What Drives Employee Stock Options Programs? Safeguarding Human Capital and Recruiting Wanted Skills

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*We believe that the investments in firm-specific human capital are at risk from employee turnovers and that a firm's productivity is improved when capital and skill are better matched. We extend the attraction and retention justifications associated with employee stock options programs by hypothesizing that such programs are used more often by firms that invest in employee training and new physical capital. Our hypotheses are largely borne out in our panel of 219 U.S. firms between 1990 and 1999. The empirical results support a positive association between the likelihood of employee stock option programs adoption and investments in employee training and physical capita*l.

INTRODUCTION

Employee stock options are contracts that give employees the right to buy a share of a firm's stock at a pre-specified exercise price and under pre-specified terms. Most employee stock options expire in ten years and are granted an exercise price equal to the market price on the date of the grant (i.e., at-the-money stock options). Typically, a grant of stock options cannot be exercised immediately, but only over time, and most commonly, employees can exercise stock options grants gradually over four to five years. Once a stock option is exercisable, the option becomes vested. Employee stock options are non-tradable, and are typically forfeited if the employee leaves the firm prior to vesting.

Since 1980, the use of stock options programs has been growing and is now a widespread practice. Broad-based stock options programs, adopted mainly by firms in the 1990s, can be generally defined as stock options for employees other than the firm's top five executives. In a 2001 study, the percentage of options held by non-executives was seen as a large share of total options outstanding (Core and Guay 2001). In 2002, it was reported that over 70 percent of options granted went to employees below the top five executives (Murphy 2002).

The literature generally supports a positive impact of broad-based stock options programs on firm performance (Sesil and Lin 2011). We do not replicate analyses of past research studies here. However, the results from these studies should not be interpreted causally, i.e., the employment of broad-based stock options programs does not necessarily cause a firm to have better performance or productivity. On the contrary, the results may reflect, at least in part, a selection mechanism by which those firms that are embedded with certain characteristics have chosen to adopt these programs. The results seem to suggest that there are strong economic incentives within some firms to disperse stock options broadly. In other words, the adoption of the program is not likely to be random; rather it is driven by the actors in the system who are most affected. This study examines the determinants of broad-based stock options programs in an attempt to shed some light on the selection mechanism[1].

The current literature attempts to justify the adoption decision with several arguments with some success. Among these, a majority of the literature seems to agree on the attraction and retention justifications in which a firm can attract and retain highly motivated, skilled, and optimistic employees by offering them stock options. We extend the findings of this observation by further stating the following: First, stock options serve as a mechanism to safeguard a firm's investment in firm-specific capital. Firms that have provided on-the-job training for their employees will aim for a low rate of voluntary turnover. Second, in the context of capital-skill complementarity, investment in additional physical capital may lead to adopting a stock options program in an attempt to recruit employees with wanted skills. To the best of our knowledge, the current literature remains silent on these two possible avenues, which is the major task we embark upon in this study.

This work is organized as follows. Section II covers literature review and introduces our hypotheses. Section III introduces our data set and empirical strategy. Section IV documents the estimation results. Section V concludes this study.

LITERATURE REVIEW AND HYPOTHESES

Literature Review

Incentive/Motivation

Several studies, employing some version of the standard Principal-agent theory, suggest that the introduction of stock options plans can be justified by the need to align interests between principals (shareholders) and agents (employees). When shareholders are too diffuse to monitor employees, corporate assets can be used for the benefit of employees rather than for maximizing shareholders' wealth. The provision of ownership rights reduces the incentive for agents' moral hazard since it makes their compensation dependent on their performance (Jensen 1983). The stock options program is then regarded as one way of attaining this goal. A reasonable case can be made for this action in stock options granted to top executives whose decisions affect the value of the firm. As discussed in Jensen and Murphy (1990), executives are provided with variable compensation and incentives through three primary mechanisms: (1) flow compensations, such as annual salary and bonus; (2) changes in the value of the CEO's portfolio of stocks and options; and (3) the market's assessment of the CEO's human capital. In 1980, CEO annual flow compensation was mainly in the form of salary and bonus (Hall and Liebman 1998) with only 30% of CEOs receiving new option grants. Mean salary and bonus was $655 thousand compared to $155 thousand from new option grants. By 1994, options had become a major component of CEO flow compensation with 70% of CEOs receiving new option grants, and mean option grants amounting to 1.2 million compared to $1.3 million in cash pay. Running through the statistics, one can immediately observe that stock options represent a large and significant proportion in a CEO's total compensation, which, in theory, leads to the relevance of the incentive effect[2].

However, as one moves deeper into the organization to employees subordinate to the executives and especially below management level, equity-based incentives take on a relatively less important role. In particular, while the size of the grants of stock options is small compared to total compensation, the incentive effect is probably ambiguous. Further, it runs into more difficulties when applied to stock options granted to employees without significant decision power. Individual actions of rank-and-file employees do not have a discernible effect on the firm's overall performance (Murphy 2002).

On the contrary, an alternative approach stressing a potential mutual monitoring effect of granting broad- based stock options on group rather than individual behavior (Kroumova and Sesil 2006; Lin 2009) emerges. Kandel and Lazear (1992) is an example of a contribution along these lines. They argue that group-based compensation programs (e.g., stock options programs) may actually induce employees to monitor the behavior of co-workers and impose social sanctions (peer pressure) on those employees who shirk from cooperative work group norms. Consequently, one can expect monitoring costs and mutual monitoring to drive the use of stock options programs for non-executive employees especially in large firms[3].

