Market Valuation and Employee Stock Options

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Abstract

This paper investigates a market-valuation-based hypothesis for employee stock options (ESOs). It examines how market valuation has affected the decision to grant ESOs, the amount of options granted, and the distribution of options among executives and rank-and-file employees. I find strong empirical evidence that firms with high market valuation and volatility are more likely to adopt ESOs and grant more options to their employees. Furthermore, when top executives perceive the current market valuation is high, they grant a smaller portion of options to themselves relative to rank-and-file employees. All these results are consistent with the theoretical predictions from the model of Zhang (2002), which argues that ESOs can be used as a method to sell overvalued equity.

1 Introduction

Employee stock options (ESOs) have attracted a lot of attention recently as the number of option holders has grown substantially. According to the National Center for Employee Ownership (NCEO), the number of employees holding company options was roughly 1 million in 1990. As of November 2001, this number had grown to 10 million.[1] Over the past decade, stock options constituted a large portion of the compensation of many rank-and-file employees, especially those in the technology sector. An important question is why firms grant options to so many employees and in such large quantities.

The popular press has cited incentives and employee retention as the two most important reasons.[2] The incentive hypothesis is derived from public shareholders' objective to align the interests of chief executive officers (CEOs), managers and employees with their own interests. Stock ownership is one way to align the interests of these disparate groups, and employee stock options are one form of stock ownership. While providing incentives is certainly an important reason for granting options to CEOs and other top managers,[3] the incentive effect provided by granting options to rank-and-file employees is at least questionable (Oyer and Schaefer (2001)). The employee retention hypothesis argues that options can discourage employees from leaving because options have vesting periods (Ittner, Lambert and Larker (2001)) or because options can match employees' outside opportunities (Oyer (2001)). Other proposed motivations for broad-based employee stock options include liquidity constraints (Core and Guay (2001)), where options reduce the need for cash compensation, and the employee sorting effect (Lazear (2001), Oyer and Schaefer (2001)), where options are used as a screening method for highly motivated employees.

This paper investigates an alternative motivation for ESOs. I argue that firms may grant options to employees in order to capture potential future stock overvaluation. If managers and

[1] See http://www.nceo.org.

[2] See, "Options for Everyone", *Business Week*, 1996.

[3] See Core, Guay and Larker (2001) for a survey.

investors have different beliefs about firm values, managers might expect that overvaluation will occur at some time in the future. Options by contract design will be exercised only when the market price is above the strike price. When options are exercised, firms usually issue new shares to employees, and then employees can sell these new shares to investors. Companies receive cash proceeds from the exercise of options and employees get the difference between the market and strike prices. Because periods of market overvaluation are more likely to coincide with periods of high share prices, firms effectively sell outside investors overvalued equity through option exercise. These optimistic investors overpay for shares at the time of option exercise and effectively subsidize firms by compensating employees. In this way, managers can use ESOs to reduce current employee compensation costs and capture the benefit of future market volatility.[4] This is the "market valuation rationale" for ESOs.[5]

In this paper, I test several empirical implications derived from this rationale. If capturing market excess volatility is one of the motivations for ESOs, cross-sectionally, firms with high market valuation and high volatility are more likely to use ESOs and grant more options to their employees. The positive correlation between volatility and option grant is easily understood if stock volatility is a proxy for the excess volatility perceived by managers. The relationship between valuation and option grant is caused by two factors: the common practice of issuing at-the-money options and expected future market valuation. Because the majority of options are granted at-the-money, that is, the option strike price is set at the market price at the time of option grant, a high current market valuation leads to a high strike price. This makes options less costly and more attractive to the managers. Additionally, if the expected

[4]Seasoned equity offering (SEO) is another method to capture high market valuation. However, SEO sends a bad signal to the market and leads to a decrease in share prices (Myers and Majluf (1984), Loughran and Ritter (1995), Spiess and Affleck-Graves (1995), etc.). In contrast, the action of grant options to employees is not a signal of whether the current market valuation is too high or too low. This is because firms may grant employee stock options even when their stocks are currently undervalued. As long as investors misperception is highly volatile, it is optimal for firms to grant options. ESOs also have other advantages compared with SEOs. For example, ESOs do not involve transaction costs such as brokerage fees and SEC filings.

[5]For a general equilibrium analysis of this market valuation rationale, see Zhang (2002).

future market valuation is high, more options will be granted today to capture the future overvaluation. Overall, there is a positive correlation between market valuation and option grants.

Both the level of option grants and the decision to grant ESOs are explored in this paper. Several measures have been used as proxies for market valuation: for example, book-to-market ratio and two measures of economic value, which are computed using residual income model (RIM) with either realized earnings or analyst-forecasted earnings. Regardless of the proxy used for market valuation, the evidence strongly supports the hypothesis that firms with higher market valuations and higher volatility issue more ESOs. I also find that firms are more likely to adopt employee stock options under the same circumstances.

Along the same lines, if managers' intent for granting options is to sell overvalued equity, their own valuation of the options will be low during periods of high market valuation. Therefore, managers would prefer to receive fewer options themselves and grant more to rank-and-file employees when market valuation of the equity is high. Because managers can decide when to grant options, the optimal strategy for managers is to grant more options to themselves when their own valuation of options is high. Empirically, it is observed that managers are indeed attempting to time the market in distributing options. Executives grant a larger share of options to themselves when the market valuation is low, and employees receive a larger share during periods of high valuation. This provides further evidence that managers use ESOs as an indirect way to sell overvalued company stocks.

Another implication is that the positive correlation between valuation and option grant is weaker for financially constrained firms and also for extremely overvalued firms. This implication is based on the interaction between financial constraints and option grants. Because firms with binding financial constraints need to rely on ESOs as part of employee compensation, these firms' sensitivity of option grant to market valuation is lower than that of non-financially constrained firms. For firms which are extremely overvalued, employees recognize that options are less valuable and thus require a greater number as compensation. In this case, the correlation between option grant and market valuation is again small. This hypothesis is confirmed by empirical analysis. Because this is a unique prediction from the market valuation hypothesis, testing it can help to differentiate other explanations.

This paper contributes to the existing literature on three fronts. First, this paper provides a new motivation for granting options to rank-and-file employees. Previous literature documents that firms grant ESOs mainly because of incentive, retention and liquidity effects. This paper argues that ESOs may also benefit firms by exploiting future investors. Future investors who buy overvalued stocks end up paying part of the employee compensation bill. In this sense, ESOs become an effective way to sell overvalued equity and thus gain popularity.

The second contribution of this paper is to the empirical analysis of broad-based stock option plans. I find that market valuation and volatility constitute important factors for broad-based stock options. These market-valuation-based factors also appear to be robust to different specifications. My results on other control effects are generally consistent with findings by Core and Guay (2001), and Kedia and Mozumdar (2002). Another interesting result of this paper is the evidence that managers appear to distribute more options to rank-and-file employees when they perception of market valuation is high. All these results are consistent with the theoretical predictions from the model of Zhang (2002).

Finally, this paper complements the existing literature on managerial market timing. A large literature has documented the correlation between important corporate decisions and equity market valuations. For example, firms tend to repurchase stocks when the stocks are undervalued (Stephens and Weisbach (1998), D'Mello and Shroff (2000)), and seasoned equity issues tend to coincide with high market valuations (Marsh (1982), Jung, Kim and Stulz (1996), Lee (1997), Hovakimian, Opler and Titman (2001), etc.). Baker, Stein and Wurgler (2002) find evidence that aggregate equity financing patterns depend on the cost of the equity. Graham and Harvey (2001) report that two-thirds of chief financial officers (CFOs) in their survey agree that "the amount by which our stock is undervalued or overvalued was an important or very important consideration" in issuing equity. In this paper, firms grant broad-based options because managers anticipate that the stocks will be overvalued in the future. Managers do not need to be sure that their firms are overvalued at the time of option grant. As long as they are sure that future investors' perceptions are highly volatile, ESOs are optimal. This places a smaller burden on managers' ability to assess the true value of their firms. The empirical results suggest that managers do attempt to take advantage of future market overvaluation in the form of ESOs.

