PERFORMANCE IMPACT OF EMPLOYEE STOCK OPTIONS[1]

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ABSTRACT

In a sample of 200 large Nasdaq firms we examine the determinants of stock option grants and study whether options are associated with superior firm performance. We find that firms grant options in the face of financial constraints, to give incentives to increase firm value, and to hire and retain employees. We further find that grant of options to retain key employees and to relax financial constraints increases firm value and results in positive abnormal returns. However, there is little evidence that option grants to align employee incentives in high growth firms results in superior performance. There also exists some evidence that difficulty in the estimation of the true cost of stock options results in over estimation of firm value and abnormal returns, though this effect is confined only to the case when Fama-French size and book-to-market portfolios are used as reference portfolios.

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Over the last few years, the use of stock options as part of compensation has increased dramatically (Murphy (1999)). Shares allocated to employee incentive plans in the largest 200 firms in the U.S. went up from 6.9% in 1989 to 13.2% 1997.[2] The estimated Black-Scholes value of employee stock options grants, in a sample of 820 companies, increased twelve-fold from 1993 to 2000, a rate five times that of net income and three times that of underlying equity values.[3] Not only has stock option usage increased in the US, it has also increased around the world. Towers Perrin, an executive consultancy, estimated that about 30% of European firms introduced share-based compensation from 1997 to 1999 and about 40% will introduce them in the period 2000-2002.[4]

This has generated a lot of controversy regarding the benefit of stock options. Are stock options working? Are shareholders seeing the gains from increasing use of stock options to compensate an increasing fraction of employees? Defenders of stock options believe that stock options have been a major driver of the economic boom of the late nineties and have been a source of aligning the interests of employees with those of shareholders. Those against stock options believe that the gains from stock options have been overrated. Warren Buffet, one of the leading proponents of this view, believes "Although options…can be an appropriate, and even ideal, way to compensate and motivate top managers, they are more often wildly capricious in their distribution of rewards, inefficient as motivators, and inordinately expensive for shareholder".[5]

In this paper, we attempt to address this controversy by examining whether there is any evidence that stock options enhance firm value. There is little prior empirical evidence on the

[2] Estimates of Pearl Meyer & Partners, an executive compensation consultancy, as reported in The Economist, August 7th 1999 .
[3] Estimates of Bernstein Research, as reported in Bernstein Disciplined Strategies Monitor, July 2001.

gains from incentive-based compensation. The exceptions are Yermack (1994) and Mehran (1995), both of whom find some evidence that firms awarding stock options to their CEOs perform better.[6] Frye (1999) examines the performance impact of employee stock options in a sample of 121 firms for the years 1992-1994 and finds that equity based compensation is positively related to firm performance as measured by Tobin's Q. In this paper, using 200 of the largest Nasdaq firms for the period 1995 to 1998, we examine the effect of stock options, for both executives and non-executives, on firm performance as measured by abnormal stock returns. We further attempt to identify the sources of these gains in our sample. We chose a sample of Nasdaq firms as these firms are heavy users of stock options and may have characteristics that make them more conducive to the use of stock options in comparison to large NYSE listed firms

We first examine the determinants of stock option grants in our sample of firms, primarily to determine if results found in prior studies continue to hold in our sample. Consistent with prior work we find evidence that firms grant options to align employee incentives with those of shareholders.[7] Incentives from option grants are higher for firms with growth opportunities that stand to gain more from increased alignment. As stock options grants do not require a cash outlay by the firm, stock option grants tend to be greater for firms which face financial constraints. Lastly, we find that firms grant stock options to hire and retain employees.

Next, we examine whether firms create value for their shareholders when they grant stock options and further examine if the gains in performance are a function simply of greater stock

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[4] As reported in "Europe Catches American Fever for Incentives based on Market, " International Herald Tribune, April 5, 2000.

[5] Warren Buffet, Bershire Hathaway's Annual letter to Shareholders (1998).

[6] Yermack (1994) examined 452 large firms over the period 1984 to 1991 and found that firms awarding stock options to their CEO's realize superior stock market returns. Mehran (1995) examined 153 randomly-selected manufacturing firms in 1979-1980 found evidence that firm performance is positively related to the percentage of equity held by managers and to the percentage of their compensation that is equity-based.

option grants or depend on whether the grants are in line with the predictions of compensation theories. The evidence suggests that firms, which grant options as predicted by compensation theories generate positive abnormal stock returns for their shareholders. In particular, we find that firms, which grant options to hire and retain key employees show superior firm performance. There is also evidence that grants of stock options by firms facing financial constraints create excess returns. This suggests that stock options may be one mechanism through which start-ups and other cash strapped firms can effectively compete in the labor market. However, there is little evidence in our sample that use of stock options to align incentives in high growth firms is associated with any gain in firm performance.

The skeptics of options point to the hidden costs of stock options. To quote Warren Buffet, "We think the quality of earnings as reported by a company with significant stock options grants every year is dramatically poorer than one where that doesn't exist."[8] This raises the concern that any gains to stock options may be due to the accounting distortions and the inability of markets to correctly estimate the cost of options. We attempt to control for the degree of information asymmetry faced by firms and consequently for the probability of an error in the estimation of the true cost of stock options. There exists some evidence that the difficulty in the estimation of the true cost of stock options results in excess returns, though this effect is confined only to the case when Fama-French size and book-to-market portfolios are used as reference portfolios.

The rest of the paper is organized as follows. Section II describes the data, Section III examines the determinants of options grants, Section IV examines the relationship between firm performance and stock options usage and Section V concludes.

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[7] See Yermack (1995), Frye (1999) and Core and Guay (2001).

II. Sample Selection and Data description

Our sample consists of the largest 200 firms on Nasdaq by equity market capitalization in 1998. The smallest firm in the sample had a market capitalization of $861 million in 1998 while the largest (Microsoft) had a market capitalization of $268 billion. For these 200 firms option data were collected for the years 1994 to 1998.

Table Ia provides a description of the data. On average, sample firms had options outstanding that accounted for 14.2% of total shares outstanding. This is larger than the average of 6.7% reported by Core and Guay (2001) for a sample of 756 large firms. On average about 76% of the options outstanding were held by non-executive employees. [9] Again this is larger than the 67% reported by Core and Guay (2001). This is not surprising because our sample consists of Nasdaq firms, which use stock options more extensively. On average, the firms grant about 5% of shares outstanding every year, and employees exercise 18% and forfeit 8% of options outstanding. The picture is quite similar when we look at just employee stock options. Employee stock options are obtained by subtracting executive stock options from total options outstanding. Employee options account for about 12.1% of shares outstanding (Table Ib). Employees exercise 35% of the options outstanding, which is greater than that for executives.[10]

We estimate the Black-Scholes value of these options and a similar picture emerges. [11] The value of options outstanding as a fraction of the market value of equity was about 11%

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[8] Warren Buffet and Charlie Munger, Berkshire Hathaway Interview, Outstanding Investor Digest 13, #3 and #4, 9/24/98.

[9] The option data were collected from the 10-K statements and the proxy statements. Option data for executives (the top five officials of the firm) was obtained from the proxy statements. Data was collected for individual executives and aggregated to come up with total executive option holdings.

[10] Data on options outstanding, granted and exercised are available for executives and could be subtracted to obtain employee stock options. However, forfeitures were reported only at the firm level and separate data at the executive level was not available.

[11] Consistent with prior literature we use the Black-Scholes model adjusted for dividend payouts (Black and Scholes (1973), and Merton (1973)) to value the options though many assumptions of the model (no vesting period, and no

(Table Ic). Value of options granted was about 4% of the market value of equity. Of the total value of options outstanding at the beginning of the year, approximately 26% was exercised and 10% was forfeited.