Attraction/Selection and Retention

The second approach to stock options programs based on the idea of sorting comes from the perception that option grants may attract employees with certain characteristics that are particularly valuable to the firm. Consider, for instance, by offering stock options, firms can hope to attract employees who are optimistic about the firm's particular prospects since this ties the employees' compensation with the firm's future performance. This, in turn, may contribute to a better working environment and more innovative practices. Firms may be able to attract individuals with a willingness to take more risk by offering such programs because stock options are embedded with the risk of stock price fluctuations. Furthermore, the vesting provisions of stock options programs also aid in retention. Firms can retain key employees, who can only exercise their stock options after they are vested in the program. Further, employee turnover becomes costly particularly while such separation constitutes the loss of firm-specific skills (Lin and Sesil 2011). Hence, if innovation and willingness to take risk are considered as important characteristics and if firms greatly value firm-specific human capital, we can expect firms to invest in attracting and retaining better motivated and better skilled employees by introducing the stock options program.

Existing Empirical Evidence on Alternative Determinants

According to the National Center for Employee Ownership (NCEO) data (Weeden, Carberry, and Rodrick, 1998), 91% of the firms surveyed initiated a broad-based stock options program as a means for improving employee attraction (selection) and retention. Ittner, Lambert, and Larcker (2003) summarize the relative importance of self-reported objectives in a sample of 194 new economy firms. Employee retention is the most often cited objective for stock options plans.

In a selection model, Lazear (1999) concludes that many facts regarding the prevalence of stock options programs are more consistent with selection than with providing incentives. Oyer and Schaefer (2004) reject an incentive-based explanation for broad-based stock options plans, and conclude that selection and retention explanations appear to be consistent with the data gathered from three distinct sources. Kroumova and Sesil (2006) conduct a cross-sectional and longitudinal analysis on a panel of firms and provide support to the claim that higher monitoring costs prompt firms to adopt and maintain employee stock options programs. Oyer and Schaefer (2003) document that if firms' option-granting decisions are driven by economic profit maximization, then the observed broad-based stock options grants are most consistent with explanations involving retention and attraction of employees.

Running through these academic discussions and evidence, one can immediately observe the lack of further detail available in the area of attraction and retention. Under what circumstances do adoption decisions emerge in an attempt to attract and retain valuable employees? To the best of our knowledge, the current literature remains largely silent on this critical question. Although it is implied that the major reason firms care about retention is to avoid the loss of firm-specific skills, stock options are a costly way of reducing turnover (Lazear and Gibbs 2008) since options introduce substantial risk into the compensation package. Given the rank-and-file employees' risk aversion, there will be a hefty risk premium the firm needs to pay. This may not be the most desirable way to accomplish the purpose of attraction and retention. Nonetheless, the program may carry its own significance given its widespread usage. We extend the current findings by examining alternative thoughts underlying the two justifications.

In what follows, we introduce two hypotheses that constitute the broad-based stock options employment decisions under the notion of attraction and retention. To the best of our knowledge, the lines of reasoning of the hypotheses have not been researched, and this is the major task we undertake in this study.

Hypotheses

Hypothesis A: Stock Options Are Used to Safeguard a Firm's Investments in Firm-Specific Training

Although it is true that firms value retention since a separation may lead to a loss in firm-specific human capital, such human capital is firm-specific in the notion that it is only valuable to the current employer and is thus non-transferable. According to Robinson and Zhang (2005), an investment in firm-

specific human capital is fairly risky from the point of view of individual employees, since the firm (ex post) may threaten not to use the services rendered by the investment as a way to extract a greater share of the surplus value that has resulted from this investment. Similarly, the employees may act much the same way to extract greater returns for themselves.

Equilibrium exists when both firms and employees refrain from paying for any investments in specialized human capital. On the other hand, this action may also seriously dilute a firm's competitive advantage. The human capital theory implies that there exists little incentive for firms to compensate employees for the firm-specific human capital since it is non-separable from the current employer. However, it is important to note that the vast majority of human capital exists somewhere between firm-specific and general (Stevens 1996; Becker 1993). The combination of the two boundaries suggests, therefore, that employee ownership may be used to encourage and safeguard investments in human capital. Employee-owned companies are the ultimate examples of governance structures that empower employees and protect investments in firm-specific human capital (Blair 1995; Inderst and Mueller, 2007). Firms that have provided on-the-job training for employees will aim for a low rate of turnover. Along these lines, granting stock options to non-executive employees, if properly structured, is hypothesized as having the ability to encourage and safeguard investments in firm-specific human capital via reduced voluntary employee turnover.