The paper is organized as follows: Section 2 describes the market valuation rationale for ESOs and obtains the testable hypotheses. Section 3 describes the data, and Section 4 provides the empirical results. Section 5 concludes the paper.

2 Hypothesis development

2.1 Market valuation rationale for ESOs

The model in Zhang (2002) is based on heterogeneous beliefs between insider managers and outside investors. When there are differences of opinions, stock prices may deviate from the fundamental value perceived by the manager. Options are exercised only when stock prices are higher than strike prices. As long as the strike prices of options are high enough, it is more likely the case that stocks are overvalued when options are in-the-money. Through the option exercise by employees, the firm effectively sells overvalued equity to outside investors. At the time of option grant, anticipating the income from future option exercise, the firm can reduce the cash salary to employees without fear of employees leaving. Therefore, future investors who buy overvalued stocks are effectively paying part of employee compensation.

This model is in the same spirit as that of Shleifer and Vishny (2001), who model acquisitions as driven by market valuations. In their model, investors who buy overvalued shares of a merged firm are subsidizing the original shareholders of both the bidder firm and the target firm. In this model, the same investors are subsidizing both employees holding stock options and the original shareholders. In this sense, future investors are exploited by managers. This agrees with prior studies of earnings management evidence and long-run returns, which suggest that managers aim to exploit new rather than existing investors. The same point is also emphasized by Baker and Wurgler (2002).

Employees are willing to accept options for different reasons. As noted in Core and Guay (2001), if information asymmetries between the firm and its employees are lower than those between the firm and outside investors, equity compensation can have cost advantages relative to external equity financing. If employees are as optimistic as future investors, then options will be highly valuable to them. If employees share the same belief as managers, they are still willing to accept options as long as the volatility of investors' misperception is large enough.

Note that the main driving force of this market valuation rationale for ESOs is the managers' perception of market "excess" volatility. As long as managers believe that the market price is more volatile than the underlying fundamental values, options may become beneficial to firms. There may be other reasons to drive this excess volatility. For example, risk premiums vary over time, and managers may anticipate a less volatile risk premium. However, it is generally observed empirically that firm stock prices are more volatile than the fundamental values.[6] This fact is clearly summarized by Campbell, Lo and MacKinlay (1997) on page 283 of their book:

> In conclusion, the VAR approach strongly suggests that the stock market is too volatile to be consistent with the view that stock prices are optimal forecasts of future dividends discounted at a constant rate.

Therefore the market valuation rationale for ESOs is more general than the model conditions in Zhang (2002).

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[6]Surveys of this literature include Campbell, Lo and MacKinlay (1997), Gilles and LeRoy (1991), LeRoy (1989), Shiller (1989) etc.

2.2 Testable hypotheses

2.2.1 Employee stock options grant

The level of options granted to employees is studied first. The market valuation rationale implies the following hypothesis:

Hypothesis 1: Option grant is positively correlated with market valuation and volatility.

Based on the valuation rationale, ESOs help firms capture possible future overvaluation. Because of the common practice of issuing at-the-money stock options, the strike price is high if the current market value is high. When options are exercised, firms receive the strike price directly from issuing new shares. Thus, a high strike price increases the direct cash proceeds from future share issues and makes options less costly to managers. Cross-sectionally, overvalued firms issue more stock options than undervalued firms. However, this relation between market valuation and option grant is not linear, because employees need to be willing to accept these options. This effect will be discussed in more detail when Hypothesis 4 is introduced.

In addition to affecting the strike price of options, market valuation also influences option grant through expected future market valuation. If managers expect future market valuation to be high, more options are justified. In this case, the correlation between option grant and current market valuation is positive if managers expect the future market valuation to remain the same.

High volatility indicates higher option value and a higher probability of market overvaluation in the future. Both of these effects point to the same positive sign between option grant and volatility. Note that the relationship between option grant and firm valuation is the primary focus of my empirical tests, and this hypothesis has not been introduced and tested before.

Book-to-market measure is used as a proxy for market valuation. Two other choices, which are related to the concept of economic value, are also used. Details of the proxy variables will be discussed later, in Section 3. Since Hypothesis 1 states that market valuation and option grant are positively correlated, and high book-to-market indicates low market valuation, a negative sign between option grant and book-to-market is expected. Meanwhile, volatility is expected to have a positive effect on option grants.

We also control for other effects for ESOs that have been documented in the literature. Core and Guay (2002) argue that firms provide incentives more intensively to non-executives when direct monitoring of employees is costly. If this holds, then, when firms are larger and more decentralized and when firms have greater growth opportunities, the direct monitoring cost will be higher. The logarithm of the sales and the number of employees are used as proxies for decentralization and firm size. The research and development expenses scaled by assets is also used as a measure of growth opportunities.

Firms with financial constraints will grant more options than firms without them. Because grants of stock options require no immediate cash payout, firms with cash constraints are expected to use this form as a substitute for cash pay (Yermack,1995). It is expected that stock option compensation will be substituted for cash pay by companies with cash constraints, high capital needs and high costs of accessing capital markets. Financial constraints are proxied with the index created by Kaplan and Zingales (1997). This off-the-shelf index has also been used by other researchers as a proxy for financial constraints. The predicted sign will be positive.

The marginal tax rate may be a potential determinant of option grants (Yermack(1995), Hall and Liebman (2000)). When future corporate tax rates are expected to be lower, the immediate tax deduction from cash compensation is more favorable than the deduction from deferred compensation. Therefore, *ceteris paribus*, the use of stock-based compensation is expected to be more costly for firms with high marginal tax rates.

Due to the constraints of vesting periods, firms can use stock options to retain employees. It is generally believed that growth firms rely more heavily on human capital. Hence, it is predicted that the importance of retaining employees is greatest in firms where human capital is more intensive. As described above, research and development expense scaled by assets is used to capture growth opportunities. Furthermore, firms may grant options to reward performance (Core and Guay (1999)). Stock returns in the current year and the previous year are used as proxies for firm performance.

Finally, industry indicator variables are included to control for the industry-mean compensation expense. The model for the option grant is summarized as follows:

$$\begin{aligned}\log(\text{Option grant})_t &= \beta_0 + \beta_1 \text{Valuation Proxy} + \beta_2 \text{Volatility} + \beta_3 \text{KZ index}_t \\ &+ \beta_4 \text{RD}_t/\text{A}_{t-1} + \beta_5 \text{Marginal tax rate}_{t-1} + \beta_6 \text{Stock return}_t + \beta_7 \text{Stock return}_{t-1} \\ &+ \beta_8 \text{Log(sales)}_{t-1} + \beta_9 \text{Log(\# of employees)}_{t-1} + \beta_c \text{Industry controls.} \end{aligned} \tag{1}$$

Various different measures are used as proxies for option grant. These measures will be discussed in detail in Section 3.

2.2.2 The decision to grant ESOs

In terms of a firm's decision to adopt ESOs, the market valuation rationale leads to the following hypothesis:

Hypothesis 2: The probability of a firm choosing stock options is negatively correlated with value-price ratio and positively correlated with the firm's volatility.

Market valuation and volatility factors carry the same effects as explained in the previous hypothesis on the level of option grant. Whether a firm decides to grant stock options depends both on the current and future market values perceived by the managers. Volatility matters because it is related to the probability of future market overvaluation.

We also include financial constraints, size, growth, tax, performance etc. as control factors. Note that the effect of financial constraints on the option grant choice is not clear. On the one hand, financial constraints make option grant a necessity to undertake new projects. On the other hand, a firm may not be able to use options to fill the cash shortage if the firm's volatility is too low. Thus, some financially constrained firms may simply forego profitable projects altogether. Empirically, one will observe these firms as financially constrained but not issuing options. It is therefore difficult to predict whether financial constraints contribute to the option grant decision or not. It is an empirical question which effect of financial constraints is more dominant in determining ESO choice.