There appear to be some predictable yearly trends in option holdings. Median options outstanding as a fraction of shares outstanding steadily increases from 4% in 1994 to about 12% in 1998 (Table Id). Along with this trend of increasing options holdings, there is also a slight decreasing trend in the fraction of options held by top management, which declines from 21% to 19% over this time period. Granting of options remains steady at about 2.9%. Firms do not appear to change their grant policy much from year to year and the correlation of grants to previous year's grants for the same firm is 0.75. There are no yearly trends in the exercise and forfeiture of options.

Not surprisingly, some of these variables are highly correlated (Table Ie). Option grants are positively correlated with options outstanding. Forfeitures and grants are positively correlated presumably because firms, which have a high degree of employee turnover, i.e., high forfeiture tend to grant more options to hire new employees or retain existing employees. Forfeiture and exercises are negatively correlated. This is also expected because firms that are not doing well are the ones with low exercises and large forfeitures. The median forfeited option in our sample is \$14.2 out-of-the-money.[12] Approximately, 10% of forfeited options were in-the-money in the year of forfeiture.

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restrictions on trading) are violated. See Carpenter (1998) and Meulbroek (2001) for valuation under restricted assumptions. To estimate the Black-Scholes value and the option delta we have assumed that the maturity of all options outstanding, exercised and forfeited is five years and the maturity of options granted is ten years. The exercise prices used are the weighted average exercise prices for these options obtained from the 10-K statements. The stock prices and historical volatility were obtained from CRSP.

[12] The extent to which forfeited options are out-of-the-money is determined as the difference between weighed average exercise price for forfeited options and the average stock price for the year.

There also appear to be industry trends in the use of options (Table If). Not surprisingly, technology firms had a higher fraction of options outstanding, a smaller fraction of options held by executives, and large annual grants. In contrast, the financial firms had low annual grants and had a higher fraction of options held by executives. Health care was also relatively more aggressive with option usage.[13]

III. Determinants of Stock Option Grants

III.A Definition of Variables and Hypothesis Development

In this section, we examine why firms grant options. Yermack (1995) examined stock options grants to CEOs in a sample of 792 large firms from 1984 to 1991. He examined several hypotheses regarding why firms grant options to CEO's and found little evidence that firms follow optimal compensation practices. In more recent work, Core and Guay (2001) examine the determinants of option grants to employees in a sample of 756 large firms over the period 1994 to 1997. They find evidence that firms use greater stock option compensation to provide retention incentives and to create incentives to increase firm value. They also find evidence of greater stock option compensation in firms facing financial constraints.

Consistent with Core and Guay (2001), we test three hypotheses of why firms grant options in our sample of large Nasdaq firms. First, we hypothesize that firms grant options to align incentives of employees with those of shareholders (Jensen and Meckling (1976), Jensen and Murphy (1990)). Though this is true for CEOs and for other top executives who are in decision-making positions within the firm, it may not hold for lower level employees. It has been further argued that the incentives from equity based compensation are weakened by the existence of free rider problems among employees (Alchian and Demsetz (1972)). Is it possible

[13] This is consistent with overall option usage patterns. According to Bernstein Research technology sector has the highest usage of options followed by health care. See "Equity Portfolio Strategy: Implications of the rising use of

to motivate lower level employees to act in ways that result in an increase in share price? Kandel and Lazear (1992) show that employees with stock options may through mutual monitoring and peer pressure be able to collectively increase firm value.

The greater is the firm's need to align employee incentives with those of shareholders, the greater will be the stock option compensation. Consistent with prior literature, we hypothesize that incentives will be larger in firms with valuable growth opportunities.[14] These growth opportunities are empirically proxied by the ratio of research and development, as well as advertising expenses, to sales (referred to as R&D/Sales), the ratio of the firm's book value to market value of equity and Tobin's Q.[15]

This brings us to the second reason for why firms grant stock options. Firms also grant options to hire and retain key employees. Oyer (2000) studies a model where workers outside opportunities are positively correlated with firm profits or stock price and where both turnover and adjusting compensation is costly. Under these assumptions, he finds that stock options serve as a relatively inexpensive retention device, as the workers reservation wage is positively correlated with firm performance and compensation. Even though stock options fail to have strong incentive effects, their wide spread usage may be explained by their suitability as a retention tool. We hypothesize that stock options compensation will be higher for firms if they have a greater need to hire and retain key employees.

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stock options", Bernstein Research March 1997.

[14] In growth firms stock options may also be used to reward managers over a multi-year period that encompasses the release of project related information (See Bizjak, Brickley and Coles 1993). Or alternatively, use of stock option may help resolve complexity associated with managerial evaluation in the face of greater information asymmetries related to growth potential.

[15] Firms are required to report research and development expenses only if they are at least 1% of sales. We therefore treat firms, which report no R&D (advertising) expenses as having zero R&D (advertising) expenses. We exclude from the sample firm years with extreme values (i.e., greater than 50% of sales of the firm). Tobin's Q is defined as the market value of assets divided by the book value of assets. Market value of assets is book value of assets (Compustat data item 6) + market value of equity less the book value of common equity (item 60) + Balance Sheet deferred taxes (Compustat data item 74). These empirical proxies have been used by Yermack (1995), Bizjak, Brikley and Coles (1993, and Smith and Watts (1992)) among other.

We have two empirical proxies for the firm's need for retention. The first is the proxy of the intensity of growth opportunity as used by Core and Guay (2001). The larger is the growth opportunity the greater is the marginal impact of motivated or key employees. We proxy for this as the excess of market value over book value per employee, i.e. (Market value of equity – book value of equity)/ number of employees (referred to as RETENTION). The second proxy is the fraction of options forfeited. As options forfeited capture the degree of turnover of employees, a high forfeiture rate is a proxy for the need to give higher incentives to hire new employees and retain old employees. Alternatively, a high forfeiture rate could also be indicative of the inability of the firm to retain its employees and suggest greater stock option compensation to hire and retain employees.

Finally, it has been proposed that firms facing financial constraints are more likely to grant options (Core and Guay (2001), Yermack (1995), Matsunaga, Shevlin and Shores (1992)). Use of stock options as compensation in lieu of cash not only allows start-ups, that are strapped for cash, to compete with larger rivals in recruiting and retaining key employees, but may also allow firms facing financial constraints to tide over periods of cash short fall. Empirical proxies for financial constraints used are interest coverage, dividend payout ratio, and NOL (net operating losses carried forward). In summary, firms with lower interest coverage, lower dividend payout and higher NOL are more likely to grant stock options.

Lastly, we control for leverage. John and John (1993) propose that firms with large debt outstanding will reduce the grant of options to reduce incentives for shareholder alignment.[16]

We use two different measures to capture the incentives provided from stock option grants. First, we use the ratio of the number of options granted in a year (both executive and

[16] We do not control for some compensation theories which link CEO characteristics to the grant of stock options as we are examining all stock options grants rather than just CEO stock option grants.

employee) to the total shares outstanding (referred to as GRANTRAT). Second, following Jensen and Murphy (1990) and Yermack (1995), we measure incentives provided from options as the product of the delta (the hedge ratio) of options granted, and the fraction of firm given in options (GRANTRAT). This second measure of incentives from grants is referred to as PAY2GRT. This measure captures the dollar change in the options value to dollar change in firm value.[17]

III.B Univariate Results

We begin by providing preliminary evidence on firm characteristics for different levels of grant incentives. Table II displays median values of firm characteristics for quintiles formed on the basis of both GRANTRAT (ratio of option grant to shares outstanding) and PAY2GRT. GRANTRAT appears to be positively correlated with growth opportunities. Firm years with higher grant of options have higher Tobins' Q, lower book-to-market and higher R&D intensity. A very similar picture emerges in Panel B with quintiles formed on the basis of PAY2GRT. Both measures of option grant incentives are also positively correlated with the need for retention and with the intensity of forfeitures. Lastly, we see that both measures of option grants are correlated with the degree of financial constraints faced by firms. Quintiles with higher options granted are associated with lower dividend payout ratio, higher net operating losses carried forward (NOL) and lower net income margins. There appears to be no evidence that interest coverage varies across the quintiles. This is not surprising as many of these firms have very little debt and so very little interest expense. These preliminary results suggest that there

[17] Baker and Hall (1998) point that though dollar change in the option portfolio per dollar change in firm value is the right incentive measure for average sized firms it may underestimate incentives for large firms. For large firms they recommend using the dollar change in option value for a percentage change in firm value, as the appropriate measure of incentives. Hall and Liebman (1998) and Core and Guay (2001) use this alternate measure. The median firm in our sample has market capitalization of $1.6 billion in 1998 (compared to $2.2 billion in 1994 for Hall and Liebman (1998)) and only 13 of the 200 firms have market capitalization greater than 10 billion. We therefore use dollar change in option value for a dollar change in firm value, as the measure of incentives.

appears to be some evidence in support for all three determinants of firms' option grant activities.