Hypothesis B: Stock Options Are Used in an Attempt to Improve the Match Between Physical Capital and Skill

As well documented in the literature, employee stock options are employed for the purpose of attracting and retaining individuals with specific characteristics such as a special taste for risk and motivation. Yet, another possibility emerges while firms experience production expansion. In the context of capital-skill complementarity (Griliches, 1969; Flug and Hercowitz, 2000), firms benefit from a better match of physical capital and employee skills. Indeed, Kruse (1993) argues that profit sharing firms may hire more capable (or skilled) employees. During expansions, firms are more likely to invest in the latest physical capital, which leads to higher production premiums if matched with the right set of skills. This argument is further implied by the uneven distribution of stock options inside a firm. According to a survey by the National Center for Employee Ownership (NCEO), besides the stock options issued to executives, 52% of options allocated to such employees who could be assumed as valuable employees. Hence, we conjecture that investments in physical capital lead to a positive employment of broadly dispersed stock options as a means to obtain a better match.

DATA AND EMPIRICAL STRATEGY

Our initial data set comes from the National Center for Employee Ownership (NCEO) [4]. Using its own resources and knowledge of the field, as well as information obtained from the media and consultants, NCEO identified a total of 563 public and private companies from different industry sectors reported as sponsoring some form of broad-based stock options plans. From this list, the NCEO had information on the start year of broad-based stock options plans for 193 firms. Using the original list of 563 firms, the start dates for another 98 firms were confirmed. This was accomplished through survey data collected in 2001 and early 2002 and by examining SEC 10-K and 8-K forms between the years 1983 and 2002[5]. In total, there are 291 public and private companies with a confirmed adoption year. While broad-based stock options are generally defined as the options grants toward employees below the top 5 executives, adopting such a broad definition may cloud the empirical analysis since the options granted to the executives/managers right below the top 5 level (such as the 6th, 7th… executives) may have quite different implications than the grants toward *non-management* employees on the program impact and determinants (e.g., Core and Guay ,2001).

For the purpose of this study, we follow NCEO's definition of broad-based stock options plans as the plan with at least 50 percent of non-management employees who received stock options. Conventionally, broad-based stock options programs were largely adopted by firms in the 1990s. This is confirmed on the NCEO list. Of the 291 firms with an identified adoption year, only 79 (27%) adopted the program outside the

1990s. We retain only those firms with adopting years from 1990 to 1999 for the following reasons. First, firms that employed the program in other time periods may be structurally different from those adopted in the 1990s. To reduce the impact of such unobserved heterogeneity, we analyze only those firms that adopted the program in the 1990s. Second, while it remains possible that other compensation schemes may carry similar effects as stock options programs, it is less likely that firms simultaneously adopt these programs for a shorter time period as in the current study (Blasi and Kruse 2006). The information on start years was then combined with 2006 Standard and Poor COMPUSTAT's full coverage, firm-level data for 1990-1999. After eliminating missing values on such interested variables as sales and employment, we arrived at an unbalanced panel of 86 firms and 676 observations as our *adopters*. The total number of adopters retained in this study reduced substantially from 291 to 86. The reasons for the drop were twofold: First, among the 291 public and private firms in NCEO, 206 appear to be public firms. Second, within these 206 firms, 120 companies are eliminated due to either missing data (59 firms) or adoption year outside the 1990s (61 firms).

Table 1 compiles the industry distribution of the 86 adopting firms. The adopters are drawn from 31 industries and more skewed toward the new economy[6] industries. In line with the literature, firms that adopt employee stock options programs are more likely new economy firms.

TABLE 1
INDUSTRY COMPOSITION OF THE ADOPTING FIRMS

		Adopters		COMPUSTAT firms	
SIC	**Industry Name**	**# of firms**	**Percentage**	**# of firms**	**Percentage**
2040	Grain Mill Products	1	1.16%	16	0.17%
2621	Paper Mills	1	1.16%	23	0.25%
2810	Industrial inorganic chemicals	1	1.16%	24	0.26%
2820	Plastic, synthetic materials; ex glass	1	1.16%	10	0.11%
2834	Pharmaceutical preparations	2	2.33%	210	2.25%
2836	Biological products, ex diagnostics	1	1.16%	142	1.52%
2911	Petroleum refining	1	1.16%	45	0.48%
3312	Steel works & blast furnaces	1	1.16%	41	0.44%
3452	Bolt, nut, screw, rivets, washers	1	1.16%	6	0.06%
3533	Oil & gas field machy, equip.	1	1.16%	18	0.19%
3559	Special industry machinery, nec.	6	6.98%	61	0.65%
3569	General indl mach &eq., nec.	1	1.16%	17	0.18%
3571	Electronic computers	3	3.49%	26	0.28%
3572	Computer storage devices	4	4.65%	33	0.35%
3576	Computer communications quip.	5	5.81%	68	0.73%
3577	Computer peripheral eqip., nec.	1	1.16%	61	0.65%
3620	electrical industrial apparatus	1	1.16%	20	0.21%
3661	Tele & telegraph apparatus	4	4.65%	72	0.77%
3663	Radio, TV broadcast, comm. eqip.	2	2.33%	101	1.08%
3674	Semiconductor, related device	12	13.95%	140	1.50%
3823	Industrial measurement instr.	1	1.16%	32	0.34%
3825	Elec. meas & test instruments	4	4.65%	42	0.45%
3826	Lab analytical instruments	2	2.33%	44	0.47%
3829	Meas & controlling dev., nec.	1	1.16%	31	0.33%
3841	Surgical, med instr, apparatus	3	3.49%	65	0.70%
3844	X-ray & related apparatus	1	1.16%	14	0.15%
3845	Electro. medical apparatus	4	4.65%	102	1.09%
3861	Photographic equip. & supply	1	1.16%	23	0.25%
7370	Computer programming, data process	2	2.33%	290	3.10%
7372	Prepackaged software	16	18.60%	517	5.53%
7373	Computer integrated system design	1	1.16%	169	1.81%
	Total	86	100%		

Total COMPUSTAT population firms: 9343

Table 2 and Figure 1 demonstrate the distribution of the adopting year, while showing that there does not seem to be an adopting year clustering pattern. This helps to rule out a year-trend on adoption.

