasonable sample size, current-year data are utilized in these cases. This procedure is not expected to bias the results, since firm characteristics are not expected to shift excessively fast from year to year.

weighted average time to vest is 3.335 years, whereas the mean value for the weighted average time to maturity is 6.256 years. The mean value for the vest to maturity ratio (weighted average) is 0.540. The average value for contract maturity is well below the usual average of 10 years documented in U.S. studies (see, e.g., Murphy, 1999).

[Insert Table 6 here]

Equality in means is tested in Panels B and C. In general, the average values for vesting schedules, contract maturities, and vest to maturity ratios are surprisingly homogeneous across the sub-groups. Statistically significant differences in means can be found in Panel B in the case of the vest to maturity ratio (minimum). The ratio of minimum time to vest to minimum time to maturity is significantly (at the 10% level) higher in the case of top management plans compared to broad-based plans. In Panel C, the vest to maturity ratio (maximum) is significantly (at the 10% level) higher in the high-growth opportunities group, compared to the low-growth opportunities group. On the whole, it seems that target groups of stock option plans and growth opportunities are not important factors related to vesting schedules or contract maturity.

Table 7 reports regression results explaining variation in vesting schedules and contract maturity. Panel A presents results regarding determinants of vesting schedules, whereas Panels B reports results regarding determinants of contract maturity. Panel C reports estimation results where the dependent variable is specified as the vest to maturity ratio. The dependent variables (vesting schedules, contract maturity, and vest to maturity ratios) are specified in three different forms, namely, i) the minimum time to vest (maturity), ii) the weighted average time to vest (maturity), and iii) the maximum time to vest (maturity). The vest to maturity ratios are constructed by dividing these measures. All estimations are conducted using OLS.

[Insert Table 7 here]

The results suggest that financial leverage is an important factor driving stock option vesting schedules. All coefficients of leverage are negative and significant at the 1% level in Panel A. The coefficients of state ownership are positive throughout the specifications in Panel A, and statistically significant in specifications [I] and [II], at the 1% and 10% levels, respectively. Reassuring the descriptive results in Table 6, growth opportunities (Tobin's *Q*) and the target group of stock option plans do not seem to be related to

vesting schedules. In Panel B, the results reveal a negative relation between firm focus and contract maturity. All coefficients of firm focus are negative, and statistically significant in specifications [I] and [II], at the 1% and 5% levels, respectively. Furthermore, the results suggest that state-owned firms have longer contract duration, with all coefficients of state ownership being positive, and significant at the maximum of 5%. Finally, in Panel C, the results reveal that financial leverage decreases the vest to maturity ratio, with all coefficients of leverage being negative and significant at the 5% level.[26]

5. Summary and conclusions

This paper addresses several questions in the compensation literature by examining stock option compensation practices of Finnish firms. First, the paper examines firm characteristics related to the use of stock options. The results suggest that principal-agent theory succeeds quite well in predicting the use of stock options. The results indicate that the likelihood of using stock options is increasing in firm size and growth opportunities, consistent with the arguments that monitoring costs increase in firm size and that compensation should be more closely tied to the stock price when the investment opportunity set is larger (see, e.g., Jensen and Meckling, 1976; Demsetz and Lehn, 1985; Milgrom and Roberts, 1992). Some evidence is also found for a substitution effect between cash compensation and stock options. Furthermore, ownership structure seems to be an important determinant for the use of stock options. A higher degree of ownership concentration reduces the likelihood of using stock options, whereas institutional ownership increases this probability. Finally, the results indicate that the likelihood of using stock options is decreasing in risk and firm focus. The former result is consistent with theory, which suggests that a trade-off should be made between providing incentives and optimal risk-sharing for managers and shareholders, such that incentives should decrease with firm risk. The latter result is consistent with the argument that monitoring of the manager's effort is more costly in diversified firms compared to focused firms.

[26] Pasternack (2002b) argues that the duration of equity incentives may be related to exercise prices of stock options. As a test of robustness, all specifications in Table 7 were re-estimated including the in-the-moneyness of stock options at the date of granting. The in-the-moneyness variable is defined as $[(S\text{-}X)/X]$, where S corresponds to the firm's stock price at the granting date, and where X is defined as the minimum exercise price of stock options granted. None of the in-the moneyness variables were found to be statistically significant, and including this variable did not alter any signs or significance levels of the estimated coefficients in Table 7.

The practice of granting stock options to lower-level employees has become increasingly popular among firms. However, several studies argue that it is somewhat difficult to justify this practice from a theoretical point of view (see, e.g., Core and Guay, 2001). Hence, this study examines whether the determinants of stock options targeted to top management differ from the determinants of broad-based stock option compensation. Some evidence is found that the factors driving these two types of incentives differ. Most importantly, the results indicate that the likelihood of top management stock options is increasing in firm size, whereas the opposite is true in the case of broad-based stock option plans. This is expected, since lower-level employees in large firms are less likely to be able to influence the stock price through their individual actions. Furthermore, the results indicate that the likelihood of broad-based plans is increasing in cash flow constraints, consistent with the notion that firms with cash flow constraints grant stock options to lower-level employees as a substitute for a lower capacity to pay cash compensation (Yermack, 1995; Core and Guay, 2001).

The documented positive relation between growth opportunities and the use of stock options becomes vague when incentives are classified as targeted solely to top management or to a broader group of employees. First, the results fail to find any significant relation between growth opportunities and the use of top management stock options. Second, the relation becomes ambiguous in the case of broad-based plans, depending on the measure of growth opportunities. Finally, the structure of the firm's business operations seems to influence the likelihood of using top management incentives, but not broad-based incentives. Specifically, the results suggests that the likelihood of using top management stock options is decreasing in firm focus, consistent with the argument that monitoring of the manager's effort is more costly in diversified firms compared to focused firms.