Note that this ambiguity does not carry over to the study of option grant amount. All firms in the study of option grant amount are already option users. For a financially constrained firm, the options it grants is the maximum of the following two: (1) the options required to cover a lack of cash; and (2) the optimal number of options granted by a similar firm with no constraints. Therefore, cross-sectionally, one would observe a positive correlation between option grant and financial constraints.

In summary, the following logistic regression is run to study a firm's decision on whether to grant options.

$$\begin{aligned}\text{Option grant choice}_t &= \beta_0 + \beta_1 \,\text{Valuation Proxy} + \beta_2 \,\text{Volatility} + \beta_3 \,\text{KZ index}_t \\ &+ \beta_4 \,\text{RD}_t/\text{A}_{t-1} + \beta_5 \,\text{Marginal tax rate}_{t-1} + \beta_6 \,\text{Stock return}_t + \beta_7 \,\text{Stock return}_{t-1} \\ &+ \beta_8 \,\text{Log(sales)}_{t-1} + \beta_9 \,\text{Log(\# of employees)}_{t-1} + \beta_c \text{Industry controls}. \end{aligned} \tag{2}$$

2.2.3 The fraction of executive option grant

Based on the market valuation rationale for ESOs, if managers intend to sell overvalued equity through granting options, their own valuation of the options will be low if they think the equity is overvalued. Therefore, managers would prefer receiving fewer options and granting more to rank-and-file employees when market valuation of the equity is high. When market valuation is low, managers would assign a larger share of the total option grant to themselves. This leads to the following hypothesis:

Hypothesis 3: Managers' share of options is negatively correlated with market valuation.

This hypothesis is tested by regressing the log transformation of the fraction of options granted to executives (PCTEXEC) on valuation proxy and other control variables.

$$\begin{aligned}\log(\text{PCTEXEC})_t &= \beta_0 + \beta_1 \text{Valuation Proxy} + \beta_2 \text{Volatility} + \beta_3 \text{KZ index}_t \\ &+ \beta_4 \text{RD}_t/\text{A}_{t-1} + \beta_5 \text{Marginal tax rate}_{t-1} + \beta_6 \text{Stock return}_t + \beta_7 \text{Stock return}_{t-1} \\ &+ \beta_8 \text{Log(sales)}_{t-1} + \beta_9 \text{Log(\# of employees)}_{t-1} + \beta_c \text{Industry controls}. \end{aligned} \tag{3}$$

If the sign of the coefficient on the valuation proxy is positive, this is evidence that managers attempt to time the market in granting options.

2.2.4 Option grants for overvalued and financially constrained firms

The last hypothesis addresses the correlation between option grant and market valuation in two subsamples. In particular:

Hypothesis 4: The correlation between option grant and value-price ratio is less negative for financially constrained firms and for extremely overvalued firms.

Consider financially constrained firms first. Some financially constrained firms may have severe cash shortfalls, and issuing options cannot fill the gap. These firms are not observed in the sample of firms that grant options. The financially constrained firms that are included in the sample may be forced to grant options to reduce cash outlay. Liquidity is a much more important factor for these firms when they consider stock option grants, and overvaluation effect is not the primary reason. Therefore, one may observe that these firms have a weaker correlation between option grant and market valuation than firms in general.

The other subsample with a weaker correlation comprises firms that are overvalued by a large margin. When firms are extremely overvalued, that is, when their market values are very high, the probability of option being in-the-money is small if employees think the valuation is too high. Recognizing this effect, employees value each option unit less, and hence the saving in firm compensation costs is low. On the other hand, firms cannot issue infinite numbers of options because of the market impact of exercising these options. If there is a huge supply of new shares from option exercise, prices generally fall and therefore make options even less valuable *ex ante*. For these reasons, one may find that the correlation between market valuation and option grant is closer to zero in this highly overvalued sample when compared with the general sample. This is why I argued previously that the relationship between option grant and market valuation is not linear.

This hypothesis is tested by including an interaction term between market valuation proxy and the dummy variable for being in the subsample.

$$
\begin{aligned}
\log(\text{Option grant})_t = \beta_0 &+ \beta_1 \,\text{Valuation Proxy} + \beta_{1v} \,\text{Valuation Proxy} * I(subsample) \\
&+ \beta_2 \,\text{Volatility} + \beta_3 \,\text{KZ index}_t + \beta_4 \,\text{RD}_t/\text{A}_{t-1} + \beta_5 \,\text{Marginal tax rate}_{t-1} \\
&+ \beta_6 \,\text{Stock return}_t + \beta_7 \,\text{Stock return}_{t-1} + \beta_8 \,\text{Log(sales)}_{t-1} \\
&+ \beta_9 \,\text{Log(\# of employees)}_{t-1} + \beta_c \text{Industry controls}. \qquad (4)
\end{aligned}
$$

3 Data

3.1 Option grant

A large sample of firms that grant options is obtained from the COMPUSTAT Executive Compensation database. The Executive Compensation database contains the number, strike price, and maturity of options granted to executives in a given year. In addition, the ratio of these option grants to the total options granted to all employees is also reported. From this, I can back out the total number of options granted to all employees in a given year.[7] It is assumed

[7] Garvey and Milbourn (2001) and Mehran and Tracy (2001) use the same measure to approximate the total option grant of a firm in a given year. One problem with this measure is that firms which did not issue any options to any executives but did issue options to non-executive employees in a given year is not in the sample. As long as these firms do not follow a systematic pattern, this sample is still a representative sample of option-granting firms.

that firms grant the same options to non-executive employees at the same time that they grant options to executives. If there are multiple grants from a firm in one year, the maximum implied total option grant is used as the measure of the total number of options granted by the firm in that year. The strike price and maturity of the options are taken as the average of the multiple grants.

After removing missing observations, the base sample covers nine years from 1992 to 2000 and includes 2,010 firms and 9,669 firm years. The same industry classification as in Brav (2000) is used to assign all firms into 17 industries. Table 1 shows the industry breakdown of all firms and firm years. As can be seen from the table, this sample is not concentrated in any one industry.

I use several variables to measure the size of option grant to all employees. The first measure is option value (OPTVAL), the Black-Scholes value of the options granted. To estimate the Black-Scholes value, the option strike price, market stock price at the time of the grant, time to maturity, volatility, risk-free rate and dividend yield are needed. The option strike price, market stock price and dividend yield are obtained from the Executive Compensation database. The database also provides the maturity date of the option grant. It is assumed that the options are granted with time to maturity on a yearly unit, and thus the time to maturity is the number of years between the grant year and maturity year. The time to maturity is further reduced by a factor of 0.3 to account for early exercise of the options.[8] Volatility is obtained from the CRSP monthly returns in the previous five years or in at least the previous two years if there are not enough data. The risk-free rate is the average of five-year Treasury constant maturity returns.[9] The second measure is option incentive (OPTINC), which is also used by Core and Guay (2001). This is defined as the change in dollar value of the option if the stock price changes by 1%. This is essentially the delta from the Black-Scholes model multiplied by 1% of the stock price. Both of these measures are an increasing function of stock price,

[8]The same approach is used in ExecComp when Black-Scholes values of options are computed. The factor of 0.3 is not critical to the results. I tried reducing the maturity by a factor of 0.5 and found no qualitative difference.

[9]Results here are robust to the choices of maturity, the volatility measure and the risk-free rate.

and since stock price also appears in the control effect value-price ratio, this may bias my results. To avoid this problem, another measure of option grant that does not depend on stock price or volatility is included. This measure is called option amount (OPTAMT), defined as the number of options granted. OPTAMT is attractive because it does not depends on price or volatility directly, but it may be difficult to compare OPTAMT between two firms because the underlying stocks may not be similar. The approach in this paper is to look at all three measures together. If all three option grant measures suggest the same effect, then I have high confidence in the result.[10]

In addition, I also scale these three measures by the number of employees in the firm. This is, I obtain the average option value granted per employee (OPTVALPE), per employee option incentive (OPTINCPE), and average option amount per employee (OPTAMTPE).