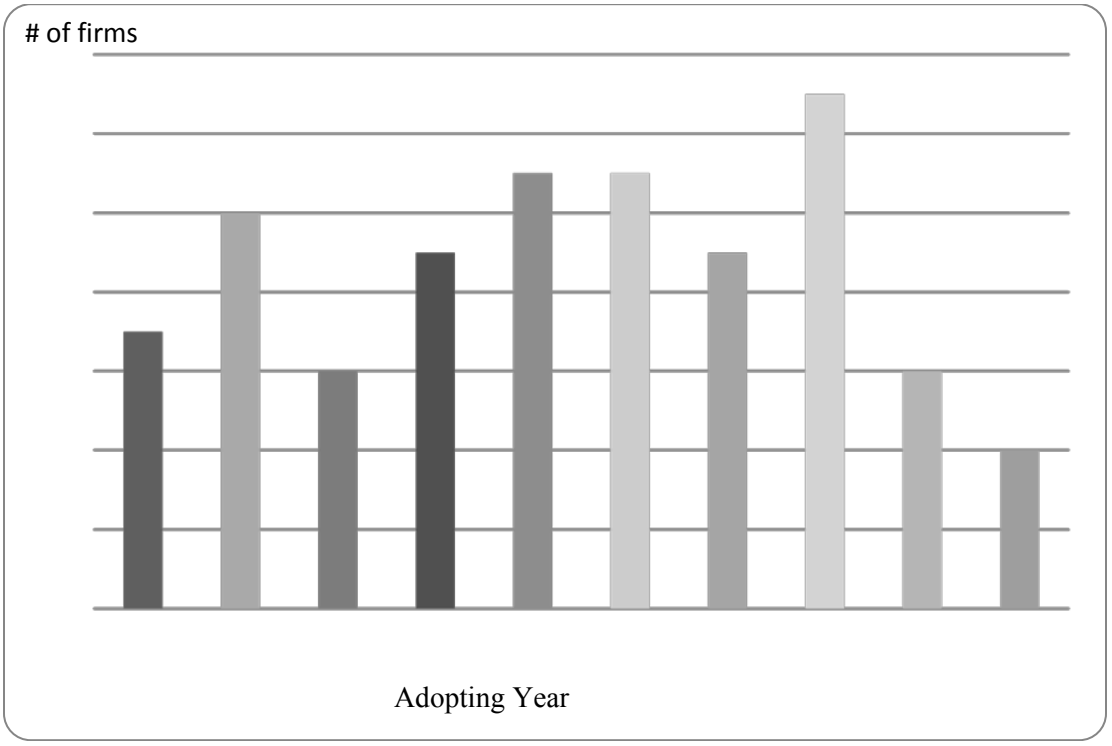
TABLE 2
ADOPTING YEAR DISTRIBUTION

Adopting Year	# of firms
1990	7
1991	10
1992	6
1993	9
1994	11
1995	11
1996	9
1997	13
1998	6
1999	4
Total No. of Firms	86

One potential drawback of the NCEO data set is that it includes only those firms that eventually adopted broad-based stock options programs; therefore, it is not possible to compare them with firms that did not have these programs. Comparing adopting and non-adopting firms, however, is an important part of our analysis, where NCEO data set is added to our own set of "peer" control firms. The control group of non-adopting firms comprises firms that are similar in size and within the same industry as firms in the NCEO sample (adopters). The idea is that firms that operate within the same industry and are similar in size will tap into the same labor market and thus employ human capital of similar quality. These firms may also use similar human resource management practices.

To construct the control group, we identified, for every adopter, the next largest or the next smallest (in terms of total employment) or both (if available) non-stock options companies within the same 4-digit industry classification. This was done by first excluding the stock options firms (the NCEO list) from the COMPUSTAT population of firms and then matching each broad-based stock options firm to the non-stock options companies at the adoption year. We arrived at 133 firms with 933 observations as the non-stock options "peer companies". One advantage of constructing a control group in such a way is that it helps to control much of the industry-specific factors. In order to convert nominal numbers into real terms, the variables to the 1997 dollar are deflated using the GDP deflator.

FIGURE 1
ADOPTING YEAR DISTRIBUTION



To summarize, there are 219 firms with 1609 observations in total. This allows for an in-depth empirical investigation of the determinants of broad-based stock options programs that could not be conducted in the previous literature, including the literature using the original NCEO dataset. We estimate the probability of adopting a broad-based stock options program as a function of a list of firm characteristics. The model is

$$P(BBD_{i,t} = 1 \mid x_{i,t-1}) = PA(\alpha + \beta_1 * lnemp_{i,t-1} + \beta_2 * lncapitalint_{i,t-1} + \beta_3 * lnRandDemp_{i,t-1} + \beta_4 * lnproducitivty_{i,t-1} + \beta_5 * MBratio_{i,t-1} + \beta_6 * lnSGAemp_{i,t-1} + \beta_7 * lncapitalinvestment_{i,t-1} + \beta_8 * DAratio_{i,t-1} + \beta_9 * New\ Economy_{i,t} + \beta_y * Year\ dummies) \quad (a)$$

where *PA* stands for the population-averaged logit model.