As a complement to the analysis of factors affecting the use of stock options over time, the paper extends previous research on factors driving introductions and revisions of stock option plans (Morgan and Poulsen, 2001; Pasternack, 2002a). Recent work regarding the relation between risk and incentives has shown that the value managers and employees place on equity incentives may be very different from their market value, due to inability of hedging unsystematic risk (Lambert et al., 1991; Carpenter, 1998; Meulbroek, 2001; Jin, 2002). Based on these insights, the effect of risk on the likelihood of stock option introductions and revisions is explored. The results reveal that systematic risk significantly increases the probability that firms adopt stock option plans, whereas total firm risk and unsystematic risk do not seem to matter.

Furthermore, the paper examines factors associated with time-dimensional contracting frequency. In accordance with previous work, e.g., Milgrom and Roberts (1992), it is assumed that expected contracting benefits are greater in firms with high growth opportunities. In a dynamic setting, the fact that the firm is characterized by high growth opportunities suggests that ownership and incentive levels deviate more rapidly from optimal levels than in stable firms with low growth opportunities. Supporting this notion, the results reveal that growth opportunities are an important determinant of firms' time-dimensional stock option contracting frequency. Specifically, high growth opportunities tend to increase this frequency.

Finally, the paper examines aspects largely unexplored in the literature, namely, determinants of stock option vesting schedules and contract maturity. The results reveal a negative relation between financial leverage and vesting period length. The conclusion remains the same if vesting is measured as the vest to maturity ratio. This result is consistent with several alternative arguments in the literature. First, financial leverage may serve as a substitute for long-term equity incentives (see, e.g., Jensen, 1986, 1993). Furthermore, the benefits of long-term contracting are assumed to be greater in firms with high growth opportunities (Fudenberg et al., 1990). Hence, the obtained result lends support to the substantial body of research showing that firm's with high growth opportunities tend to have lower degrees of financial leverage (see, e.g., Smith and Watts, 1992). Finally, higher firm risk reduces the value that risk-averse and undiversified executives and employees place on equity-based compensation. To mitigate this reduction in value, firms may reduce restrictions on equity incentives, e.g., by shorter vesting. The probability of financial distress is an increasing function of financial leverage, and thus, if one assumes that leverage is a proxy for firm risk, then the result that vesting periods are decreasing in financial leverage seems reasonable.

Furthermore, the results reveal that both vesting schedules and contract maturity tend to be longer in state-owned firms. These results corroborate the prediction that labor retention motives are emphasized in firms involving state ownership. In addition, the results suggest that the duration (time to maturity) of stock option plans tends to be shorter in focused firms compared to diversified firms. Treating firm focus as a proxy for monitoring costs (monitoring of the manager's effort is assumed to be more costly in diversified firms compared to focused firms), then the result is consistent with the argument that benefits of long-term contracting are increasing in the degree of monitoring costs.

Appendix A

This section describes the definitions and calculations of the employed variables. Data regarding firm variables are obtained from the Research Institute of the Finnish Economy (ETLA). Ownership data are obtained from *Pörssitieto* manuals and the Finnish Central Securities Depository (FCSD). Stock return data are obtained from the Swedish School of Economics and Business Administration (SSEBA). Data regarding stock option compensation are obtained from Alexander Corporate Finance Oy (ACF).

A.1. Firm variables

Investment: measured as gross investment in fixed assets during the accounting period divided by fixed assets (book value of gross plant, property, and equipment).

Leverage: measured as the book value of long-term debt divided by the book value of assets.

Dividend payout: measured as the total amount of dividends distributed during the firm's accounting period divided by the book value of assets.

Wages to labor: measured as the ratio of total labor costs during the firm's accounting period divided by the average number of employees during the corresponding period.

Labor growth: measured as the annual logarithmic change in the average number of employees.

Labor variability: measured as the absolute value of the annual logarithmic change in the average number of employees.

Operating cash flow: measured as the ratio of EBITDA to book value of assets.

Free cash flow: measured as the ratio of EBITDA less gross investment and total dividends to book value of assets.

Capital to sales: measured as the ratio of fixed assets (book value of gross plant, property, and equipment) to sales.

Firm size: measured as the logarithm of sales.

Tobin's Q: calculated as the sum of market value of equity and book value of total debt, divided by the book value of assets. Market values of equity are obtained from *KOP Pörssiyhtiöt* manuals and *Kauppalehti* databases.

Firm focus: Firm-year observations are classified as diversified or focused by analyzing the distribution of annual sales. The employed accounting data provided by ETLA specifies the firm's industry as the area where a minimum of 60% of sales are generated; otherwise the firm is categorized as multi-business. Hence, firm focus is measured as an indicator variable taking the value of one if at least 60% of annual sales are generated in a single segment, and zero otherwise.

A.2. Ownership variables

Ownership concentration: calculated as the fraction of shares held by the three largest shareholders. To filter out the effect of state ownership, ownership concentration is calculated excluding state ownership. For example, if the Finnish State is the second largest shareholder of the firm, then ownership concentration is calculated as the fraction of shares held by the first, third, and fourth largest shareholder of the firm.

Institutional ownership: measured as an indicator variable taking the value of one if a financial institution is among the three largest shareholders, and zero otherwise.

State ownership: measured as an indicator variable taking the value of one if the Finnish State is among the three largest shareholders, and zero otherwise.