III. C Multivariate Results

The multivariate analysis provides further support for the above results. There is significant support for the hypothesis that firms grant stock options to provide incentives to create firm value. The coefficient of Tobins' Q is positive and significant at the 1% significance level for both measures of grant incentives and in the presence of both year and industry effects (table III). The coefficient of book-to-market is negative and significant. The coefficient of R&D/Sales is positive though never significant. Firms with high Tobins' Q and low book-to-market give higher incentives from option grants. In our sample of Nasdaq firms, smaller firms grant significantly more stock options as the coefficient of firm size is negative and significant. The coefficient of RETENTION is negative implying that firms with greater need for retention grant fewer stock options, but it is never significant at conventional levels. The coefficient of options forfeited is positive and highly significant. Firms with a high intensity of forfeitures grant more stock options as predicted. Finally, there also appears to be evidence in favor of the hypothesis that firms grant more stock options when they face financial constraints. Firms with large operating losses carried forward grant significantly more stock options. There is some evidence that firm's with low dividend payouts grant more stock options. In summary, consistent with results in the previous section there is evidence that firms grant options when faced with financial constraints, to provide incentives in high growth firms and to hire and retain employees.

IV. Stock Market Performance and Option Incentives

In this section, we examine whether option usage generates positive abnormal stock price performance. There is very little evidence that use of stock options create value. Yermack (1994) and Mehran (1995) find some evidence that stock options are associated with firm performance though they both concentrated exclusively on CEO stock option grants mostly in the 1980's. Frye (1999) finds evidence that employee stock options results in better firm performance but uses Tobin's Q as her measure of performance, which is problematic since Tobin's Q may be measuring ex ante growth opportunities rather than ex post performance.

IV.A Operating Performance and Stock Options

Since the accounting of stock options underestimates the true cost of options, we provide only preliminary results on how operating performance measures vary with the firm's stock option activity, and rely mainly on risk adjusted stock returns to capture firm performance. The operating performance measures that we consider are annual growth in sales, growth in net income, growth in operating income and growth in the number of employees. As per SFAS No. 128, firms granting stock options at-the-money or out-of-the-money are not required to expense them, but merely to report it in the footnotes. Consequently, firms granting a large fraction of options will have smaller compensation expenses in comparison to firms paying cash instead of stock options. Firms granting a large fraction of stock options will thus report higher Net Income and Operating Income, which might explain their better operating performance. However, this does not affect growth in sales and the number of employees.

Table IV displays the results of median growth in operating performance measures for quintiles formed on the basis of options outstanding. We find that all four measures of operating performance are positively correlated with options outstanding. Firms with larger incentives

from options outstanding at the beginning of the year are associated with larger growth rates in sales, number of employees, net income, and operating income. A similar picture emerges when we form quintiles based on both measures of incentives from options granted. Moving from the smallest to the largest category of options outstanding, sales growth (growth in employees) increases from 14% (10%) to 36% (31%). Net income and operating income growth increases from 13% and 14% to 34% and 45%, respectively. However, as discussed above, measures of operating performance could be biased on account of the accounting treatment of stock options. Therefore, we next examine the relation between option activity and stock market performance.

IV.B Estimating Abnormal Returns

We estimate one year abnormal stock returns by calculating a simple buy and hold return on a sample firm and subtracting the buy and hold return on a reference portfolio as proposed by Barber and Lyon (1997).[18] We use two different approaches to estimating the returns to the reference portfolio. First, given the importance of size and book-to-market in explaining the cross section of stock returns, (Fama and French (1992, 1993)) we use the return on matched size and book-to-market portfolios as the benchmark return.[19] We use Fama and French 25 (5x5) size and book to market portfolios of all NYSE/AMEX and Nasdaq firms.[20] Second, we use the Nasdaq value weighted index as the reference benchmark portfolio. We do not include the NYSE/AMEX returns as our sample consists of only Nasdaq firms.

[18] Barber and Lyon (1997) show that cumulative abnormal returns yield positively biased test statistics while buy and hold abnormal returns yield negatively biased test statistics.

[19] Several recent papers use size and book-to-market adjusted returns to measure abnormal stock returns, for e.g., Brav and Gompers (1997). Several papers adjust returns only for size. We do not report size adjusted returns as it ignores the importance of book-to-market and has been shown by Barber and Lyon (1997) to generate biased test statistics.

[20] The returns on these portfolios as well as the portfolio breakpoints were obtained from Professor French's website. The portfolios are constructed once a year at the end of June and are the intersection of 5 portfolios formed on size (market value of equity) and 5 portfolio formed on the ratio of book value of equity to market value of equity. The size breakpoints for year t are the NYSE market equity quintile at the end of June of year t. The book to market breakpoint are also based on NYSE quintiles calculated using book value of equity for fiscal year end t-1 and

Our first measure of abnormal returns, referred to as FF25BHAR is given by $FF25BHAR = \prod_{t=1}^{12}(1+R_{it}) - \prod_{t=1}^{12}(1+R_{FF25t})$ where R_{it} is the return in month t for firm i, and R_{FF25t} is the return in month t for the benchmark, i.e., the size and book-to-market matched portfolio. We also examine the raw annual buy and hold return for each firm which are referred to as FYRBHR and given by $FYRBHR = \prod_{t=1}^{12}(1+R_{it})$.

The second measure of abnormal return, referred to as NASDBHAR, is $NASDBHAR = \prod_{t=1}^{12}(1+R_{it}) - \prod_{t=1}^{12}(1+R_{NASDt})$ where R_{it} is as above and R_{NASDt} is the month t return on the Nasdaq index.[21]

IV.C Abnormal Returns: Empirical Results

Preliminary evidence indicates that firm performance as measured by stock market returns is also positively correlated with options granted and options outstanding (Table IV). Raw annual returns increase from 28% to 46% as we move from the lowest to the highest quintile by options outstanding. Similarly, Fama-French (Nasdaq) adjusted returns increase from 2% (-4%) to 23% (14%). A similar picture emerges when we examine quintiles by option grants.

We hypothesize that firm performance is a function of option activity. The greater are the incentives in place from options outstanding in the beginning of the year the greater will be the firm performance for that year. Firm performance will also be a function of the incentives provided from new grants of options during the year. The higher are the incentives from option

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market equity at the end of June of year t. The portfolios for July of year t to June to year t+1 include all NYSE, AMEX and Nasdaq stocks, which are within the size and book to market breakpoints.

grants during the year the greater will be firm performance. Huddart and Lang (1996) document that employee exercise patterns are positively related to stock prices. This suggests that years of high employee exercises are indicative of good firm performance. We therefore also include the fraction of outstanding options that get exercised. Lastly, we include the fraction of outstanding options that get forfeited. This is a proxy for large employee turnover and therefore should be associated with negative firm performance.