$BBD_{i,t}$ is a dummy variable indicating the appearance of a broad-based stock options program in firm *i* at year *t*.

$lnemp_{i,t-1}$ is the natural log of total employment of firm *i* in year *t-1*

$lncapitalint_{i,t-1}$ is the natural log of total capital stock per employee of firm *i* in year *t-1*

$lnRandDemp_{i,t-1}$ is the natural log of research and development expenditure per employee of firm *i* in year *t-1*

$lnproductivity_{i,t-1}$ is the natural log of total sales per employee of firm *i* in year *t-1*

$MBratio_{i,t-1}$ is the market-to-book ratio of firm *i* in year *t-1*

$lnSGAemp_{i,t-1}$ is the natural log of sales, general, and administrative expenditure per employee of firm *i* in year *t-1*

$lncapitalinvestment_{i,t-1}$ is the natural log of capital investment per employee of firm *i* in year *t-1*

$DAratio_{i,t-1}$ is the debt-to-asset ratio of firm *i* in year *t-1*

$New\ Economy_{i,t}$ is a dummy variable indicating whether the firm belongs to the new economy industries[6].

Logit specification is adopted for a more consistent estimator yielded in panel data (Hsiao 1986). Based on past studies (e.g. Kroumova and Sesil, 2006), total employment is used as the proxy variable for the motivation/mutual monitoring arguments and supplemented by capital stock. The two variables are expected to yield a positive sign revealing a concern of monitoring costs, but carry a negative sign if firms adopt the program as a way to motivate employees, particularly, since the concern of free riding is at a minimum in smaller firms. Research and development expenses are employed as the proxy variable in an effort to examine the general selection and retention justifications. This is then supplemented by the market-to-book ratio.

The two variables are anticipated to carry a positive sign if attraction and retention of employees is a major program adopting consideration. We attempt to examine the two alternative avenues underlying attraction and retention mechanisms as outlined in Hypotheses A & B by employing two variables – selling, general, and administration expenses (hereafter: SGA) and capital investment. SGA is utilized because it includes outlays related to employee training as well as to brand promotion, distribution channels, and information systems (Lev and Radhakrishnan 2003). Thereby, SGA is associated with investments in firm-specific human capital. If the adoption decision is in an attempt to secure and encourage such investments, SGA is expected to be positively related to the likelihood of adoption. Lastly, as outlined in Hypothesis B, in an attempt to promote a better match of capital and skill, firms are more likely to disperse stock options broadly when they are on the verge of a growing stage. Accordingly, we employ capital investment to examine this hypothesis.

We attempt to provide additional control for firm size by normalizing selected firm characteristics by total employment. Although this way of normalizing will make the independent variables a function of firm size, it is unlikely to contaminate the estimated parameters. The new economy dummy variable aims at providing more control over industry effects. To avoid inconsistency in resulting standard errors due to serially correlated outcomes, all standard errors (and hence z statistics) are clustered by firms. Consequently, all our estimates are calculated in this fashion as a means to obtain more robust inferences (Bertrand, Duflo, and Mullainathan 2004).

Endogeneity is a key and serious issue for the kind of analysis conducted in this research. In general, endogeneity refers to the fact that an independent variable included in the model is potentially a choice variable, correlated with observables or unobservables relegated to the error term. Wooldridge (2001) lists three common sources of endogeneity: (1) simultaneity, (2) omitted variables, and (3) measurement error. We believe simultaneity and omitted variables are the most relevant sources that could largely undermine the effort and the results in the current work. Simultaneity arises when at least one of the explanatory variables is determined simultaneously along with the dependent variable. If so, the disturbance and the explanatory variable will be correlated, leading to the endogeneity bias. In the current framework, such bias exists when companies have pre-existing high productivity or when companies have been on an upward growth path in productivity and are more likely to adopt broad-based stock options programs (i.e., reverse causality). Hence, it is important to include a measure of productivity as a predictor. In fact, the pre-adoption levels in all independent variables are used to avoid such a problem.

The second source of endogeneity (i.e., omitted variable bias) may arise during some alternative compensation schemes that carry similar attraction and retention effects but are omitted from the estimation. It would be ideal to include the variables that help to control for such a source of bias. However to our knowledge, such a data is not available. Nonetheless, we believe the bias (if there is any)