Foreign ownership: measured as the fraction of shares held by foreign investors at the end of the firm's accounting period. Data on firm-specific foreign ownership have been available on a monthly basis from the FCSD from October 1993 onwards.

A.3. Risk measures

Total risk: calculated as the variance of daily stock returns during the firm's accounting period. The stock returns are total firm stock returns, and a minimum requirement of 60 daily stock returns is chosen as the restriction for inclusion of annual firm observations.

Systematic risk: estimated by a year-to-year market model regression based on daily stock returns, and calculated as the corresponding beta-squared multiplied by the variance of daily market index returns. The market index corresponds to the Helsinki Stock Exchange (HEX) Portfolio total return index. This index is a value-weighted index where all companies traded on the main list of HEX are represented. However, the weight of any individual company is limited to 10%, thus eliminating the dominance of a few extremely large firms traded on HEX (e.g., Nokia). This index is, however, only available for the time period 1991 – 2000. The market index employed during the years 1987 – 1990 corresponds to the WI-index calculated at the Swedish School of Economics and Business Administration. Knif (1988) argues that the WI-index describes the Finnish market portfolio and is well suited for the estimation of beta coefficients. Furthermore, the dominating effect of a few abnormally large Finnish firms traded on the main of list of HEX has only been a problem in the latter part of the 1990s.

Unsystematic risk: calculated as the residual variance from a year-to-year market model regression based on daily stock returns.

A.4. Stock option plan characteristics

The variable *Time from plan* is calculated for the contracting sample (348 observations) at the end of the firm's accounting period. The variables measuring stock option vesting schedules and contract maturity are calculated for new contracting events in the sample (125 observations) at the date of granting.

Time from plan: defined as the time (years) since the implementation of the firm's most recent stock option plan.

Minimum time to vest: calculated as the time (years) until the earliest vesting date (i.e., the date at which options become exercisable).

Weighted average time to vest: calculated as the weighted average time (years) until stock options become vested (exercisable). The weights used in the calculation correspond to the ratio of the number of shares obtainable upon exercise in each individual stock option tranche divided by the total number of shares obtainable upon exercise of all stock options.

Maximum time to vest: calculated as the time (years) until the most distant vesting date.

Minimum time to maturity: calculated as the time (years) until the earliest date when stock options expire.

Weighted average time to maturity: calculated as the weighted average time (years) until stock options expire. The weights are calculated in a similar manner as in the case of vesting schedules.

Maximum time to maturity: calculated as the time (years) until the most distant expiration date of stock options.

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Table 1
Sample characteristics

The sample covers the time period 1987 – 2000, and consists of firms traded on the main list of the Helsinki Stock Exchange (HEX). The number stock option plans in effect for the firms in the sample is 152, and the number of new contracting events in the sample is 125. Sample firms' outstanding stock option portfolios are examined annually, and classified in Panel A. [2] (lower section) as top management schemes, if all outstanding stock option plans are targeted to top management. If at least one stock option plan is targeted also to non-executive employees, the stock option scheme is classified as broad-based. In Panel A. [3], (lower section) the firm's outstanding stock option scheme is classified as dividend protected, if at least one outstanding stock option plan is subject to dividend protection.

Panel A. Sample characteristics					
A. [1] General characteristics		**A. [2] Target group of new option plans**		**A. [3] Dividend protection**	
Number of option plans in effect during sample period	152	Top management plans	90	Dividend protection	61
[%]	0.661	[%]	0.720	[%]	0.488
Total number of option plans in Finland [1987 - 2000]	230	Broad-based plans	35	No dividend protection	64
		[%]	0.280	[%]	0.512
A. [4] Firm characteristics		Total	125	Total	125
Total number of firms in sample	99				
Total number of firm-year observations	653	Firm-years with top management plans	262	Firm-years with dividend protection	132
-Option plans outstanding [all firm-years]	38	[%]	0.753	[%]	0.379
-No option plans outstanding [all firm-years]	19	Firm-years with broad-based plans	86	Firm-years with no dividend protection	216
-Introducing / ending option compensation	42	[%]	0.247	[%]	0.621
-Firms with option plans outstanding [38+42]	80	Total	348	Total	348
-Firm-year observations with option plans outstanding	348				
[%]	0.533				
-Firms with no option plans outstanding [19+42]	61				
-Firm-year observations with no option plans outstanding	305				
[%]	0.467				

Panel B. Timing of stock option plans					
B. [1] Introductions		**B. [2] Follow-up contracts**		**B. [3] New contracting events in sample**	
1987	1	1987	0	1987	1
1988	2	1988	0	1988	2
1989	3	1989	2	1989	5
1990	0	1990	1	1990	1
1991	0	1991	2	1991	2
1992	1	1992	0	1992	1
1993	4	1993	1	1993	5
1994	12	1994	2	1994	14
1995	3	1995	2	1995	5
1996	2	1996	4	1996	6
1997	5	1997	10	1997	15
1998	11	1998	14	1998	25
1999	7	1999	13	1999	20
2000	6	2000	17	2000	23
Total	57		68		125

Table 2
Descriptive statistics

The sample covers the time period 1987 – 2000, and consists of firms traded on the main list of the Helsinki Stock Exchange (HEX). Panel A reports summary statistics for the full sample, whereas Panel B divides the sample into the contracting sample, Panel B. [1], and the non-contracting sample, Panel B. [2]. Firm-year observations are included in the contracting sample if the firm has one or more stock option plans in effect; otherwise the observation is included in the non-contracting sample. A *t*-test (assuming unequal variances) is used to investigate equality in means in Panel B. The significance levels 1%, 5%, and 10% are denoted with ***, **, and *, respectively. All risk measures are multiplied by 100. See Appendix A for variable definitions.