The results of the above model are displayed in table V. When we use size and book-to-market adjusted abnormal returns, i.e., FF25BHAR the coefficient of options outstanding is positive and significant. The coefficient of the square of options outstanding is negative and significant. This suggests that as options outstanding increase stock market performance increases but at a decreasing rate. The coefficient of GRANTRAT is also positive while that of the square of GRANTRAT is negative. Abnormal returns increase as firms grant more stock options though at a decreasing rate. When year and industry effects are introduced the results are substantially weaker. Only the coefficient of options granted is significant. The results are not affected by how we measure incentives from options outstanding and options granted. The results are also qualitatively similar when we use Nasdaq adjusted abnormal returns (Table Vb). There exists some weak evidence that options outstanding at the beginning of the year and option granted during the year are associated with positive abnormal returns.

The coefficient of the fraction of options exercised is positive and significant. This supports the evidence documented by Huddart and Lang (1996) that employee exercises are positively related to stock price performance. However, given our data we are not in a position to determine whether this relationship between employee exercise and abnormal returns is due to

[21] Brav and Gompers (1997) point out that long run performance in event studies may be biased as event returns are correlated in calendar time. However, since we do not estimate abnormal returns around an event this is not relevant

insiders timing the exercise of their options or is simply a manifestation of insiders following a policy of exercising when stock prices rises sufficiently high.[22] The evidence of the positive relationship between fraction of options exercised and abnormal returns is robust to using different measures of incentives from options, different measures of abnormal returns, and to the inclusion of year and industry effects.

There is also strong evidence that firm years with high forfeitures are associated with significant negative firm performance. The coefficient of the fraction of options forfeited is always negative and significant. This result is also robust to the use of different measures of incentives and firm performance. This suggests that firms with high turnover in their employees, as captured by the high forfeitures, are associated with negative abnormal returns. This could be due to a loss in firm performance on account of losing key employees or an indication of the ineffectiveness of the firm's stock option program in retaining key employees.

IV.D Source of the Abnormal Returns

Although the above results are suggestive of the fact that stock option grants are associated with positive abnormal returns, it is not clear where these performance gains come from. Is it possible for all firms to achieve positive abnormal returns by simply granting more options? The skeptics of stock options may claim that these gains are due to the inability of the market to estimate the true cost of options and any gains will be reversed in the future as the costs of stock options become clearer. In this subsection and the next, therefore, we examine whether these gains in performance are due to the market's inability to figure out the true cost of stock options, and if not, how stock options may have contributed to firm performance.

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to our estimation of abnormal returns.

[22] See Carpenter and Remmers (2001) who look at abnormal returns before and after executive exercises to determine whether there is evidence of insiders timing their option exercises.

As seen in the previous section, there is evidence in our data that firms grant options when growth opportunities are high, when firms want to hire and retain key employees, and when they are facing financial constraints. In light of these findings, we wish to examine if the positive abnormal returns arise from firms granting employee stock options rationally in response to these factors, or if the abnormal returns are associated with higher levels of stock options per se.

To examine if indeed not all option grants, but only those associated with the firm characteristics mentioned above, result in positive abnormal returns, we distinguish between firms with characteristics that predict higher option grants and those that require lower optimal grants. As discussed above, firms with greater growth opportunities grant greater incentives through stock options. We use R&D/Sales ratio to capture the firm's growth opportunities and hypothesize that large option grants by high growth firms (proxied by high R&D) are associated with greater positive abnormal returns than option grants by low growth firms. To test this we create a low R&D/ Sales dummy variable which takes the value one when the firm reports having no R&D and advertising expenses and zero otherwise. We interact this dummy variable with GRANTRAT (options granted as a fraction of shares outstanding at the beginning of the year) to create another variable referred to as GRLOW. Similarly, we create a high R&D dummy which takes the value one if the firm reports having nonzero R&D or advertising expenses and zero otherwise, and interact this with GRANTRAT to create GRHIGH. A testable prediction of our hypothesis is that the coefficient of lagged GRHIGH should be significantly greater than the coefficient of lagged GRLOW. In other words, optimal grants in prior periods (i.e., higher options grants by higher growth firms) are associated with positive firm performance.

Similarly, we test for whether firms' use of stock options in the face of financial constraints creates positive abnormal returns. This is done, as above, by separating firms which face financial constraints from those that do not, and testing whether options grants in the two groups are associated with a differential impact on abnormal returns. We use NOL to proxy for a firm's financial constraints and create a low NOL dummy which takes the value one when the firm has zero operating losses carried forward and a high NOL dummy which takes the value one when the firm has positive net operating losses carried forward. Interacting these dummies with GRANTRAT gives us two variables referred to as GNLOW and GNHIGH. A test of the value impact of granting options in the face of financial constraints is to test if the coefficient of lagged GNHIGH is significantly greater than that of lagged GNLOW. We also create two similar variables called INLOW and INHGH which are formed by the interaction of PAY2GRT with the low and high NOL dummy respectively.

Third, we test whether option grants to hire and retain employees create firm value. The statistical significance of the negative impact of forfeited options on returns is already an indication that inability to retain employees is associated with negative abnormal returns. We further test this hypothesis by creating another variable to capture the importance of the employees that left the firm. If the firm's stock price performance has been poor, and the options granted to employees are out-of-the-money, there is likely to be high turnover as even average employees look for better opportunities. However, if the forfeited options are in-the-money then it is probably the case that they were unvested. If employees choose to leave in-the-money unvested options, then it is highly likely that they were compensated for these losses by the new firms which they joined. These employees leave despite the fact that the firm is doing well since they are bid away by other firms with more attractive packages, indicating that these are the most

prized employees. Such employees are likely to be in short supply in the labor market, and their loss is a proxy for the inability of the firm's stock option program to retain key employees.[23] Therefore, if a firm has a large fraction of in-the-money forfeited options, it should be associated with negative abnormal returns. To capture this effect we create an in-the-money dummy which takes the value of one if the weighted average exercise price of the options forfeited is greater than the average share price in the year and zero otherwise (referred to as MONEY1).[24]

Finally, we want to control for the fact that the observed positive abnormal returns are due to an underestimation of the true cost of options. By one practitioner estimate, the 100 largest US firms overstated their profits on average by 30% in 1995 and 36% in 1996 and by as much as half in the financial year ending in 1998, due to not correctly accounting for the cost of stock options.[25] As stock prices reflect all future expected profits, if reported profits are higher due to distortions in the accounting of stock options investors might have been misled and valued the firm higher. However, in an efficient stock market there should be no such bias. Aboody (1996), Huson, Scott, and Weir (1999) and Core, Guay, and Kothari (2001) present evidence to support the view that the market factors in the cost of stock options.[26] However, Garvey and

[23] Options could also be forfeited if employees are fired. As the largest option grants occur when employees are hired and subsequently are granted to high performance employees, large forfeitures in this case are indicative of a misplaced hiring policy or ineffective performance evaluation. In either case, it should be associated with negative abnormal returns. Data limitations prevent us from separating forfeitures due to voluntary and involuntary turnover. Options could also be reported as being forfeited if they are repriced, though there appears to be no evidence that this is of primary concern in our sample over this time period.

[24] As we use weighted average exercise price of the forfeited options and the average share price during the year to create this dummy, it is possible that options which are classified as in-the-money may have been out-of-the-money at the time they were forfeited and vice versa. Though the measure is noisy there is no systematic bias and it should not affect our results.

[25] Estimates by Smithers & Co., a research firm in London as reported in Forbes, May 18 1998 and in Economist, August 7th 1999.

[26] Huson, Scott and Weir (1999) document that stock return response to changes in accounting income is smaller for firms with a greater number of shares reserved for conversion. Core, Guay and Kothari (2001) find that return-earning and price-earning relations are negatively related to the deviation between economic dilution from options and reported dilution from options.

Milbourn (2001) find evidence to the contrary and show that firms with employee stock options subsequently earn negative abnormal returns.