Table 2 provides the summary statistics of these measures. As shown in the table, all six measures are highly skewed to the right, with the mean estimates close to the 75th percentile. To avoid large values dominating the regressions, the logarithms of these measures are used as the dependent variables in the option-grant regressions. After the transformation, these measures are much less skewed, with the means close to the medians.[11] Another measure included in Table 2 is the fraction of options that are granted to the top five executives in a given year (PCTEXEC). This variable is used to test whether executives treat themselves differently from rank-and-file employees in terms of granting options.

3.2 Value-price ratio

It is necessary to find a measure of value-price ratio as a proxy for the market misvaluation, or *perceived* mispricing. The first choice is book-to-market ratio (BE/ME). This ratio has been interpreted by several authors as a proxy for mispricing (La Porta, Lakonishok, Shliefer, and

[10]Another measure, option fraction, which is defined as the number of options granted over the number of shares outstanding, was also adopted as a measure of option grant. The results were the same.

[11]Core and Guay (2001) also use the logarithm transformation on the option incentive.

Vishny (1997)). Moreover, the support for interpreting this ratio as a proxy for *perceived* mispricing is even stronger. For example, the survey by Graham and Harvey (2001) finds that managers use BE/ME ratio as an important factor in the decision to issue equity. Several empirical works have documented that, when the BE/ME is low, managers tend to issue equity,[12] and they tend to be net sellers in their personal account according to Jenter (2001). Fama and French (1992, 1996) find BE/ME has power in predicting stock returns. All these results suggest that book-to-market ratio can be a sensible proxy for *perceived* value-price ratio.

Both the second and third choices relate to the concept of economic value. The economic value of a firm is computed using RIM, which dates back to Preinreich (1938) and was later popularized by Ohlson (1995). In particular, Ohlson (1995) demonstrates that under a clean surplus assumption (that is, the change in book value equals earnings minus dividends), RIM is equivalent to the dividend-discounting model and discounted-cash-flow model of firm valuation. Under RIM in infinite terms, the value of a firm can be written as

$$V_t = B_t + \sum_{i=1}^{\infty}(1+r)^{-i}E_t[X_{t+i} - rB_{t+i-1}], \qquad (5)$$

where V_t is the value of a firm's equity at date t, B_t is the book value at date t, X_t is the earning for period t, and r is the cost of equity capital. $X_{t+i} - rB_{t+i-1}$ can be considered as the abnormal income generated by the firm at time $t+i$.

In practice, Equation (5) needs to be implemented in a finite period. Penman and Sougiannis (1998) have shown that the RIM model outperforms the discounted-dividend model and discounted-cash-flow model in finite-period implementations because RIM model relies less heavily on the estimation of terminal values. Treating the abnormal income over the last couple of years in the finite period as a perpetuity, Equation (5) becomes

$$V_t = B_t + \sum_{i=1}^{T}(1+r)^{-i}E_t[X_{t+i} - rB_{t+i-1}] + \frac{(1+r)^{-T}}{r}TV. \qquad (6)$$

where TV is the perpetual abnormal income. TV is usually restricted to be nonnegative based on the rationale that managers are not expected *ex ante* to invest in negative NPV projects.

[12] See Marsh(1982), Korajcyk, Lucas, and McDonald (1991), Pagano, Panetta, and Zingales (1998), etc.

The second choice of value-price ratio computes the economic value of a firm using realized future earnings to replace expected future earnings, as in Penman and Sougiannis (1998). This measure is called *value-price ratio based on realized earnings*, (VR/P). D'Mello and Shroff (2000) use this measure to show that firms tend to repurchase stocks when they are undervalued.

The third choice of value-price ratio obtains the economic value using analysts' forecasted earnings as expected earnings as in Frankel and Lee (1998), and Lee, Meyers and Swaminathan (1999). This measure is called *value-price ratio based on forecasted earnings*, (VF/P). Frankel and Lee (1998) have shown that VF/P is a good predictor of long-term cross-sectional returns, and it appears to contain information beyond market beta, book-to-market ratio and total market capitalization.

The cost of equity capital r is chosen as the risk-free rate plus 4.32% based on the estimation of equity premiums by Fama and French (2002). The risk-free rate is the average of the five-year Treasury constant maturity rate. Other measures of risk-free rate or equity cost do not change my results. The main concern is on cross-sectional difference of value-price measures. As argued by Lee, Meyers and Swaminathan (1999), although the economic value may be off due to underestimation or overestimation of the cost of equity or systematic bias in forecasting earnings, the value-to-price ratio can still be a good proxy as long as this ratio captures the cross-sectional variation of market mispricing.

3.3 Financial constraints measure

The index created by Kaplan and Zingales (1997), (KZ), is adopted as a measure of financial constraints. This index is used in Lamont, Polk and Saa-Requejo (2001) as a proxy of financial constraints for a large sample of firms. It is also used in Baker, Stein and Wurgler (2002) in their study of equity dependence. This index has several attractive features. First, it is an objective, off-the-shelf index that has been used by other researchers as a proxy for financial constraints. Second, this creates a single index for financial constraints so that firms can be ordered in the dimension of financial constraints. This is quite useful since I want to study a subsample of financially constrained firms. Last, the index uses variables readily available from COMPUSTAT and can be easily constructed for all firms.

Following Lamont, Polk and Saa-Requejo (2001) and Baker, Stein and Wurgler (2002), a KZ index is constructed for each firm-year as the following linear combination:

$$\text{KZ index}_t = -1.002\frac{CF_t}{A_{t-1}} - 39.368\frac{DIV_t}{A_{t-1}} - 1.315\frac{CB_t}{A_{t-1}} + 3.139\,LEV_t + 0.283\,Q_t \qquad (7)$$

where CF, A, DIV, CB, LEV and Q denote cash flow, assets, cash dividends, cash balances, leverage and Tobin's Q measure respectively. Details of constructing these variables can be found in Table 3. Note that one of the value-price proxies is book-to-market ratio, which is closely related to Q. This may be problematic in the regression of both book-to-market ratio and KZ index. As a robustness check, a four-variable KZ index without Q is constructed just as in Baker, Stein and Wurgler (2002), and the results do not change.

3.4 Other control variables

Volatility (VOL) is calculated from the CRSP monthly returns in the previous five years or in at least the previous two years if there are not enough data. A number of additional control variables are included to control for the effects identified by other researchers. One is the ratio of research and development expenses to asset, RD_t/A_{t-1}. This measure was used as proxy for growth opportunity by Kedia and Mozumdar (2002) and as proxy for capital needs by Core and Guay (2001). The second control variable is the marginal tax rate (TAX) as in Graham (1996). Because option grants reduce current compensation cost and defer tax deduction to the time of the option exercise, *ceteris paribus*, the use of option-based compensation is expected to be less costly for firms with low marginal tax rates. Stock returns (RET) in the current year and previous year are used as proxies for firm performance (Yermack (1995)). To control for size effect, the logarith transformation of sales (SALES) and number of employees (#EMP) are included if the dependent variable is firm-wide option grant measure. If the dependent variable is per-employee option grant measure, only Log(sales) is included to control for size effect. Finally, industry controls are included to control for industry-mean compensation expense. This is the same approach adopted by Core and Guay (2001) in their analysis of non-executive employee options. I ran panel regression with fixed effect to control for firm-specific behavior.

3.5 The choice to grant options

In addition to studying the sample of option-granting firms, I would like to study the firms' decision on granting options. In order to do this, a representative sample containing firms that use employee stock options and firms that do not needs to be constructed. This is a challenging task because it is not easy to determine that a firm is not an option user. The shares reserved for stock options in COMPUSTAT (Item 215) is used to categorize firms into option granters and non-granters. This data item has been used previously by Fenn and Liang (1997) to approximate employee stock option grants. Here this item is mainly for the purpose of categorizing. This data item covers the years from 1985 to 1995. If Item 215 is positive, it is assumed that the firm granted options in that year; otherwise, the firm did not grant options in that year. The explanatory variables are computed the same way as described above. Any firm year that does not have all the explanatory variables available is deleted from the sample. This leaves us with a final sample of 38,077 firm years with 28,030 firm years of granting options and 10,047 of not granting options. Table 4 presents the summary statistics of issue sample and non-issue sample. In general, non-issue firms tend to have higher value-price ratios than issue firms. For example, the median BE/ME is 0.63 for firms that use options while it is 0.84 for firms that do not adopt options. The volatility of issue firms is also higher than that of non-issue firms. This is consistent with my hypotheses that firms which are overpriced and volatile are more likely to grant options.