Variable	Mean	Median	Std. Dev.	1st Quart.	3rd Quart.	Minimum	Maximum
Panel A.			**Full sample [653 observations]**				
Tobin's *Q*	1.448	1.065	1.586	0.914	1.371	0.428	22.770
Investment to capital	0.273	0.200	0.802	0.120	0.319	0.004	20.233
Long-term debt to assets	0.262	0.245	0.150	0.147	0.358	0.000	0.856
Dividends to assets	0.017	0.011	0.023	0.005	0.021	0.000	0.249
Wages to labor	0.191	0.186	0.063	0.150	0.223	0.053	0.611
Labor growth	0.049	0.025	0.331	-0.045	0.111	-3.017	5.082
Labor variability	0.148	0.077	0.300	0.033	0.155	0.000	5.082
Operating cash flow to assets	0.121	0.111	0.072	0.080	0.149	-0.242	0.486
Free cash flow to assets	-0.003	0.010	0.097	-0.038	0.056	-0.510	0.281
Capital to sales	0.628	0.464	0.974	0.280	0.705	0.002	13.367
Sales [€000.000]	1 184.613	509.778	2 190.132	145.314	1 249.468	24.219	30 375.917
Ownership concentration	0.345	0.306	0.197	0.196	0.451	0.016	0.970
Institutional ownership [1/0]	0.809						
State ownership [1/0]	0.124						
Firm focus [1/0]	0.799						
Total risk	0.083	0.060	0.076	0.039	0.097	0.001	0.612
Systematic risk	0.009	0.004	0.017	0.002	0.011	0.000	0.214
Unsystematic risk	0.074	0.052	0.072	0.033	0.086	0.001	0.608
Number of firms	99						

(*continues*)

Table 2 (*continued*)

Variable	Mean	Median	Std. Dev.	Minimum	Maximum	
Panel B. [1]		**Contracting sample [348 observations]**				*t*-value [equal means]
Tobin's *Q*	1.731	1.156	2.100	0.654	22.770	(5.29)***
Investment to capital	0.242	0.194	0.171	0.013	1.011	(-0.99)
Long-term debt to assets	0.237	0.230	0.137	0.001	0.694	(-4.41)***
Dividends to assets	0.022	0.015	0.027	0.000	0.249	(5.16)***
Wages to labor	0.203	0.202	0.064	0.065	0.590	(5.56)***
Labor growth	0.078	0.045	0.291	-3.017	0.985	(2.37)**
Labor variability	0.163	0.087	0.253	0.001	3.017	(1.31)
Operating cash flow to assets	0.139	0.127	0.075	-0.200	0.486	(7.20)***
Free cash flow to assets	0.003	0.017	0.102	-0.510	0.281	(1.44)
Capital to sales	0.652	0.479	1.090	0.055	13.367	(0.68)
Sales [€000.000]	1 499.300	568.559	2 812.251	32.628	30 375.917	(4.17)***
Ownership concentration	0.315	0.283	0.168	0.018	0.841	(-4.25)***
Institutional ownership [1/0]	0.868					
State ownership [1/0]	0.135					
Firm focus [1/0]	0.782					
Total risk	0.074	0.058	0.058	0.001	0.446	(-3.16)***
Systematic risk	0.011	0.005	0.022	0.000	0.214	(3.94)***
Unsystematic risk	0.063	0.050	0.047	0.001	0.302	(-4.19)***
Foreign ownership [318 obs.]	0.248	0.183	0.220	0.004	0.963	
Contracting frequency [years]	1.997	1.712	1.519	0.000	8.685	
Number of firms	80					
Panel B. [2]		**Non-contracting sample [305 observations]**				
Tobin's *Q*	1.124	0.985	0.399	0.428	3.464	
Investment to capital	0.308	0.213	1.159	0.004	20.233	
Long-term debt to assets	0.289	0.261	0.160	0.000	0.856	
Dividends to assets	0.013	0.008	0.016	0.000	0.091	
Wages to labor	0.176	0.174	0.059	0.053	0.611	
Labor growth	0.016	0.007	0.369	-2.733	5.082	
Labor variability	0.132	0.063	0.345	0.000	5.082	
Operating cash flow to assets	0.101	0.097	0.061	-0.242	0.329	
Free cash flow to assets	-0.008	-0.002	0.091	-0.438	0.211	
Capital to sales	0.601	0.444	0.824	0.002	12.942	
Sales [€000.000]	825.561	468.908	1 008.702	24.219	5 135.282	
Ownership concentration	0.381	0.335	0.221	0.016	0.970	
Institutional ownership [1/0]	0.741					
State ownership [1/0]	0.111					
Firm focus [1/0]	0.820					
Total risk	0.094	0.063	0.091	0.009	0.612	
Systematic risk	0.007	0.004	0.008	0.000	0.052	
Unsystematic risk	0.087	0.055	0.090	0.007	0.608	
Number of firms	61					

Table 3
Probit estimation results predicting the use of stock option plans

The sample covers the time period 1987 – 2000. The first top management stock option plan was introduced in 1987, whereas the first broad-based plan in the current sample was introduced in 1994. Panel A reports estimation results for the full sample. Panel B reports results predicting the use of top management stock option plans, whereas Panel C reports estimation results predicting the use of broad-based stock option plans. In Panel A, the dependent variable takes the value of one if the firm has a stock option plan in effect during a given year, and zero otherwise. In Panel B, the dependent variable takes the value of one if stock options are targeted solely to the top management of the firm, and zero otherwise. In Panel C, the dependent variable takes the value of one if the firm has at least one stock option plan in effect targeted also to lower-level (non-executive) employees, and zero otherwise. All specifications include a full set of year indicator variables (not reported). The *t*-statistics (reported beneath each regression coefficient) are calculated using robust standard errors. The significance levels 1%, 5%, and 10% are denoted with ***, **, and *, respectively. All risk measures are multiplied by 100. See Appendix A for variable definitions.