is at the minimum in our framework for the following two reasons. First, there is little evidence supporting a correlation of the adoption decisions of employee stock options programs and other similar compensation schemes. Even the decisions are related, the shorter time periods (1990-1999) in our estimation help to control such a bias since it is unlikely that firms would adopt compensation programs with similar effects in a short period of time. Second, if the employment decision of employee stock option programs was affected by some pre-existing compensation schemes that carry similar attraction and retention effects, the impact is captured by the constant term but at the expense of assuming the unobservable remains constant over our analyzed periods. Yet, according to Cole (1898), once a human resource practice is adopted, it is unlikely to be discontinued. Consider, for instance, Employee Stock Ownership Plan (ESOP). ESOP is a type of employee benefit plan, similar in some ways to a profit-sharing program. According to NCEO, ESOPs are a very common form of employee ownership in the United States. They have been growing in strength since about 1974. In an ESOP, a company sets up a trust fund, into which it contributes new shares of its own stock or cash to buy existing shares. Shares in the trust are allocated to individual employee accounts. As employees accumulate seniority with the company, they acquire an increasing right to the shares in their account, a process known as vesting. Employees must be 100% vested within 3 to 6 years, depending on whether vesting is all at once or gradual. Hence, similar to a broad-based stock options program, ESOP provides employees a way to participate in firm growth. Thus, we can conjecture that these programs might be considered to be substitutes, perceived to have the same attraction and retention effects (Kim and Ouimet, 2008). The constant term in our statistical model could help to capture this effect.

Table 3 summarizes the proxy variables in this study. Debt-to-asset ratio is added as an additional control due to the fact that a broad dispersion of stock options does not constitute a cash outlay, which is more of a concern under cash constraints. Table 4 provides the summary statistics of the variables in equation (a).

TABLE 3
PROXY VARIABLES FOR ADOPTING AND MAINTAINING JUSTIFICATIONS

Adoption Justifications	Proxy Variables
Motivation/Mutual Monitoring	(1) Total Employment[1] (2) Capital Intensity[2]
Attraction	(1) Research and Development expenses per employee[3] (2) Market-to-Book Ratio[4]
Retention	(1) Research and Development expenses per employee[3] (2) Market-to-Book Ratio[4]
Reward	(1) Productivity[5]
Investment in firm-specific human capital	(1) Sales, General, and Administrative Expenditure (SGA) per employee[6]
Capital-Skill Complementarity	(1) Capital Investment per employee[7]
Cash Constraint	(1) Debt to Asset Ratio[8]

1. Total employment is the total number of employees excluding temporary ones.
2. Capital intensity is measured by net Property, Plant, and Equipment (COMPUSTAT data #8) per employee
3. Research and Development expenses is the R&D expenses a firm incurred in a year.
4. Market to Book ratio is calculated as (Adjusted fiscal year ending stock price/ total common equity).

5. Productivity is calculated as (Total Sales/total employment)
6. The Sales, General, and Administrative Expenditure is obtained from COMPUSTAT data #189.
7. The capital investment figures are obtained from COMPUSTAT data #30.
8. Debt to Asset Ratio is computed as (Total Debt/Total Assets)

TABLE 4
VARIABLE DEFINITIONS AND DESCRIPTIVE STATISTICS

Variable	Definitions	Means	Standard Deviations
BBDt	Dummy variable indicating the presence of broad-based stock options program in year t	0.273	0.45
lnEmpt-1	Natural log of total employment in year t-1	0.495	1.77
lnCapitalintt-1	Natural log of total capital stock per employee in year t-1	3.478	0.93
lnRanddempt-1	Natural log of research and development expenditure per employee in year t-1	2.586	1.18
lnProductivityt-1	Natural log of total sales per employee in year t-1	5.186	0.57
MBratiot-1	Market to Book ratio in year t-1	16.115	385.56
lnSGAempt-1	Natural log of sales, general, and administrative expenditure per employee in year t-1	4.06	0.738
lnCapitalinvestmentt-1	Natural log of capital investment per employee in year t-1	2.263	0.988
DAratiot-1	Debt to Asset ratio in year t-1	0.11	0.145
New Economy	Dummy variable indicating New Economy industries	0.51	0.5

No. of Observations – 1609
No. of Firms – 219

ESTIMATION RESULTS

By the way of constructing a control group, we are able to assign a "virtual" adopting year to control firms corresponding to their adopting peers. Consider, for instance, firm A adopted a broad-based stock options program in 1995. Firm AA is identified as firm A's controlling peer and would be assigned a virtual adopting year of 1995. This enables us to do a preliminary comparison between adopters and their controlling peers, in particular, during pre-adoption periods. Table 5 shows the comparisons between adopters and their controlling peers, both in overall level and in pre- and post-periods. Generally, the adopting firms show higher levels of employment, capital intensity, research and development expenditure, productivity, market-to-book ratio, SGA expenditure, capital investment, but slightly lower debt-to-asset ratio. These lead to the following observations, at least in terms of basic summary statistics. First, in line with the monitoring cost argument, large firms and firms with higher monitoring difficulties are more likely the adopters. Second, more productive firms tend to employ the broad-based program in which rises the concern of reverse causality. Third, firms with more growth potential are more likely to disperse stock options broadly. Fourth, the program is more likely to be adopted to safeguard the investment in firm-

specific capital as evidenced by the generally higher SGA expenditures experienced by the adopters. Fifth, it is likely that firms on the verge of an expansionary stage engage in attracting better-skilled employees by introducing the stock option program. Sixth, the employment of the employee stock options program does not seem to be driven by the need of reducing cash outlay. Generally, the summary statistics support hypotheses A and B. To gain more insight into the program adopting decision-making, we turn to a formal statistical method – model (a).