4 Empirical results

4.1 General results

The first regression is as follows:

$$\log(\text{OPTVAL})_t = \beta_0 + \beta_1 \text{BE}_{t-1}/\text{ME}_{t-1} + \beta_2 \text{VOL}_{t-1} + \beta_3 \text{KZ}_t + \beta_4 \text{RD}_t/\text{A}_{t-1}$$
$$+\beta_5 \text{TAX}_t + \beta_6 \text{RET}_t + \beta_7 \text{RET}_{t-1} + \beta_8 \text{Log(SALES)}_{t-1} + \beta_9 \text{Log(\#EMP)}_{t-1} + \text{controls}. \quad (8)$$

The market valuation rationale for ESOs has predicted that β_1 is negative and β_2 is positive. Results from three sets of regressions are reported. The first is pooled OLS regression with heteroskedasticity-robust White (1980) t-statistics. Pool OLS regression uses all the firm-year data in one regression and includes industry dummies to control for industry-wide effect. In the second set of regressions, the Fama and MacBeth (1973) procedure is applied. Cross-sectional regressions are run for all the available firms in each year first. The reported coefficients are the means of all the coefficients in the annual regressions. The reported t-statistics are time series t-statistics of the mean coefficient. The third regression is a panel regression with firm level fixed effect.

Table 5 reports the results of these three regressions when the dependent variable is Log(OPTVAL) and Log(OPTVALPE). The coefficient of BE/ME is significantly negative in pooled regression, cross-sectional regressions and panel regression. The coefficient is also very stable over the three types of regressions. For example, using the result from the Fama-MacBeth regression, if BE/ME increases by 0.1, then the option value granted by a firm drops by 12.2%. The coefficient of volatility also has the predicted sign and is statistically significant. If the volatility of a firm increases by 10%, the option value granted by a firm increases by about 22%. These resultsresults provide initial evidence that support Hypothesis 1: The amount of options granted to employees by a firm is negatively correlated with value-price ratio and positively correlated with firm volatility.

The other effects are generally consistent with the existing literature on employee stock options. The proxy for financial constraints, KZ, has a significant positive coefficient, indicating that financially constrained firms grant more options. The ratio of R&D to assets has a significantly positive coefficient, consistent with the growth opportunity scenario by Kedia and Mozumdar (2002). The coefficient on marginal tax rate (TAX) is generally insignificant. This appears to contradict the findings by Core and Guay (2002). I also use the same proxies they use for tax rate, dummy variables for high marginal tax and low marginal tax. The coefficients on these tax dummies are again insignificant in general. The main difference between my regression to theirs is the inclusion of volatility. Without volatility, marginal tax rate is significantly negative, as expected. It turns out that marginal tax rate is negatively correlated with volatility. Hence, when volatility is not included in the regression, marginal tax rate has the expected negative sign, but this might simply reflect the positive correlation between volatility and option grant. After inclusion of volatility, marginal tax rate becomes insignificant. Both current return and lagged return contribute positively to the amount of option grant. This is also consistent with the argument by Yermack (1995) that options are used as a reward for performance. Finally, the size proxy, log of sales, shows a strong positive effect on option grant at the firm level but a negative effect at the per-employee level. That is, large firms issue more options than small firms but small firms issue more options per employee.

In Table 6, results for Fama-MacBeth regressions with different measures for option grant are reported. No matter which proxy is used for option grant, the coefficient on BE/ME is always significantly negative. The same positive effect on volatility is also observed across different option grant measures. All these are consistent with the hypothesis.

4.2 Other market valuation measures

Using RIM, the economic value of the firm, or equivalently, the *perceived* fundamental value of the firm, is computed by two different methods. One value (VR) is computed assuming that managers have perfect foresight and using the realized earnings as the expected earnings

(Penman and Sougiannis (1998), D'Mello and Shroff (2000)). The other value (VF) uses analysts' forecasted earnings as the expected earnings in RIM (Frankel and Lee (1998), Lee, Meyers and Swaminathan (1999)). Each value term is divided by the market price of the stock to yield two additional measures of market valuation.

Table 7 reports the regressions with these two value-price ratios in place of BE/ME in the initial regression. The effects remain the same. The coefficients on the two new value-price ratios are significantly negative, and the coefficients on volatility still maintain their signs and significance.

In addition to current market valuation, option grants are related to perceived future valuation. To address this issue, I break market valuation into two components, a long-term mean and a temporary deviation from the mean. If managers believe that the valuation ratio reverts to the mean in the long run, the average value-price ratio can be a proxy for perceived future valuation. Then, the temporary deviation can be a proxy for current market valuation. The market valuation rationale predicts that the signs on both the long-term mean and temporary deviation should be negative. Cross-sectionally, overvalued firms are likely to grant more options than undervalued firms. This is the effect on the long-term mean part of the valuation. Over time, a firm is likely to grant more options when the market values it more highly than its historical level. This is the effect on the temporary change.

For each firm, the average of the respective valuation ratio (Mean ratio) is computed. This is the proxy for perceived future valuation of the firm. Then, the difference between the valuation ratio in each year and the mean ratio of the firm (Dev. ratio) is used as the proxy for temporary fluctuation of valuation. These results are reported in Table 8. Regardless of the valuation ratio, the regression coefficients on the temporary change and the long-term mean are always negative and significant. Note that the long-term mean ratio contributes more than the temporary deviation to option grant. For example, an increase of 0.1 in mean book-to-market ratio reduces the total option grant value by 11%, while a corresponding increase of 0.1 in the deviation of book-to-market ratio reduces the total option grant value by 8%. This is true for all the different value-price measures. Hence, the expected future valuation appears to be more important in determining option grant than current valuation. All these results strongly support the valuation motivation for company option grant.

4.3 The choice to grant options

In the study of firms' decisions to grant options to their employees, results from two sets of regressions are reported. The first is pooled logistic regression using all firm-year observations. The second uses the Fama-MacBeth (1973) procedure. That is, logistic regressions in each year are run first, and the time-series summary of the coefficients are reported. Table 9 reports results of the logistic regressions with the same control effects as in Equation (8). Hypothesis 2 predicts that the sign of the coefficient on value-price ratio is negative, and that the sign of the coefficient on volatility is positive. Both of these predictions are supported in Table 9. The coefficient on the KZ index is positive when value-price ratio is BE/ME or VR/P. When value-price ratio is VF/P, its coefficient is negative. This seems to suggest that financial constraints also contribute to firms' granting decisions.

The other coefficients are consistent with the existing literature. High R&D spending is a proxy of high growth opportunity and large human capital. This leads to a high probability of granting options. The same effect is also predicted by Frye (2000) and Zingales (2000). In addition, marginal tax rate has a significant negative effect on the probability of firms granting options. This is expected, since high marginal tax indicates a firm is paying high taxes at the moment. Granting options defers employees' compensation to the future, further increasing the tax burden. This is in contrast with the results reported in the regression for option grant. In that regression, marginal tax rate has no significant impact on how many options firms grant to employees. However, marginal tax rate significantly affects the firms' decision to adopt ESOs.

Table 10 reports results when breaking the market valuation into a long-term average and a short-term deviation. The logistic regressions use each of the three value-price measures, and results are similar across these three regressions. Overall, the long-term average market valuation has a strong effect on corporate decisions to grant options, while the annual variation in market valuation has a less significant effect. For most firms, once the employee stock option plan is initialized, it is difficult to get rid of it. Hence, it is reasonable to expect that firms care more about long-term valuation of their stocks when making such a long-term corporate decision. The short-term swing of market valuation is less a factor in this decision-making process.