Independent variables	**Dependent variable**					
	Panel A. Stock option plan [1/0]		Panel B. Top management plan [1/0]		Panel C. Broad-based plan [1/0]	
	[I]	[II]	[I]	[II]	[I]	[II]
ln[sales]	0.155***	0.125**	0.193***	0.183***	-0.211***	-0.248***
	(3.00)	(2.25)	(4.18)	(3.77)	(-3.60)	(-3.95)
Zero-dividends [1/0]	-0.179	-0.156	-0.310	-0.298	0.113	0.150
	(-0.87)	(-0.76)	(-1.55)	(-1.48)	(0.32)	(0.43)
Long-term debt to assets	0.919*	0.909*	0.703	0.729	-0.477	-0.437
	(1.86)	(1.83)	(1.55)	(1.60)	(-0.70)	(-0.64)
Free cash flow to assets	-0.325	-0.202	1.279*	1.352*	-4.142***	-4.206***
	(-0.46)	(-0.27)	(1.81)	(1.87)	(-4.04)	(-4.08)
Capital to sales	0.002	-0.001	-0.060	-0.068	-0.079	-0.102
	(0.03)	(-0.01)	(-0.84)	(-0.91)	(-1.08)	(-1.37)
Investment to capital	-0.027	-0.036	0.008	0.003	-1.409**	-1.667**
	(-0.65)	(-0.87)	(0.16)	(0.06)	(-2.08)	(-2.36)
Tobin's *Q*	0.471***	0.430***	-0.005	-0.015	0.164***	0.143***
	(3.64)	(3.28)	(-0.12)	(-0.38)	(3.52)	(3.12)
Wages to labor	-3.924***	-4.020***	-3.761***	-3.763***	0.796	0.994
	(-2.94)	(-3.00)	(-2.73)	(-2.74)	(0.65)	(0.81)
Labor variability	0.480*	0.489*	0.319	0.325	0.685	0.724
	(1.67)	(1.73)	(1.55)	(1.58)	(1.50)	(1.54)
Ownership concentration	-1.105***	-1.020***	-0.698**	-0.666**	-0.756*	-0.708
	(-3.14)	(-2.88)	(-2.23)	(-2.12)	(-1.74)	(-1.63)
Institutional ownership [1/0]	0.794***	0.803***	0.290*	0.295**	0.671***	0.684***
	(4.54)	(4.57)	(1.96)	(1.99)	(2.87)	(2.95)
State ownership [1/0]	-0.250	-0.271	0.016	0.009	-0.614**	-0.673**
	(-1.24)	(-1.33)	(0.09)	(0.05)	(-2.33)	(-2.51)
Total risk	-2.298**		-1.229		-2.620	
	(-1.99)		(-1.25)		(-1.61)	
Systematic risk		8.322		1.617		4.259
		(1.14)		(0.41)		(0.96)
Unsystematic risk		-3.142**		-1.640		-5.246**
		(-2.25)		(-1.44)		(-2.41)
Firm focus [1/0]	-0.399***	-0.379**	-0.311**	-0.311**	0.082	0.088
	(-2.59)	(-2.46)	(-2.21)	(-2.20)	(0.38)	(0.42)
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
Log likelihood	-298.145	-297.048	-360.971	-360.715	-175.848	-174.767
Pseudo R-squared	0.339	0.342	0.179	0.180	0.187	0.192
Dep. variable [at 1 in %]	0.533	0.533	0.401	0.401	0.198	0.198
Number of observations	653	653	653	653	435	435

Table 4
Probit estimation results predicting introductions and revisions of stock option plans

The sample covers the time period 1987 – 2000. In specifications [I] and [II] in Panels A and B, the dependent variable takes the value of one if the firm introduces a stock option plan, and zero otherwise. In specifications [III] and [IV] in Panels A and B, the dependent variable takes the value of one if the firm introduces or adopts a follow-up stock option plan, and zero otherwise. Panel A reports estimation results using a control sample of firms that have not introduced stock options during the sample period. Panel B reports corresponding results against an extended control sample consisting of firms that have not introduced stock options, and firm-years before introduction for the firms that later introduce stock options during the sample period. The independent variables are measured at the end of the previous year. All specifications include a full set of year indicator variables (not reported). The *t*-statistics (reported beneath each regression coefficient) are calculated using robust standard errors. The significance levels 1%, 5%, and 10% are denoted with ***, **, and *, respectively. All risk measures are multiplied by 100. See Appendix A for variable definitions.