An underestimation of the costs of options will translate into positive abnormal returns if the degree of underestimation of the costs of stock options increase over time. If the firm has the same level of options outstanding and consequently the same degree of overestimation of firm value it will not lead to abnormal returns but merely to a higher stock price with respect to the underlying cash flows. Therefore, to estimate whether the market correctly factors the cost of options there has to be model of when the market learns the true cost. Garvey and Milbourn (2001) assume that the market learns the true cost upon exercise of options and ignore the effect of such learning on subsequent grants of stock option.

Building a model of when and how the stock market learns of the true cost of options is beyond the scope of the paper. However, to empirically proxy for this error we exploit potential cross sectional differences among sample firms in the extent of this error. In the debate on exactly how to value and report the costs of employee stock options, an active participant has been the analyst community.[27] We hypothesize that stock prices are likely to more accurately reflect costs of stock options for firms that have a large analyst following in comparison to firms that have a very small analyst following. The larger the number of analysts following the firm, the smaller is the information asymmetry and smaller the probability that the cost of options has been ignored by all of them.

If error in the estimation of the true cost of options leads to positive abnormal returns then these abnormal returns should be higher the greater the information asymmetry, i.e., the smaller the number of analysts that follow the firm. The coefficient of the number of analysts

should be negative and significant in the presence of estimation errors in the costs of option. Note that in the absence of the error we would expect the coefficient to be positive. Firms with higher analysts following should be associated with lower information asymmetries and lower costs of external financing and also associated with higher liquidity. Increase in analyst coverage should therefore be associated with positive abnormal returns. The data for analyst coverage is obtained from the I/B/E/S database.

IV.E Source of Abnormal Returns: Empirical Results

When we control for the above mentioned sources of gains we find that options outstanding and options granted are not associated with any significant positive abnormal returns (Table VI). While the estimated coefficients are positive as before for options outstanding (granted) and negative for the squared term, they are not significant. We find continued support for the Huddart and Lang (1996) results that employees tend to exercise options at price peaks as the coefficient of options exercised is negative and significant. There also continues to be strong evidence that firms with high forfeitures have significant negative abnormal returns. Further, the coefficient of MONEY1 is negative and significant. When a firm has in-the-money forfeitures, which proxies for the loss of key employees, it is further associated with significant negative abnormal returns. This result is robust to the use of different measures of incentives and to different measures of abnormal returns. This provides strong evidence that inability of the stock option plan to retain key employees is associated with negative abnormal returns.

There is also evidence that stock option grants by firms that face financial constraints is associated with positive abnormal returns. Grants by firms with larger financial constraints are associated with higher positive returns than grants by firms with lower financial constraints. The

[27] See "Equity Portfolio Strategy: Further analysis of the use of stock options", Bernstein Research, July 1997, "Equity Portfolio Strategy: Implications of the rising use of stock options", Bernstein Research, March, 1997, and

difference is statistically significant and is robust to the use of different measures for capturing incentives and stock price performance. The coefficient of the lagged NOL is negative and marginally significant. This is not surprising as firms with net losses carried forward are unlikely to be have positive abnormal returns.

There is however little evidence that options grants by firms with higher growth opportunities result in abnormal returns. The impact of stock options grants by low and high R&D firms is not statistically different from each other in any specification of the model though the estimated coefficient is always higher for the high R&D group. The coefficient of lagged R&D/Sales is positive but not significant.

Finally, there appears to be some evidence that the positive returns are associated with misestimation of the true cost of options. The coefficient of the number of analysts is negative suggesting that firms with higher information asymmetries are indeed associated with higher returns. However, the result is sensitive to how we measure stock performance. It is significant only when FF25BHAR are used to measure stock price performance and not when NASDBHAR is used. This may be due to the fact that Nasdaq firms have higher option usage and adjusting for Nasdaq returns removes the average level of misestimation associated with stock options usage leaving the abnormal returns free of the bias.

IV.F Robustness Checks

We do a number of robustness checks to examine the sensitivity of our results. In particular our result, that use of stock options as incentive mechanisms in high growth firms does not add value, could be due to the fact that our proxy for growth opportunities, i.e., R&D/ Sales is not sufficiently strong. The other empirical proxies for growth opportunities, book-to-market and Tobin's Q, are problematic as they have built in market valuation of firms and will be

"Employee stock options in the banking industry", Credit Suisse First Boston, 1999 among others.

correlated with the dependent variable. However, to examine if the results are a function of our specification, we create dummies for high growth based on book-to-market and Tobin's Q. This dummy takes the value one if the book-to-market or Tobin's Q lies in the bottom or top quartile of the respective distribution. Similarly, we create dummies for low growth firm years. We find that use of these dummies does not change our results. The difference between high and low growth firms is never significant. Higher option grants by high growth firms for incentive alignment are not associated with any significant abnormal returns.

We also create another proxy for financial constraints. Fazzari, Hubbard and Petersen (1988) use dividend payout ratio as a proxy for financial constraint. Though many of the firms in our sample have never paid dividends and zero dividends may not be good proxy of financial constraints for these firms, we use dividend payout ratio instead of net operating losses carried forward to proxy for financial constrains. The high (low) financial constraint dummy takes the value one when the firm pays no (non-zero) dividends. There is no change in our results. Use of stock options in the face of constraints continues to be significantly associated with positive abnormal returns.

Lastly, the use of the variance in analysts forecasts (standard deviation of the annual earning forecasts) instead of the number of analysts to proxy for the degree of information asymmetry does not qualitatively change the results.

V. Conclusion

In this paper we examine whether firms' use of stock options results in superior stock performance. We select 200 large Nasdaq firms and examine their stock option activity over the

period 1995 to 1998. We find evidence that firms grant options in the face of financial constraints, to create incentives to increase firm value, and to hire and retain key employees.

Further, we find that there is evidence to support the argument that firms' use of options to retain key employees creates value and is associated with positive abnormal returns. There is also evidence that firms' use of stock options in the face of financial constraints creates value. However, there appears to be no evidence that use of stock options to provide better incentives in high growth firms is a source of gain in firm performance. Finally, there appears to be some evidence that an inability of the market to estimate the true cost of stock options partially explains the observed positive returns. This is especially true when the reference portfolio is the Fama-French size and book to market portfolios, which consist of NYSE and AMEX firms, which typically have much smaller stock option usage than our sample of Nasdaq firms.

These results throw light on the debate concerning whether stock options create value, especially given their increased usage in the U.S and rapid adoption in other countries. In our sample, the grant of stock options have created value when they have succeeded in hiring and retaining key employees and in the process have allowed start-ups and other financially constrained firms to compete effectively in the labor market. The evidence in this sample does not support the view that increased alignment of employees with shareholders results in any increase in firm performance. The evidence suggests that options may be more important in their role as effective retention tools rather than as effective mechanisms to align managerial incentives with those of shareholders.

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Table Ia

Summary Statistics for Option Activity

Total options outstanding and options granted are expressed as fractions of total shares outstanding at the beginning of the year. Options exercised and forfeited are fractions of total options outstanding at the beginning of the year. The sample consists of the top 200 firms by market capitalization listed on the Nasdaq in 1998 for the years 1995 to 1998.

	Total options to shares outstanding	Fraction of options held by executives	Options granted to total shares outstanding	Options exercised to total options outstanding	Options forfeited to total options outstanding
Mean	0.14	0.24	0.05	0.18	0.08
Median	0.10	0.20	0.03	0.16	0.04
Minimum	0	0	0	0	0
Maximum	0.85	0.99	0.61	2.00	1.19
Standard Deviation	0.12	0.19	0.07	0.14	0.14
Number	714	670	715	691	686

Table Ib

Summary Statistics for Employee Option Activity

For the purposes of this table, only employee stock options have been considered. Employee stock options are obtained by subtracting executive stock options from total stock options outstanding. Employee options outstanding and options granted are expressed as fractions of total shares outstanding at the beginning of the year. Options exercised are expressed as a fraction of total employee options outstanding at the beginning of the year. The sample consists of 200 largest firms by market capitalization listed on Nasdaq in 1998 for the years 1995 to 1998.