4.4 Percentage of options granted to executives

The decision to grant options and the total option grant by a firm have been studied. Another way to test the market valuation motivation of option grant is to look at whether executives treat themselves differently from rank-and-file employees. This is the essence of Hypothesis 3, which states that executives may assign a larger share of options to themselves when they perceive the market is undervalued. To test this hypothesis, the ratio of options granted to the top five executives over options granted to all employees, which is called *executive option fraction* (PCTEXEC), is computed. The log of the executive option fraction is used as the dependent variable in the regression. If executives grant options to capture perceived overvaluation, they will grant fewer to themselves if the market valuation of the firm is high and more if the market valuation of the firm is low. If executives consider the market overvalues the company, they anticipate the stock to underperform the market, and options with such a high strike price are less attractive to them. Granting options to rank-and-file employees, however, is a different matter. In this sense, the valuation rationale predicts that the regression coefficient between log of the executive option fraction and value-price ratio is positive. This unique prediction is derived from my hypothesis that firms grant options to employees as a method to capture future valuation fluctuation of the market.

Table 11 reports the regressions with log of PCTEXEC as a dependent variable. Three sets of regressions are reported, pooled OLS regression, Fama-MacBetch regression, and panel regression with firm fixed effects. The results are consistent with model expectations. Executives appear to grant more options to themselves during periods of low valuation. This is in stark contrast with what has been found on the total option grant. These regressions provide strong support to the market valuation rationale proposed in this paper.

The coefficient of volatility on PCTEXEC is significantly negative in pooled regression and Fama-MacBetch regression but insignificant in panel regression. It is difficult to predict *ex ante* the direction of the volatility effect. On the one hand, high volatility implies high option value, and thus executives may prefer more options. On the other hand, high volatility indicates high risk, so managers may want to avoid such options. The empirical results suggest that the second effect is more dominant.

In Table 12, I report the results for Fama-MacBeth regressions using VR/P and VF/P, as well as separate long-term mean valuation measures and temporary deviation measures. Regardless of the valuation measures, the coefficient between value-price and PCTEXEC is always negative and significant. When valuation measures are separated into a long-term mean and a temporary deviation, the long-term mean effect is much more dominant. Thus, managers in high market valuation firms grant a smaller fraction of options to themselves.

4.5 Financial constraints on the valuation effect

One unique prediction from this model is that the negative correlation between value-price ratio and option grant is smaller for financially constrained firms. This is the first part of Hypothesis 4. To test this hypothesis, an interaction term between value-price ratio and an indicator for financially constrained firms is included in the base regression (Equation (8)). Hypothesis 4 predicts that the coefficient of this interaction term is positive.

Financially constrained firms are defined as those firms with the top 20% of the KZ index. Kaplan and Zingales (1997) argue that in only 15% of the firm-years is there any likelihood that a firm is constrained. Lamont, Polk and Saa-Requejo (2001) use 33% as the cutoff point.

The current cutoff point of 20%, though arbitrary, lies between these two existing thresholds. The results are not sensitive to the exact cutoff point. The same results are obtained using cutoff points from 10% to 50%.

Results for this regression using each of the three value-price ratios are reported in Table 13. Only results from Fama-MacBeth regressions are reported. The results provide strong support for Hypothesis 4. When the dependent variable is Log(OPTVAL), the means of the interaction coefficients are all positive and significant using each of the three value-price ratios. When the dependent variable is log of per-employee option grant value, the coefficients are all positive, although two of them are not significant. These results are consistent with the hypothesis that a cash-constrained firm has a lower correlation between option grant and market valuation.

4.6 Extreme overvaluation on the valuation effect

The second part of Hypothesis 4 states that the negative correlation between value-price ratio and option grant is smaller for firms that are extremely overvalued. This hypothesis is tested by including an interaction term between value-price ratio and an indicator for extreme overvaluation in Equation (8). Because the coefficient between option grant and valuation ratio is negative for the whole sample, and the same coefficient is expected to be negative but closer to zero for the extremely overvalued sample, so the predicted sign of the coefficient of the interaction term is positive.

Extremely overvalued firms are defined as those that are in the bottom decile in corresponding valuation ratio. That is, firms that have the lowest 10% valuation ratios are considered as extremely overvalued. Again, the cutoff point of 10% is not critical for the result. The same results are obtained if the extreme valuation threshold is selected from 5% to 30%. Results for this regression are reported in Table 14. The evidence to support Hypothesis 4 is quite strong. All interaction coefficients are significantly positive in all six reported regressions. Note that the coefficient estimate on the interaction between value-price ratio and extreme overvaluation is larger than the absolute value of the coefficient estimate on the value-price ratio. This indicates that the correlation between valuation and option grant actually change sign for extremely overvalued firms. This can be explained if employees also believe the shares to be overvalued and they assign a low value to these options. This may cause the relationship between option grant and market valuation to be an inverted U shape. All of these arguments confirm the prediction that the correlation between option grant and market valuation is weaker for extremely overvalued firms.

4.7 Differentiating from competing hypotheses

In Equation (8), book-to-market ratio is interpreted as a proxy for market mispricing, or *perceived* misvaluation. Hence, it is argued that the negative coefficient on BE/ME is evidence to support the market valuation rationale. However, some researchers consider BE/ME as a proxy for growth opportunities (Smith and Watts (1992)) and expect that firms with low BE/MEs have greater growth opportunities. Using this interpretation of book-to-market ratio, Kedia and Mozumdar (2002) argue that incentives are larger in firms with valuable growth opportunities, and that these firms might grant more options to align the incentives of employees with shareholders. Core and Guay (2001) consider firms with greater growth opportunities to have high capital needs and issue more options as a consequence. Both theories point to the same negative sign between option grant and BE/ME.

Results following this regression are attempts to differentiate the hypothesis in this paper with these two competing hypotheses. First, other proxies for market valuation are employed to test the hypothesis that option grant is affected by market valuation. The fundamental value for each firm is estimated using residual income model, and the ratio of this fundamental value over price is applied as a more direct proxy for market misvaluation. The results obtained with these value-price ratios are the same as those from BE/ME.

Next, several unique predictions from the market valuation rationale are tested. In particular, the model predicts that the negative correlation between option grant and valuation ratio is weaker for financially constrained firms and for extremely overvalued firms. The other unique prediction based on this model is that executives grant a larger proportion of options to themselves when a firm's valuation is low. On the contrary, the incentive hypothesis by Kedia and Mozumdar (2002) and the capital-need hypothesis by Core and Guay (2001) do not make these predictions. In their models, the predicted correlation between option grant and BE/ME do not change with the financial-constraints measure and value-price ratio, and there is no valuation effect on the distribution of options between executives and employees. Given the empirical evidence that support these unique predictions, it can be concluded that the market-valuation-based rationale for granting employee stock options is valid.

4.8 Individual components of the KZ index

Although the KZ index is off-the-shelf and has been used by a number of researchers, there might be some concerns over the use of such an index. To make sure that the results are not sensitive to the KZ index as a measure for financial constraints, the individual components of the KZ index are used to replace the KZ index in the regression. One of the components, Q, is closely related to BE/ME, so it is not included in the regressions reported. However, similar results are obtained if Q is also included. The four components included are cash flow (CF), dividends (DIV), cash balance (CB), and leverage (LEV). The first three components are normalized by assets (A) in the previous year. These results are reported in Table 15. The coefficients on BE/ME and volatility do not change signs when individual components of the KZ index are used. The negative correlation between option grant and value-price ratio, and the positive correlation between option grant and volatility, point to the same conclusion.

4.9 Robustness

A number of checks have been done to ensure these results are robust to different specifications. For example, as has been reported, different measures of option grant are adopted, and different measures of value-price ratio are used as proxies for market valuation. When computing the economic value by RIM, the 30-day Treasury rate was used as the risk-free rate instead of the five-year rate reported here, and the cost of equity was computed by CAPM instead of the current risk-free rate plus a fixed premium. For the volatility measure, the volatility reported in the ExecComp database was used. And different versions of the KZ index, such as a four-component index without Q, or using net plant, property and equipment (Item 8) instead of assets to scale the components of the index, were adopted. None of these changes has any effect on the results. The main theme of the paper, that firms grant options to capture part of perceived market overvaluation, is robust across all these different specifications.