Independent variables	**Dependent variable**							
	Panel A. Clean control sample				**Panel B. Full control sample**			
	Introduction [1/0]		Introduction and follow-up [1/0]		Introduction [1/0]		Introduction and follow-up [1/0]	
	[I]	[II]	[III]	[IV]	[I]	[II]	[III]	[IV]
ln[sales]	0.207	0.031	0.250***	0.066	-0.061	-0.178	0.083	-0.031
	(1.50)	(0.18)	(2.70)	(0.61)	(-0.61)	(-1.49)	(1.16)	(-0.37)
Zero-dividends [1/0]	1.196*	1.067	0.780*	0.796*	0.701	0.660	0.572*	0.586*
	(1.76)	(1.54)	(1.79)	(1.81)	(1.55)	(1.44)	(1.71)	(1.72)
Long-term debt to assets	-1.780	-2.954	-0.015	-1.142	-1.146	-1.654	-0.195	-0.661
	(-1.11)	(-1.57)	(-0.02)	(-1.10)	(-1.15)	(-1.54)	(-0.28)	(-0.91)
Free cash flow to assets	-1.085	-2.222	-1.711	-2.328*	2.134	1.831	-0.220	-0.334
	(-0.64)	(-1.21)	(-1.24)	(-1.68)	(1.22)	(1.01)	(-0.19)	(-0.28)
Capital to sales	0.165	0.128	-0.007	-0.007	0.160	0.140	0.019	0.016
	(1.25)	(0.94)	(-0.05)	(-0.05)	(1.33)	(1.10)	(0.17)	(0.14)
Investment to capital	0.044	0.022	0.036	0.019	-0.073	-0.091	-0.022	-0.032
	(0.60)	(0.29)	(0.59)	(0.32)	(-1.26)	(-1.53)	(-0.44)	(-0.64)
Tobin's *Q*	1.158**	0.991**	1.239***	1.121***	0.754**	0.598*	0.899***	0.838***
	(2.45)	(2.06)	(3.34)	(3.40)	(2.49)	(1.91)	(3.88)	(3.66)
Wages to labor	-0.051	-1.260	-6.270*	-7.765**	1.215	0.280	-3.385	-4.547
	(-0.01)	(-0.27)	(-1.87)	(-2.20)	(0.34)	(0.07)	(-1.29)	(-1.62)
Labor variability	1.015	0.742	2.307**	2.006**	1.684	1.713*	0.408*	0.413*
	(0.72)	(0.55)	(2.33)	(2.02)	(1.60)	(1.70)	(1.65)	(1.71)
Ownership concentration	-3.636***	-2.942***	-3.106***	-2.271***	-1.728***	-1.324**	-1.326***	-0.935*
	(-3.66)	(-2.87)	(-4.60)	(-3.28)	(-2.93)	(-2.04)	(-3.11)	(-1.94)
Institutional ownership [1/0]	1.809***	1.896***	1.735***	1.802***	1.419***	1.484***	1.383***	1.409***
	(3.49)	(3.69)	(4.40)	(4.49)	(3.44)	(3.74)	(4.83)	(4.92)
Total risk	2.755		0.072		-3.184		-3.517	
	(0.60)		(0.03)		(-0.95)		(-1.51)	
Systematic risk		66.261*		78.948***		42.107**		43.853***
		(1.86)		(2.66)		(2.48)		(2.91)
Unsystematic risk		1.126		-2.259		-4.243		-4.743*
		(0.25)		(-0.96)		(-1.10)		(-1.76)
Firm focus [1/0]	-0.944**	-0.719	-0.928**	-0.858*	-0.160	-0.018	-0.219	-0.133
	(-2.05)	(-1.50)	(-2.20)	(-1.87)	(-0.56)	(-0.06)	(-0.97)	(-0.57)
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Log likelihood	-41.614	-40.402	-76.037	-72.483	-71.659	-69.347	-131.836	-127.669
Pseudo R-squared	0.473	0.488	0.478	0.502	0.304	0.326	0.381	0.401
Dep. variable [at 1 in %]	0.290	0.290	0.490	0.490	0.166	0.166	0.292	0.292
Number of observations	131	131	210	210	229	229	353	353

Table 5
Factors associated with time-dimensional contracting frequency

The sample covers the time period 1987 – 2000. The table reports estimation results using ordinary least squares (OLS), and using firm-averages of the variables (between effects, BE). Time from plan is calculated at the end of the firm's accounting period, and is defined as the time in years since the introduction of the firm's most recent stock option plan. Panel A reports estimation results for the full contracting sample (348 observations involving 80 firms), whereas Panel B reports estimation results for the narrower contracting sample including foreign ownership (318 observations involving 80 firms). The full contracting sample contains firm-year observations from the full time period under investigation, i.e., 1987 – 2000, whereas the narrower contracting sample contains firm-year observations from the time period 1993 – 2000. This is due to the fact that data on foreign ownership provided by the FCSD has only been available from October 1993 onwards. A full set of year indicator variables is included in the OLS specifications (not reported). The t-statistics (reported beneath each regression coefficient) are calculated using robust standard errors (OLS). The significance levels 1%, 5%, and 10% are denoted with ***, **, and *, respectively. See Appendix A for variable definitions.

Independent variables	**Dependent variable: Time from plan [years]**			
	Panel A. Contracting sample		Panel B. Contracting sample [including foreign ownership]	
	OLS	BE	OLS	BE
	[I]	[II]	[I]	[II]
ln[sales]	-0.059	0.008	-0.021	0.050
	(-0.86)	(0.09)	(-0.28)	(0.51)
Tobin's *Q*	-0.105***	-0.116**	-0.094***	-0.110*
	(-4.71)	(-2.30)	(-4.14)	(-1.96)
Wages to labor	-2.616**	-1.833	-2.374*	-0.960
	(-2.01)	(-0.98)	(-1.72)	(-0.47)
Labor variability	0.109	-0.103	0.031	-0.226
	(0.30)	(-0.19)	(0.08)	(-0.39)
Ownership concentration	-0.570	-0.638	-0.419	-0.646
	(-1.19)	(-0.88)	(-0.83)	(-0.83)
Institutional ownership [1/0]	-0.074	-0.226	-0.035	-0.188
	(-0.31)	(-0.65)	(-0.15)	(-0.50)
State ownership [1/0]	-0.365	-0.595	-0.438*	-0.761*
	(-1.51)	(-1.50)	(-1.76)	(-1.78)
Foreign ownership			-0.414	-0.397
			(-1.08)	(-0.63)
Firm focus [1/0]	-0.511**	-0.385	-0.426	-0.692*
	(-2.09)	(-1.12)	(-1.59)	(-1.88)
Year dummies	Yes	No	Yes	No
Adjusted R-squared	0.080	0.087	0.071	0.102
Number of observations	348	80	318	80