	Employee options outstanding to total shares outstanding	Options Granted to employees to total shares outstanding	Options exercised to total employee options outstanding
Mean	0.12	0.04	0.36
Median	0.07	0.02	0.23
Minimum	0	0	0
Maximum	0.82	0.60	30.90
Standard Deviation	0.14	0.06	1.26
Number	683	715	637

Table Ic
Summary Statistics for Value of Options

The table displays the Black-Scholes (1973) value corrected for dividends (Merton 1973). The value of options outstanding and the value of options granted are expressed as fractions of market value of equity in the beginning of the year. Incentives from options outstanding and options granted are estimated as the product of the delta of the options and the fraction of options to total shares outstanding. Value of options exercised and value of options forfeited are both expressed as fractions of the value of the options outstanding at the beginning of the year.

	Value of options to value of equity	Value of options granted to value of equity	Incentives from options outstanding (Pay2beg)	Incentives from options granted (Pay2grt)	Value of options exercised to value of options outstanding	Value of options forfeited to value of options outstanding
Mean	0.11	0.04	0.16	0.05	0.26	0.10
Median	0.07	0.02	0.11	0.03	0.21	0.05
Minimum	0	0	0.002	0.001	0	0
Maximum	0.73	0.57	0.81	0.60	3.44	1.64
S. Dev	0.14	0.06	0.15	0.07	0.25	0.17
Number	657	658	569	569	611	628

Table Id
Yearly Trends in Options Activity

The table reports median values for each year. Options outstanding and granted are expressed as fractions of shares outstanding at the beginning of the year. Options exercised and forfeited are expressed as fractions of total options outstanding at the beginning of the year.

	Total options to shares outstanding	Fraction of options held by executives	Options granted to total shares outstanding	Options exercised to total options outstanding	Options forfeited to total options outstanding
1994	0.04	0.21	0.027	0.14	0.039
1995	0.09	0.21	0.026	0.17	0.041
1996	0.10	0.20	0.028	0.16	0.041
1997	0.11	0.20	0.033	0.16	0.037
1998	0.12	0.19	0.029	0.16	0.042

Table Ie
Correlation among the variables

The table displays Pearson correlation coefficients for the variables. Options outstanding and options granted are expressed as fractions of total shares outstanding at the beginning of the year. Options exercised and options forfeited are expressed as fractions of the total options outstanding at the beginning of the year. Columns 7-9 give the same variables for only the employee options (excluding executive options).

	Options out.	Fraction held by executive	Grantrat	Exercise	Forfeiture	Employee. Out.	Grant to employee	Exercise by employee
Options. Out	1	-0.32	0.70	0.03	0.13	0.98	0.71	-0.05
Frac. by Exec		1	-0.27	0.05	-0.15	-0.41	-0.34	0.14
Grantrat			1	0.001	0.47	0.72	0.99	-0.03
Exercise				1	-0.17	0.02	-0.01	0.18
Forfeiture					1	0.15	0.46	-0.04
Employee Out						1	0.74	-0.08
Grant (Emp.)							1	-0.04
Exercise (Emp.)								1

Table If
Industry Pattern in Options Activity

The table displays four-digit SIC categories with the highest number of firms in the sample. Options outstanding and granted are expressed as fractions of total shares outstanding at the beginning of the year.

SIC	Industry	Number of firms	Options outstanding to total shares outstanding	Fraction held by executives	Options granted to shares outstanding
6021	National Commercial Banks	25	0.03	0.28	0.01
7372	Pre-Packaged Software	21	0.20	0.13	0.08
3674	Semi Conductors, Related Devices	13	0.21	0.10	0.07
6022	State Commercial Banks	10	0.05	0.21	0.01
2836	Biologicals, Diagnostics	9	0.14	0.31	0.03
2834	Pharmaceutical Preparations	6	0.12	0.25	0.05
4841	Cable and other Pay TV	6	0.07	0.24	0.01
6331	Fire, Marine Casualty	6	0.03	0.27	0.01

Table II
Firm Characteristics by Options Granted

Panel A displays quintiles by GRANTRAT (ratio of number of options granted to total shares outstanding at the beginning of the year). The variables are Tobin's Q, the ratio of book value to market value of equity, firm size (log of total assets), ratio of R&D and advertising expenses to sales, the difference in market and book value of equity per employee (RETENTION), the fraction of forfeited options to total options outstanding at the beginning of the period, the ratio of dividends to net income, Net operating losses carried forward (NOL), the ratio of interest to net income and the ratio of net income to sales. All values are median values other than for NOL which are mean values. Panel B displays the same for quintiles by PAY2GRT which are estimated as the product of delta of the options and the fraction of firm represented by the grant.

Panel A:

	Num	GRANTRAT	Tobin's Q	Book / Market	Size	R&D / Sales	Retention	Forfeited	Dividend payout	NOL	Interest coverage	Net income margin
1	135	0.002	1.2	0.41	7.9	0	215	0.01	0.31	3.40	0	0.12
2	135	0.01	1.3	0.35	7.5	0	241	0.02	0.24	0.91	0	0.12
3	135	0.03	2.6	0.27	6.4	0.02	292	0.03	0	6.60	0.01	0.11
4	135	0.06	3.4	0.21	6.2	0.10	560	0.05	0	17.1	0.01	0.09
5	137	0.13	3.6	0.18	6.1	0.11	661	0.09	0	37.9	0	0.08

Panel B:

	Num	PAY2GRT	Tobin's Q	Book / Market	Size	R&D / Sales	Retention	Forfeited	Dividend payout	NOL	Interest coverage	Net income margin
1	115	0.004	1.1	0.41	8.5	0	217	0.02	0.34	4.25	0	0.12
2	115	0.01	1.9	0.3	6.8	0	221	0.03	0.15	1.04	0.003	0.11
3	115	0.03	2.9	0.23	6.2	0.05	501	0.04	0	11.8	0.008	0.11
4	115	0.06	3.5	0.21	6.2	0.09	545	0.07	0	19.8	0.01	0.09
5	113	0.13	3.6	0.16	6	0.12	737	0.10	0	41.0	0.002	0.08

Table III
Determinants of Firms' Option Grants

The table displays estimated coefficients from an OLS model of option grants. The dependent variable is the ratio of options granted to total shares outstanding at the beginning of the year for columns 2 and 4 (GRANTRAT), and PAY2GRT for columns 3 and 4. The independent variables are Tobin's Q, firm size (log of total assets), the ratio of R&D and advertising expenses to sales, the ratio of book to market value of equity, the difference in market and book value of equity per employee (RETENTION), the fraction of forfeited options to total options outstanding at the beginning of the period, the ratio of interest to net income, the ratio of dividends to net income, and net operating losses carried forward (NOL). The t-statistics are displayed in parentheses below. ***,**, * represent significance at the 1%,5% and 10% levels, respectively.