5 Conclusion

There is much evidence suggesting that stock prices do not track fundamental values perfectly and stock prices are "excessively" volatile. Based on the assumption of heterogeneous beliefs, Zhang (2002) illustrates, in a general equilibrium setting, that employee stock options can be used to sell overvalued stocks in the future. Investors who buy overpriced stocks are subsidizing firms that issue options to their employees. This paper formulates this market valuation rationale for ESOs and empirically tests whether this rationale is supported by the data.

The key cross-sectional prediction of the valuation rationale is that the option grant amount is positively correlated with market valuation, and volatility of price. Moreover, for financially constrained firms and extremely overvalued firms, the correlation between option grant and market valuation is weaker. Top executives self-interests leads them to grant a smaller portion of options to themselves relative to rank-and-file employees when executives perceive that the current market valuation is high. All of these predictions are confirmed by the empirical evidence. It is also shown that overvalued firms, especially firms that are overvalued for a long period, are more likely to adopt broad-based employee stock option plans. These results are robust to a variety of proxy variables and model specifications. Overall, this paper shows that employee stock options are strategies for firms to capture a part of market overvaluation, and this appears to be one of the motives for granting broad-based options to employees.

Future research can look at the option cost born by issuing firms if the stock price does not track the fundamental value perfectly. This will be of interest simply because of the wide practice of granting employee stock options in the U.S. and therefore the importance of assessing their true costs. Another interesting avenue for research would be to study market reaction to initialization of employee stock option plans, option grants and option exercise. Garvey and Milbourn (2001) is a first attempt in this direction. They have found that the market appears to anticipate a large number of option exercises. It appears that investors who have the same investment horizon as the option maturity are hurt by options. What about the long-term investors? Are they better off when firms grant options? This is a challenging question to answer empirically because of the need to estimate what the returns for long-term investors would be had firms not granted options.

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Table 1. **Industry breakup of the firms in the study of option grant amount.**

Industry	Firms		Firm Years	
	Frequency	Percent	Frequency	Percent
Airlines	30	1.493	156	1.613
Business Service	42	2.09	168	1.738
Communications	50	2.488	212	2.193
Computer Data Processing	124	6.169	513	5.306
Computer Manufacturing	58	2.886	286	2.958
Drug	77	3.831	437	4.52
Electronic Equipment	123	6.119	573	5.926
Financial Institution	101	5.025	322	3.33
Healthcare	37	1.841	139	1.438
Insurance	93	4.627	432	4.468
Metal Products	71	3.532	383	3.961
Oil and Gas	124	6.169	607	6.278
Optical Scientific Equipment	79	3.93	361	3.734
Other	752	37.41	3881	40.14
Restaurant Chains	33	1.642	158	1.634
Retail	143	7.114	678	7.012
Whole Sale	73	3.632	363	3.754
Total	2010		9669	

Table 2. **Summary statistics of dependent variables in the study of option grant amount.** Option value (OPTVAL) is the Black-Scholes value of the total employee stock options granted in a given year. Option incentive (OPTINC) is the dollar amount of option value change if the underlying stock moves by 1%. Option amount (OPTAMT) is the number of options granted in a given year. OPTVALPE, OPTINCPE, and OPTAMTPE are option value, option incentive and option amount scaled by the number of employees. PCTEXEC is the fraction of options granted to top five executives from all options granted.

Variable	Mean	Std Dev	Q1	Median	Q3
Option value (OPTVAL)	51,354,350	493,133,939	3,145,768	8,636,437	25,772,584
Option incentive (OPTINC)	864,913	7,388,276	53,214	144,041	439,471
Option amount (OPTAMT)	3,020,210	41,028,124	333,333	765,697	1,882,353
Option value per employee (OPTVALPE)	9416.838	65445.94	537.0198	1401.305	5023.076
Option incentive per employee (OPTINCPE)	134.0771	863.0237	9.832255	24.6654	82.14158
Option amount per employee (OPTAMTPE)	892.9789	7058.537	47.43833	121.0736	421.6001
Fraction of options granted to executives (PCTEXEC)	0.2531	0.1958	0.107	0.2035	0.35
Log(OPTVAL)	16.065	1.6379	14.962	15.972	17.065
Log(OPTINC)	11.995	1.6294	10.882	11.878	12.993
Log(OPTAMT)	13.622	1.3847	12.717	13.549	14.448
Log(OPTVALPE)	7.4577	1.7007	6.286	7.2452	8.5218
Log(OPTINCPE)	3.3872	1.6178	2.2857	3.2054	4.4084
Log(OPTAMTPE)	5.0144	1.6892	3.8594	4.7964	6.0441
Log(PCTEXE)	-1.731	0.9802	-2.235	-1.592	-1.05

Table 3. **Summary statistics of control variables in the study of option grant amount.** Volatility (VOL) is computed from monthly returns in the previous five years. KZ index (KZ) is the Kaplan and Zingales (1997) index of financial constraints. This index has five components: cash flow (CF = Item 14 + Item 18) over assets (A=Item 6), cash dividends (DIV = Item 21 + Item 19) over assets, cash balances (CB = Item 1) over assets, leverage (LEV = (Item 9 + Item 34)/(Item 9 + Item 34 + Item 216)), and Q (Market value of equity (ME) plus assets minus the book value of equity (BE=Item60 + Item 74) over assets). Additional variables include research and development (RD=Item 46), marginal tax rate (TAX), SALES (Item 12), number of employees (#EMP=Item 29). VR is the share value computed using Residual Income Model with realized earning. P is share price at the end of fiscal year. VF is the share value computed using Residual Income Model with analysts' forecasted earnings. Mean ratio is the average of the interested ratio for a given firm. All variables are Winsorized at the 1^{st} and 99^{th} percentiles.

Variable	N	Mean	Std Dev	Q1	Median	Q3
VOL_{t-1}	9669	0.3762	0.1584	0.2563	0.3417	0.4593
KZ_t	9669	1.032	1.197	0.34	0.989	1.674
RD_t/A_{t-1}	9669	0.037	0.0708	0	0	0.0393
TAX_t	9669	0.2476	0.1485	0.0402	0.3499	0.35
$Log(SALES)_{t-1}$	9669	20.695	1.6041	19.626	20.652	21.779
$Log(\#EMP)_{t-1}$	9669	8.5138	1.6415	7.4674	8.5346	9.6356
CB_t/A_{t-1}	9669	0.1158	0.1558	0.0148	0.0476	0.1509
LEV_t	9669	0.3501	0.2468	0.1479	0.3492	0.5124
CF_t/A_{t-1}	9669	0.1078	0.1075	0.0576	0.107	0.1617
DIV_t/A_{t-1}	9669	0.0138	0.0182	0	0.0069	0.0216
RET_t	9669	0.192	0.441	-0.06	0.167	0.409
RET_{t-1}	9669	0.219	0.419	-0.02	0.187	0.425
BE_{t-1}/ME_{t-1}	9669	0.5155	0.3386	0.2703	0.4475	0.6835
Mean BE_t/ME_t	9669	0.5213	0.3373	0.313	0.4843	0.7115
Dev. BE_{t-1}/ME_{t-1}	9669	-0.002	0.2947	-0.126	-0.022	0.0781
VR_{t-1}/P_{t-1}	5091	0.7896	0.6351	0.4167	0.6841	0.9907
Mean VR_{t-1}/P_{t-1}	5091	0.8415	0.5453	0.5347	0.7633	1.0496
Dev. VR_{t-1}/P_{t-1}	5091	-0.049	0.4701	-0.217	-0.037	0.1251
VF_{t-1}/P_{t-1}	6120	0.5464	0.3291	0.3052	0.4898	0.7216
Mean VF_{t-1}/P_{t-1}	6120	0.5673	0.2822	0.3466	0.5373	0.7474
Dev. VF_{t-1}/P_{t-1}	6120	-0.021	0.2073	-0.124	-0.024	0.0677

Table 4. **Summary statistics of control variables in the study of option grant decision.** See Table 3 for a detail description of the variables. All variables are Winsorized at the 1^{st} and 99^{th} percentiles.