Table 6
Descriptive statistics for vesting schedules, contract maturities, and vest to maturity ratios

The sample covers the time period 1987 – 2000. Vesting schedules and contract maturities are calculated at the introduction date of stock option plans. Minimum time to vest is defined as the time in years until the earliest vesting date (stock options become exercisable). Weighted average time to vest is defined as the weighted average time in years until stock options become vested. The weights used in the calculation correspond to the ratio of the number of shares obtainable upon exercise in each individual stock option tranche divided by the total number of shares obtainable upon exercise of all stock options. Maximum time to vest is defined as the time in years until the most distant vesting date. Minimum time to maturity is defined as the time in years until the earliest date when stock options expire. Weighted average time to maturity is defined as the weighted average time in years until stock options expire. The weights used in the calculation are constructed identically as in the case of vesting schedules. Maximum time to maturity is defined as the time in years until the most distant expiration date of stock options. Panel A presents summary statistics for all new contracting events in the sample. Panel B divides the sample into top management plans, Panel B. [1], and broad-based plans, Panel B. [2]. Panel C divides the sample into firms classified as having high growth opportunities, Panel C. [1], and low growth opportunities, Panel C. [2]. The firm is classified as having high growth opportunities if the lagged value of Tobin's *Q* exceeds the corresponding sample annual median value. A *t*-test (assuming unequal variances) is used to investigate equality in means in Panels B and C. The significance levels 1%, 5%, and 10% are denoted with ***, **, and *, respectively. See Appendix A for variable definitions.

Variable	Mean	Median	Std. Dev.	1st Quart.	3rd Quart.	Minimum	Maximum
Panel A. All stock option plans			New contracting events in sample [125]				
Minimum time to vest [years]	2.685	2.732	1.132	2.030	3.093	0.008	6.079
Weighted average time to vest [years]	3.335	3.279	1.070	2.918	4.036	0.008	6.079
Maximum time to vest [years]	3.955	4.110	1.271	3.181	4.830	0.008	7.148
Minimum time to maturity [years]	6.144	6.060	1.460	5.595	6.781	2.562	11.668
Weighted average time to maturity [years]	6.256	6.077	1.351	5.744	6.888	3.437	11.668
Maximum time to maturity [years]	6.360	6.090	1.335	5.797	7.005	3.937	11.668
Vest to maturity ratio [minimum]	0.449	0.436	0.197	0.329	0.515	0.002	0.987
Vest to maturity ratio [weighted average]	0.540	0.532	0.178	0.452	0.640	0.002	0.989
Vest to maturity ratio [maximum]	0.627	0.658	0.196	0.515	0.766	0.002	0.990

(*continues*)

Table 6 (*continued*)

Variable	Mean	Median	Std. Dev.	Minimum	Maximum	
Panel B. [1] Top management plans			Number of contracts [90]			*t*-value [equal means]
Minimum time to vest [years]	2.766	2.908	1.203	0.008	6.079	(1.45)
Weighted average time to vest [years]	3.356	3.583	1.194	0.008	6.079	(0.45)
Maximum time to vest [years]	3.894	4.133	1.414	0.008	7.148	(-1.09)
Minimum time to maturity [years]	6.092	6.036	1.644	2.562	11.668	(-0.83)
Weighted average time to maturity [years]	6.237	6.042	1.508	3.437	11.668	(-0.32)
Maximum time to maturity [years]	6.370	6.084	1.477	3.937	11.668	(0.17)
Vest to maturity ratio [minimum]	0.466	0.441	0.208	0.002	0.987	(1.79)*
Vest to maturity ratio [weighted average]	0.545	0.554	0.197	0.002	0.989	(0.66)
Vest to maturity ratio [maximum]	0.616	0.658	0.219	0.002	0.990	(-1.24)
Panel B. [2] Broad-based plans			Number of contracts [35]			
Minimum time to vest [years]	2.477	2.471	0.909	0.827	4.718	
Weighted average time to vest [years]	3.280	3.181	0.663	2.032	4.718	
Maximum time to vest [years]	4.111	4.082	0.788	2.532	5.501	
Minimum time to maturity [years]	6.276	6.112	0.820	4.447	8.197	
Weighted average time to maturity [years]	6.305	6.112	0.838	4.447	8.197	
Maximum time to maturity [years]	6.334	6.112	0.888	4.447	8.296	
Vest to maturity ratio [minimum]	0.404	0.432	0.159	0.105	0.797	
Vest to maturity ratio [weighted average]	0.527	0.507	0.115	0.316	0.797	
Vest to maturity ratio [maximum]	0.654	0.659	0.120	0.419	0.893	
Panel C. [1] High growth opportunities			Number of contracts [58]			*t*-value [equal means]
Minimum time to vest [years]	2.689	2.693	1.122	0.438	6.079	(0.04)
Weighted average time to vest [years]	3.425	3.444	1.067	0.438	6.079	(0.88)
Maximum time to vest [years]	4.119	4.375	1.264	0.438	6.951	(1.35)
Minimum time to maturity [years]	5.988	6.066	1.607	2.847	11.668	(-1.10)
Weighted average time to maturity [years]	6.148	6.074	1.471	3.437	11.668	(-0.82)
Maximum time to maturity [years]	6.281	6.100	1.436	3.937	11.668	(-0.61)
Vest to maturity ratio [minimum]	0.460	0.460	0.183	0.062	0.987	(0.63)
Vest to maturity ratio [weighted average]	0.565	0.592	0.165	0.062	0.989	(1.49)
Vest to maturity ratio [maximum]	0.663	0.693	0.192	0.062	0.990	(1.97)*
Panel C. [2] Low growth opportunities			Number of contracts [67]			
Minimum time to vest [years]	2.682	2.918	1.149	0.008	5.047	
Weighted average time to vest [years]	3.256	3.181	1.074	0.008	5.150	
Maximum time to vest [years]	3.813	4.008	1.269	0.008	7.148	
Minimum time to maturity [years]	6.279	6.052	1.318	2.562	10.041	
Weighted average time to maturity [years]	6.349	6.090	1.242	3.562	10.041	
Maximum time to maturity [years]	6.428	6.090	1.249	4.011	10.041	
Vest to maturity ratio [minimum]	0.438	0.429	0.209	0.002	0.982	
Vest to maturity ratio [weighted average]	0.519	0.505	0.186	0.002	0.982	
Vest to maturity ratio [maximum]	0.595	0.612	0.196	0.002	0.982	