	GRANTRAT	GRANTRAT	PAY2GRT	PAY2GRT
Intercept	0.05	0.04	0.06	0.04
	(3.00***)	(1.10)	(3.60***)	(1.10)
Tobin's Q	0.008	0.007	0.006	0.006
	(4.40***)	(3.90***)	(3.60***)	(3.10***)
Firm Size (Log TA)	-0.006	-0.01	-0.006	-0.01
	(-2.90***)	(-4.20***)	(-2.90***)	(-4.10***)
(R&D + AD)/Sales	0.025	0.01	0.03	0.015
	(0.80)	(0.30)	(0.90)	(0.4)
Book-to-Market	0.003	-0.04	-0.04	-0.09
	(0.20)	(-2.20**)	(-2.40**)	(-4.90***)
Retention	-0.003	-0.004	-0.003	-0.005
	(-1.10)	(-1.40)	(-1.00)	(-1.00)
Forfeiture/Opt out	0.22	0.20	0.21	0.21
	(11.90***)	(11.00***)	(11.90***)	(11.20***)
Interest/ Net Income	0.003	0.002	0.003	0.003
	(1.30)	(1.10)	(1.40)	(1.40)
Dividend / Net Income	-0.025	-0.03	-0.007	-0009
	(-1.70*)	(-1.90*)	(-0.40)	(-0.40)
NOL	0.0002	0.0002	0.0002	0.0002
	(6.00***)	(5.50***)	(5.50***)	(4.60***)
Leverage	0.008	-0.003	0.02	0.02
	(1.20)	(-0.40)	(2.50**)	(1.60)
R-Squared	0.39	0.49	0.41	0.50
Number of Obs.	569	569	520	520
Fixed Effects	Year	Year and Industry	Year	Year and Industry

Table IV

Options Activity and Operating Performance of Firms

The table displays median values of performance variables by quintiles of options activity. Panel A displays the results by both measures of incentives from options outstanding. Panel B displays the results by both measures of incentives from options granted. The performance variables are sales growth, net income growth, operating income growth, growth in the number of employees, fiscal year raw buy and hold returns (FYRBHR), Fama-French size and book to market adjusted returns (FF25BHAR), and Nasdaq composite Index adjusted returns (NASDBHAR). The numbers displayed are median values of variables.

Panel A

	Number	Opt. Out.	Sales Growth	NI Growth	OI. Growth	Growth in # Emp.	FYRBHR	FF25BHAR	NASDBHAR
By Options Outstanding									
1	142	0.004	0.14	0.13	0.141	0.096	0.28	0.02	-0.042
2	142	0.047	0.19	0.16	0.18	0.10	0.24	0.03	-0.039
3	142	0.10	0.22	0.21	0.22	0.14	0.38	0.11	0.077
4	142	0.169	0.33	0.35	0.36	0.24	0.42	0.24	0.12
5	146	0.33	0.36	0.34	0.45	0.31	0.46	0.23	0.14
By PAY2BEG									
1	121	0.02	0.17	0.14	0.15	0.09	0.25	0.02	-0.03
2	121	0.05	0.2	0.19	0.2	0.12	0.33	0.07	0.03
3	121	0.11	0.26	0.28	0.29	0.22	0.36	0.14	-0.01
4	121	0.19	0.35	0.34	0.37	0.25	0.49	0.25	0.17
5	123	0.34	0.39	0.41	0.45	0.32	0.47	0.25	0.16

Panel B

	Number	Opt. Grant	Sales Growth	NI Growth	OI. Growth	Growth in # Emp.	FYRBHR	FF25BHAR	NASDBHAR
By Options Granted (GRANTRAT)									
1	143	0.002	0.14	0.13	0.15	0.07	0.26	0.01	-0.06
2	143	0.01	0.20	0.18	0.16	0.12	0.28	0.05	-0.01
3	143	0.03	0.23	0.28	0.27	0.16	0.37	0.17	0.09
4	143	0.06	0.38	0.36	0.39	0.25	0.44	0.18	0.09
5	143	0.12	0.40	0.27	0.45	0.31	0.36	0.17	0.13
By PAY2GRT									
1	121	0.004	0.16	0.15	0.16	0.07	0.27	0.04	0.01
2	121	0.01	0.22	0.19	0.20	0.14	0.31	0.07	-0.01
3	121	0.03	0.28	0.30	0.30	0.18	0.42	0.20	0.14
4	121	0.06	0.39	0.35	0.42	0.28	0.43	0.16	0.09
5	123	0.12	0.40	0.26	0.43	0.32	0.36	0.18	0.14

Table Va
Firm Performance and Option Activity

The table reports estimated coefficients for OLS regression models of annual buy and hold returns adjusted for size and book-to-market portfolio returns (FF25BHAR). PAY2BEG and PAY2GRT capture incentives from options outstanding and options granted and are estimated as the product of option delta with OPT_OUT and GRANTRAT respectively. The t statistics are displayed in parenthesis below. ***, **, * denote significance at the 1%, 5% and 10% levels, respectively.

	FF25BHAR	FF25BHAR	FF25BHAR	FF25BHAR	FF25BHAR	FF25BHAR
Intercept	0.02	-0.02	0.21	0.03	-0.02	0.20
	(0.35)	(-0.20)	(0.61)	(0.40)	(-0.20)	(0.60)
Options Out. / Shares Out. (OPT_OUT)	1.37	1.47	0.81			
	(2.33**)	(2.50**)	(1.25)			
OPT_OUT^2	-1.99	-2.10	-1.30			
	(-2.40**)	(-2.60***)	(1.48)			
Incentives from Options Out. (PAY2BEG)				1.07	1.12	0.52
				(1.67*)	(1.70*)	(0.70)
$PAY2BEG^2$				-1.78	-1.85	-1.10
				(-2.00**)	(-2.13**)	(-1.20)
Options Granted/ Shares Out. (GRANTRAT)	2.02	1.90	2.10			
	(1.69*)	(1.59)	(1.68*)			
$GRANTRAT^2$	-3.37	-3.20	-2.89			
	(-1.45)	(-1.40)	(2.11**)			
Incentive from Options granted (PAY2GRT)				2.63	2.53	2.80
				(1.98**)	(1.34)	(1.96**)
$PAY2GRT^2$				-4.16	-3.96	-3.80
				(-1.65)	(-2.50**)	(-1.40)
Options exercised / Options Outstanding	0.42	0.40	0.44	0.54	0.53	0.57
	(2.09**)	(2.01**)	(2.11**)	(2.60***)	(2.50**)	(2.60***)
Options Forfeited / Options Outstanding	-0.74	-0.72	-0.82	-0.82	-0.79	-0.90
	(-3.08***)	(-1.93*)	(3.26***)	(-3.30***)	(3.10***)	(-3.40***)
Fixed Effects	None	Year	Year, Industry	None	Year	Year, Industry
R-squared	0.05	0.06	0.11	0.06	0.065	0.11
Number of Observations	640	640	640	588	588	588

Table Vb
Firm Performance and Option Activity

The table reports estimated coefficients for OLS regression models of annual buy and hold returns adjusted for the Nasdaq returns (NASDBHAR). PAY2BEG and PAY2GRT capture incentives from options outstanding and options granted and are estimated as the product of option delta with OPT_OUT and GRANTRAT respectively. The t statistics are displayed in parenthesis below. ***, **, * denote significance at the 1%, 5% and 10% levels, respectively.

	NASDBHAR	NASDBHAR	NASDBHAR	NASDBHAR	NASDBHAR	NASDBHAR
Intercept	-0.07	-0.26	0.06	-0.06	-0.25	-0.06
	(-1.10)	(-3.30***)	(0.20)	(-0.80)	(-2.90***)	(-0.20)
Options Out. / Shares Out. (OPT_OUT)	1.20	1.44	0.92			
	(2.10**)	(2.50**)	(1.40)			
OPT_OUT^2	-1.65	-1.95	-1.30			
	(-2.00**)	(-2.40**)	(-1.50)			
Incentives from Options Out. (PAY2BEG)				0.92	1.10	0.70
				(1.40)	(1.74*)	(0.90)
$PAY2BEG^2$				-1.42	-1.66	-1.12
				(-1.62)	(-1.92*)	(-1.20)
Options Granted/ Shares Out. (GRANTRAT)	2.37	1.95	2.10			
	(1.98**)	(1.64)	(1.65)			
$GRANTRAT^2$	-4.58	-3.52	-3.10			
	(-1.96**)	(-1.50)	(-1.30)			
Incentive from Options granted (PAY2GRT)				2.84	2.46	2.63
				(2.20**)	(1.86*)	(1.86*)
$PAY2GRT^2$				-5.24	-4.23	-3.93
				(-2.10**)	(-1.69*)	(-1.47)
Options exercised / Options Outstanding	0.44	0.42	0.45	0.57	0.54	0.58
	(2.20**)	(2.10**)	(2.20**)	(2.70***)	(2.58***)	(2.60***)
Options Forfeited / Options Outstanding	-0.73	-0.66	-0.79	-0.80	-0.72	-0.84
	(-3.00***)	(-2.76***)	(-3.10***)	(-3.20***)	(-2.86***)	(-3.20***)
Fixed Effects	None	Year	Year, Industry	None	Year	Year, Industry
R-squared	0.05	0.08	0.13	0.06	0.09	0.11
Number of Observations	640	640	640	588	588	588