TABLE 5
PRE AND POST COMPARISONS

		Adopters			**Non-adopters**	
Variable	**Overall**	**Pre**	**Post**	**Overall**	**Pre**	**Post**
Employment	11.069 (23.16)	19.247 (32.29)	6.682 (14.53)	5.993 (12.89)	7.727 (13.57)	5.088 (12.43)
Capital Intensity	64.242 (80.16)	73.496 (100.09)	59.278 (66.69)	46.671 (68.94)	52.400 (95.81)	43.681 (49.27)
R and D expenditure per employee	30.036 (26.77)	19.076 (18.52)	35.915 (28.62)	18.915 (19.53)	15.246 (16.27)	20.831 (20.79)
Productivity	250.898 (144.54)	235.008 (157.20)	259.421 (136.69)	195.121 (149.23)	195.902 (181.49)	194.713 (129.40)
Market to Book Ratio	25.223 (540.10)	3.044 (8.47)	37.118 (669.38)	2.595 (21.53)	0.533 (23.61)	3.669 (20.30)
SGA expenditure per employment	87.310 (50.68)	67.597 (42.81)	97.883 (51.46)	67.455 (57.47)	59.119 (40.19)	71.806 (64.28)
Capital Investment per employment	18.981 (18.88)	18.900 (19.94)	19.025 (18.31)	12.782 (16.473)	12.959 (16.57)	12.69 (16.44)
Debt to Asset Ratio	0.101 (0.136)	0.118 (0.14)	0.091 (0.13)	0.121 (0.16)	0.112 (0.15)	0.126 (0.17)
No. of Observations	676	236	440	933	320	613

Standard deviations are in the parentheses

To test the attraction and retention justifications in our data, the first column of Table 6 reports the estimation results for model (a) without the entry of the determinants proposed in Hypotheses A and B. Agrees with the literature, research and development expenses and market-to-book ratio are both significant and positive predictors of the program which supports the above two justifications. We now turn to the second column. It indicates that the addition of SGA expenses and capital investments in the model renders research and development expenses insignificant but not the market-to-book ratio. This suggests that at least part of the attraction and retention justifications is attributable to the consideration of safeguarding firm-specific capital investments and improving the capital-skill match.

TABLE 6
POPULATION AVERAGE LOGIT ESTIMATES
Prob(BBD=1)

Variables	Estimates	Estimates	Estimates
lnEmpt-1	0.088 (0.92)	0.151 (1.35)	0.103 (1.05)
lnCapitalintt-1	0.009 (0.06)	-0.262 (-0.21)	-
lnRandDempt-1	0.218 (1.93)*	-0.115 (-0.73)	-0.134 (-0.87)
lnProductivityt-1	0.407 (1.54)	0.072 (0.29)	0.0002 (0.001)
MBratiot-1	0.00002 (1.73)*	0.00003 (2.72)***	0.00003 (3.39)***
lnSGAempt-1	-	0.899 (2.31)**	0.849 (2.43)**
lnCapitalinvestmentt-1	-	0.295 (2.11)**	0.184 (1.64)*
DAratiot-1	-0.648 (-1.01)	-0.659 (-0.97)	-0.699 (-1.03)
New Economy	-0.101 (-0.28)	-0.407 (-0.96)	-
Constant	-5.380 (-3.72)***	-6.279 (-4.10)***	-6.344 (-4.36)***
Year Dummies	Yes	Yes	Yes
Wald Chi²	68.03	65.64	65.06
No. of firms	219	219	219
No. of Observations	1609	1609	1609

z statistics are in parentheses.
z statistics are adjusted for clustering on firms
* *Statistically significant at the 0.10 level*
** *Statistically significant at the 0.05 level*
*** *Statistically significant at the 0.01 level*

More specifically, the model estimates that the average firm has a 35.6% probability of having a broad-based program. Of the motivation/mutual monitoring related factors, firm size is positively associated with the likelihood of adopting broad-based stock options program in our sample. Yet it is not statistically significant. Neither is capital intensity. The sample studied does not yield conclusive evidence supporting a grant of stock options as a motivational means. As far as reverse causality is concerned, productivity is not a significant predictor, suggesting the program does not seem to be adopted as a reward for better performance. Nor do we find evidence supporting conserving cash as a program determinant. Although market-to-book ratio is predictive of the adoption of a broad-based stock options program, its magnitude is not economically

meaningful. In line with Hypothesis A, we find the associated factor, i.e., SGA expenditures, is positively and significantly associated with the likelihood of dispersing stock options broadly. More specifically, the probability of having a broad-based plan increases by approximately 2% as SGA expenditures increase by 10% from their average value, controlling for firm size. Firms that provide more on-the-job training are more likely to adopt broad-based programs in an attempt to secure investments in firm-specific human capital. Significantly, in the context of capital-skill complementarity, capital investment is positively associated with the probability of adoption. A 10% increase in capital investment is associated with a 0.6% increase in the probability of adopting. While on the verge of expansion, firms disperse stock options broadly to obtain a better match of capital and skill. Note that the constant term is negatively significant, indicating that some pre-existing and time-constant firm characteristics reduce the likelihood of adoption. One characteristic that we believe to be relevant to the current study is the alternative compensation scheme, which has similar effects on attraction and retention. If so, firms that already had similar plans in place would indeed be in less need of a stock options program, which might explain this finding.