Table 7
Determinants of stock option vesting schedules, contract maturity, and vest to maturity ratios

The total sample coverage is 1987 – 2000. The analysis is conducted using new contracting events in the sample (introductions of stock option plans and follow-up contracts). Panel A reports estimation results for determinants of vesting schedules, Panel B reports estimation results for contract maturity, and Panel C reports estimation results for vest to maturity ratios. Vesting schedules and contract maturities are calculated at the introduction date of stock option plans. Minimum time to vest is defined as the time in years until the earliest vesting date (stock options become exercisable). Weighted average time to vest is defined as the weighted average time in years until stock options become vested. The weights used in the calculation correspond to the ratio of the number of shares obtainable upon exercise in each individual stock option tranche divided by the total number of shares obtainable upon exercise of all stock options. Maximum time to vest is defined as the time in years until the most distant vesting date. Minimum time to maturity is defined as the time in years until the earliest date when stock options expire. Weighted average time to maturity is defined as the weighted average time in years until stock options expire. The weights used in the calculation are constructed identically as in the case of vesting schedules. Maximum time to maturity is defined as the time in years until the most distant expiration date of stock options. The independent variables are measured at the end of the previous year. A full set of year indicator variables is included in all specifications (not reported). Estimation is conducted using OLS. The *t*-statistics (reported beneath each regression coefficient) are calculated using robust standard errors. The significance levels 1%, 5%, and 10% are denoted with ***, **, and *, respectively. All risk measures are multiplied by 100. See Appendix A for variable definitions.

Independent variables	**Dependent variable**								
	Panel A. Time to vest [years]			**Panel B. Time to maturity [years]**			**Panel C. Vest to maturity ratio**		
	Minimum [I]	Weighted average [II]	Maximum [III]	Minimum [I]	Weighted average [II]	Maximum [III]	Minimum [I]	Weighted average [II]	Maximum [III]
Tobin's *Q*	-0.029	0.005	0.030	-0.017	-0.010	-0.006	-0.003	0.001	0.004
	(-0.84)	(0.15)	(0.80)	(-0.29)	(-0.17)	(-0.09)	(-0.60)	(0.15)	(0.53)
Total risk	-0.790	-1.937	-2.817	-0.288	-1.483	-2.646	-0.238	-0.105	0.086
	(-0.31)	(-0.74)	(-0.88)	(-0.07)	(-0.38)	(-0.68)	(-0.43)	(-0.20)	(0.15)
Long-term debt to assets	-2.570***	-2.503***	-2.664***	-1.627	-1.520	-1.522	-0.336**	-0.338**	-0.365**
	(-3.34)	(-3.20)	(-2.81)	(-1.55)	(-1.51)	(-1.50)	(-2.33)	(-2.53)	(-2.50)
Wages to labor	-1.696	-0.296	1.625	2.858	2.720	2.593	-0.505*	-0.343	-0.095
	(-1.28)	(-0.21)	(0.81)	(1.41)	(1.41)	(1.38)	(-1.97)	(-1.42)	(-0.31)
Firm focus [1/0]	0.048	0.147	0.207	-0.846***	-0.595**	-0.358	0.080	0.072	0.055
	(0.15)	(0.44)	(0.53)	(-3.16)	(-2.35)	(-1.37)	(1.33)	(1.23)	(0.89)
State ownership [1/0]	1.053***	0.589*	0.140	1.284***	1.030***	0.789**	0.063	0.021	-0.014
	(3.59)	(1.81)	(0.34)	(3.51)	(3.06)	(2.39)	(1.31)	(0.42)	(-0.24)
Top management plan [1/0]	-0.083	-0.027	-0.030	-0.244	-0.144	-0.040	0.001	0.003	-0.008
	(-0.46)	(-0.16)	(-0.14)	(-1.07)	(-0.65)	(-0.17)	(0.02)	(0.11)	(-0.24)
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R-squared	0.215	0.045	0.001	0.286	0.260	0.197	0.140	0.026	0.025
Number of observations	125	125	125	125	125	125	125	125	125

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