Table VIa
Options Activity and Sources of Firm Performance

The table displays the estimated coefficients of OLS models of firm performance. The dependent variables FF25BHAR and NASDBHAR, the annual buy and hold return adjusted for Fama-French size and book-to-market portfolio returns AND Nasdaq composite index returns. The independent variables are options outstanding and options granted as fractions of total shares outstanding at the beginning of the year. Options exercised and options forfeited are expressed as fractions of total options outstanding at the beginning of the year. GNLOW and GRLOW (GNHIGH and GRHIGH) are the interactions of options grants in the previous year with low (high) NOL and R&D dummies. Lag NOL and Lag R&D are the one year lagged values of net operating losses carried forward and the ratio of R&D and advertising expenses to sales. MONEY1 is a dummy variable, which takes the value one if forfeited options are in the money and zero otherwise. ANALYSTS is the number of analysts who follow the firm in the year. The t statistics are displayed in parentheses below. ***, **, * denote significance at the 1%, 5% and 10% levels, respectively.

	FF25BHAR	FF25BHAR	NASDBHAR	NASDBHAR
Intercept	0.28	0.29	0.07	0.08
	(1.00)	(1.10)	(0.30)	(0.30)
Options Out. / Shares Out. (OPT_OUT)	0.54	0.36	0.47	0.33
	(0.90)	(0.60)	(0.80)	(0.50)
OPT_OUT^2	-1.22	-1.04	-1.21	-1.07
	(-1.70*)	(-1.40)	(-1.66)	(-1.44)
Options Granted/ Shares Out. (GRANTRAT)	0.55	0.47	0.61	0.56
	(0.50)	(0.40)	(0.60)	(0.50)
$GRANTRAT^2$	-1.89	-1.28	-2.27	-1.76
	(-1.00)	(-0.60)	(-1.20)	(-0.80)
Options exercised / Options Outstanding	0.67	0.65	0.68	0.67
	(3.80***)	(3.70***)	(3.90***)	(3.80***)
Options Forfeited / Options Outstanding	-0.68	-0.65	-0.68	-0.65
	(-3.20***)	(-3.10***)	(-3.20***)	(-3.00***)
GRANTRAT Lag x Low NOL (GNLOW)	2.13		2.42	
	(2.70***)		(3.10***)	
GRANTRAT Lag x High NOL (GNHIGH)	4.31		4.45	
	(4.57***)		(4.70***)	
GRANTRAT Lag x Low R&D (GRLOW)		2.23		2.51
		(2.40**)		(2.70***)
GRANTRAT Lag x high R&D (GRHIGH)		2.80		3.10
		(3.42***)		(3.70***)
Lag NOL	-0.001		-0.001	
	(-1.85*)		(-1.65)	
Lag R&D / Sales		0.40		0.30
		(1.00)		(0.70)
MONEY1	-0.20	-0.21	-0.19	-0.19
	(-2.74***)	(-2.60***)	(-2.50**)	(-2.60***)
Number of Analysts	-0.007	-0.008	-0.001	-0.002
	(-2.20**)	(-2.60***)	(-0.50)	(-0.80)
GNLOW – GNHIGH	-2.18		-2.02	
	(-3.00***)		(-2.80***)	
GRLOW –GRHIGH		-0.58		-0.55
		(-0.70)		(-0.70)
Fixed Effects	Year,Industry	Year,Industry	Year,Industry	Year, Industry
R-squared	0.20	0.19	0.22	0.22
Number of Observations	578	577	578	577

Table VIb
Options Activity and Sources of Firm Performance

The table displays the estimated coefficients of OLS models of firm performance. The dependent variables are FF25BHAR and NASDBHAR, the annual buy and hold return adjusted for Fama-French size and book-to-market portfolio returns and Nasdaq composite index returns respectively. The independent variables are incentives from options outstanding (PAY2BEG) and options granted (PAY2GRT). Options exercised and options forfeited are expressed as fractions of total options outstanding at the beginning of the year. INLOW and IRLOW (INHIGH and IRHIGH) are the interactions of incentives from options granted in the previous year with low (high) NOL and R&D dummies. Lag NOL and Lag R&D are the one year lagged values of net operating losses carried forward and the ratio of R&D and advertising expenses to sales. MONEY1 is a dummy variable, which takes the value one if the forfeited options are in the money and zero otherwise. ANALYSTS is the number of analysts who follow the firm in the year. The t statistics are displayed in parentheses below. ***, **, * denote significance at the 1%, 5% and 10% levels, respectively.

	FF25BHAR	FF25BHAR	NASDBHAR	NASDBHAR
Intercept	0.28	0.30	0.08	0.09
	(1.00)	(1.00)	(0.30)	(0.30)
Incentives from Options Outstanding (PAY2BEG)	0.30	0.13	0.30	0.17
	(0.90)	(0.20)	(0.50)	(0.20)
$PAY2BEG^2$	-0.92	-0.72	-0.98	-0.84
	(-1.10)	(-0.90)	(-1.20)	(1.00)
Incentives from Options Granted (PAY2GRT)	0.92	0.83	0.85	0.82
	(0.70)	(0.60)	(0.70)	(0.60)
$PAY2GRT^2$	-2.37	-1.62	-2.7	-2.20
	(-1.00)	(-0.70)	(-1.20)	(-0.90)
Options exercised / Options Outstanding	0.74	0.72	0.76	0.74
	(3.80^{***})	(3.70^{***})	(3.90^{***})	(3.80^{***})
Options Forfeited / Options Outstanding	-0.71	-0.68	-0.69	-0.66
	(-3.10^{***})	(-2.95^{***})	(-3.00^{***})	(-2.80^{***})
PAY2GRT Lag x Low NOL Dummy (INLOW)	1.91		2.26	
	(2.40^{**})		(2.80^{***})	
PAY2GRT Lag x High NOL Dummy (INHIGH)	4.07		4.26	
	(4.20^{***})		(4.40^{***})	
PAY2GRT Lag x Low R&D Dummy (IRLOW)		1.84		2.24
		(1.87^{*})		(2.28^{**})
PAY2GRT Lag x high R&D Dummy (IRHIGH)		2.57		2.87
		(3.10^{***})		(3.44^{***})
Lag NOL	-0.001		-0.001	
	(-1.86^{*})		(-1.70^{*})	
Lag R&D / Sales		0.35		0.24
		(0.80)		(0.60)
MONEY1	-0.21	-0.22	-0.18	-0.20
	(-2.57^{***})	(-2.70^{***})	(-2.30^{**})	(-2.40^{**})
Number of Analysts	-0.007	-0.009	-0.001	-0.001
	(-2.20^{**})	(-2.57^{***})	(-0.50)	(-0.80)
INLOW – INHIGH	-2.16		-2.00	-0.63
	(-2.90^{***})		(-2.70^{***})	(-0.80)
IRLOW –IRHIGH		-0.74		-0.63
		(-0.90)		(-0.80)
Effect	Year,Industry	Year,Industry	Year,Industry	Year,Industry
R-squared	0.20	0.19	0.22	0.21
Number	533	532	533	532