Taken together, our results provide support to the attraction and retention explanations, with an emphasis on safeguarding investments in firm-specific capital and improving match of capital and skill. While intangible capital is evidenced in the literature as a major adopting predictor, our findings narrow this capital to investments in firm-specific capital. Since such investments become costly with high employee turnover, dispersing stock options broadly is one of the means that firms could employ to safeguard their investments. However, the existence of alternative compensation schemes with similar retention effect could discourage firms from adopting employee stock options programs. Moreover, our empirical evidence provides support in that a stock options program is adopted in an attempt to improve match of capital and skill during the verge of expansion phase of a company.

Finally, new economy industries do not seem to be a significant determinant. This could be attributed to the possibility that new economy firms made tremendous capital investments and were positively evaluated by the market during the 1990-1999 time period. Also, the impact of capital intensity could be absorbed by capital investment. As a way to further test the robustness of our results, we dropped capital intensity and new economy variables from model (a). The estimation results, which do not yield significant difference, are shown in the third column in Table 6.

CONCLUSION

By using a unique data set containing the start year of a broad-based stock options program, we contribute to the current literature in the following ways. First, we extend the existing research findings in which attraction and retention is evidenced as the major determinants by adding more insights. While investment in firm-specific human capital is costly, stock options serve as a means to encourage and secure such investment. Our longitudinal results support a positive association between investments in firm-specific human capital and the employment of stock options programs. Second, within the context of capital-skill complementarity, our empirical evidence supports that investments in physical capital are positively related to the likelihood of adopting broad-based programs. Meanwhile, on the verge of expansion, firms disperse stock options broadly to obtain a better match of capital and skill. Third, we do not find conclusive evidence on reverse causality according to which stock options grants are a reward for better performance.

Overall, our results suggest that broad-based stock options do not appear to be a reward for better performance, but carry their own significance. They create value by encouraging investments in firm-specific human capital and improving the match of physical capital and skill in the context of attraction and retention.

This research has a number of limitations that need to be considered before broader and more generalizable conclusions could be drawn from the analysis. First, our sample size is rather small and may not be representative of the population of public firms. However, given the fact that our sample firms are skewed more toward the new economy industries which is in parallel with the literature, we feel there is some level of validity in our results. Second, the SGA expenditures may contain some outlays not clearly related to employee training. More detailed firm level and worker level data are needed to address this concern.

ENDNOTES

1. Justifying the reasons for why firms choose a certain compensation scheme against another is an ambitious project, beyond the scope of the present study. We focus on the determinants of broad-based stock options programs. It remains true that alternative compensation schemes may carry similar effects as stock options programs. Contrasting different programs would be a good way of providing much detail into the mechanisms underlying firms' adoption decisions on compensation methods. To our knowledge, there exists no suitable data set for answering these questions.
2. Indeed, in addition to being an important component of CEO compensation, stock options are also an important element of CEO equity incentives (i.e., sensitivity of a CEO's portfolio value to stock price). Hall and Liebman (1998) reported that in 1980, 57% of CEOs held some amount of options, and by 1994, this figure had reached nearly 90%. In Core and Guay's (1999) sample of CEOs from the period 1992-1996, options contributed approximately one-third to the value of the median CEO's equity portfolio and contributed roughly half of the median CEO's total equity incentives. In defining incentives as the sensitivity of the CEO's wealth to stock price changes, for most CEOs, the assumption that the majority of incentives are driven by variation in the value of equity holdings is realistic. Jensen and Murphy (1990), and Hall and Liebman (1998) show that the vast majority of a typical CEO's incentives to increase stock price are driven by variation in the value of his/her stock and option portfolio (not by flow compensation). Core, Guay, and Verrecchia (2000) show that for a typical CEO, non-price incentives provided by flow compensation are not economically large in comparison to the price-based incentives provided by the CEO's equity portfolio.
3. However, two reasons have been used to support forceful predictions that mutual monitoring will not occur in large firms. First, to the extent that it is costly to monitor and sanction co-workers, there is an incentive to free ride on the monitoring and sanction efforts of other co-workers. Hence, the likelihood of effective mutual monitoring is decreasing in both the size of the group and the cost of the mutual monitoring. Second, while a firm's employees are more dispersed, it will be more difficult to have direct interactions and observe other employees' effort. Similarly, less interdependency among a firm's business (operating) units leads to more difficulty in promoting mutual monitoring. By utilizing the data on Continental Airlines, Knez and Simester (2001) show that group incentive programs have positive impact on firm performance if the firm's operating units are more interdependent. Consequently, while it is commonly argued that group compensation programs help to reduce monitoring costs in large firms, the effect may be conversely more pronounced in small firms since their employees are presumably less dispersed.
4. The National Center for Employee Ownership (NCEO) is a private, nonprofit membership and research organization that serves as the leading source of accurate, unbiased information on employee stock ownership plans (ESOPs), equity compensation plans such as stock options and ownership culture.
5. This was accomplished by NCEO and by researchers at Rutgers University.
6. New Economy industries include (SIC codes): Computer related industries (3570, 3571, 3572, 3576, 3577, 5045), Electronics and Semiconductor (3661, 3674), Communications (4812, 4813), Retail (5961), and Business Services (7370, 7371, 7372, 7373).

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