Variable	N	Mean	Std Dev	Q1	Median	Q3
Panel A. Issue sample						
VOL_{t-1}	28030	0.5169	0.2335	0.3494	0.468	0.625
KZ_t	28030	1.041	1.628	0.213	0.985	1.843
RD_t/A_{t-1}	28030	0.0378	0.0727	0	0	0.044
TAX_t	28030	0.1891	0.1746	0	0.2552	0.34
$Log(SALES)_{t-1}$	28030	18.222	2.2606	16.74	18.224	19.707
$Log(\#EMP)_{t-1}$	28030	6.4277	2.3915	4.9767	6.5236	8.0262
CB_t/A_{t-1}	28030	0.129	0.1598	0.0201	0.0647	0.1762
LEV_t	28030	0.367	0.3145	0.1167	0.327	0.5352
CF_t/A_{t-1}	28030	0.0514	0.1698	0.0148	0.0802	0.1381
DIV_t/A_{t-1}	28030	0.0111	0.0209	0	0	0.0155
RET_t	28030	0.145	0.525	-0.15	0.127	0.407
RET_{t-1}	28030	0.123	0.517	-0.17	0.105	0.386
BE_{t-1}/ME_{t-1}	28030	0.7512	0.6604	0.3493	0.6201	0.9978
Mean BE_t/ME_t	28030	0.6526	0.7322	0.3717	0.6324	0.9452
Dev. BE_{t-1}/ME_{t-1}	28030	0.0979	0.6955	-0.158	-0.002	0.1969
VR_{t-1}/P_{t-1}	23415	0.6769	0.9625	0.2638	0.5845	0.9549
Mean VR_{t-1}/P_{t-1}	23415	0.6767	0.7768	0.4005	0.6962	1.0061
Dev. VR_{t-1}/P_{t-1}	23415	0.0059	0.7871	-0.276	-0.03	0.1956
VF_{t-1}/P_{t-1}	9106	0.6524	0.4065	0.3735	0.5819	0.8329
Mean VF_{t-1}/P_{t-1}	9106	0.6507	0.3309	0.4226	0.6109	0.8232
Dev. VF_{t-1}/P_{t-1}	9106	0.0005	0.2579	-0.117	-0.011	0.0947
Panel B. Non-issue sample						
Variable	N	Mean	Std Dev	Q1	Median	Q3
VOL_{t-1}	10047	0.3851	0.2291	0.2385	0.3169	0.452
KZ_t	10047	0.707	1.926	0.06	0.821	1.838
RD_t/A_{t-1}	10047	0.0125	0.0422	0	0	0
TAX_t	10047	0.2515	0.1646	0.0088	0.34	0.35
$Log(SALES)_{t-1}$	10047	18.83	2.4545	17.193	19.077	20.568
$Log(\#EMP)_{t-1}$	10047	6.1679	3.2187	4.6347	6.981	8.4338
CB_t/A_{t-1}	10047	0.1088	0.1496	0.0133	0.0532	0.1369
LEV_t	10047	0.4054	0.2981	0.1512	0.4224	0.5899
CF_t/A_{t-1}	10047	0.0494	0.134	0.0102	0.0585	0.1041
DIV_t/A_{t-1}	10047	0.0197	0.0307	0	0.0065	0.029
RET_t	10047	0.147	0.424	-0.06	0.143	0.351
RET_{t-1}	10047	0.133	0.414	-0.07	0.13	0.325
BE_{t-1}/ME_{t-1}	10047	0.9412	0.7056	0.5385	0.8349	1.1603
Mean BE_t/ME_t	10047	0.8756	0.7347	0.5813	0.8443	1.1258
Dev. BE_{t-1}/ME_{t-1}	10047	0.0704	0.6781	-0.151	-0.002	0.1646
VR_{t-1}/P_{t-1}	8396	0.9074	0.8544	0.5409	0.8414	1.1504
Mean VR_{t-1}/P_{t-1}	8396	0.8984	0.6865	0.6639	0.9096	1.1642
Dev. VR_{t-1}/P_{t-1}	8396	0.0078	0.6779	-0.211	-0.028	0.1577
VF_{t-1}/P_{t-1}	3196	0.7978	0.3939	0.5502	0.7578	0.9678
Mean VF_{t-1}/P_{t-1}	3196	0.8003	0.3375	0.6031	0.7757	0.9548
Dev. VF_{t-1}/P_{t-1}	3196	-0.003	0.2319	-0.104	-0.014	0.0772

Table 5. Regressions of option grant on book-to-market, volatility and control variables

$$\text{Log(Option grant)}_t = \beta_0 + \beta_1 \text{BE}_{t-1}/\text{ME}_{t-1} + \beta_2 \text{VOL}_{t-1} + \beta_3 \text{KZ}_t + \beta_4 \text{RD}_t/\text{A}_{t-1} + \beta_5 \text{TAX}_t + \beta_6 \text{RET}_t + \beta_7 \text{RET}_{t-1} + \beta_8 \text{Log(SALES)}_{t-1} + \beta_9 \text{Log(\#EMP)}_{t-1} + \text{fixed effects}.$$

OPTVAL and OPTVALPE are used as proxies for option grant. In pooled regressions and panel regressions, the regresion coefficients are reported. In Fama-MacBeth (FM) regressions, the mean coefficients of all annual regressions are reported. T-statistics are in parenthesis. T-statistics in pooled regressions and panel regressions are computed using White's (1980) robust standard errors. T-statistics in Fama-MacBeth regressions are from the time series distribution of the coefficient (mean coefficient divided by its standard deviation and multiplied by the square-root of the number of cross sections). The coefficients and statistics associated with industry control variables are not reported.

	Log(OPTVAL)			Log(OPTVALPE)		
	Pooled	FM	Panel	Pooled	FM	Panel
Intercept	-0.688	0.7645	-4.532	9.2661	10.304	-0.339
	(-2.48)	(1.92)	(-9.21)	(37.00)	(32.14)	(-0.72)
$\text{BE}_{t-1}/\text{ME}_{t-1}$	-1.395	-1.222	-0.924	-1.217	-1.012	-0.897
	(-34.32)	(-25.09)	(-20.21)	(-26.54)	(-28.38)	(-19.21)
VOL_{t-1}	2.3578	2.276	0.546	2.605	2.4675	0.564
	(22.60)	(23.48)	(3.58)	(21.82)	(24.78)	(3.62)
KZ_t	0.0805	0.036	0.116	0.0603	0.0073	0.0664
	(7.58)	(3.22)	(8.72)	(4.95)	(0.75)	(4.89)
$\text{RD}_t/\text{A}_{t-1}$	3.7869	4.0386	-0.02	4.69	4.7534	-1.15
	(16.68)	(19.21)	(-0.06)	(17.97)	(24.78)	(-3.22)
TAX_t	-0.067	-0.022	0.1103	0.0628	0.1469	0.1399
	(-0.83)	(-0.38)	(1.26)	(0.67)	(3.56)	(1.57)
Log(SALES)_{t-1}	0.8132	0.7245	1.0167	-0.103	-0.132	0.3835
	(44.22)	(30.53)	(35.33)	(-9.85)	(-5.94)	(17.41)
$\text{Log(\#EMP)}_{t-1}$	-0.041	0.0326	-0.043			
	(-2.30)	(3.14)	(-1.58)			
RET_t	0.2339	0.2397	0.1017	0.2095	0.1695	0.11
	(8.55)	(3.45)	(4.83)	(6.64)	(1.78)	(5.12)
RET_{t-1}	0.0599	0.0887	0.0732	0.0054	0.0478	0.0415
	(1.93)	(1.01)	(3.16)	(0.15)	(0.42)	(1.75)
Fixed effect	industry	industry	firm	industry	industry	firm
Adj. Rsq.	0.5887	0.5861	0.2841	0.4841	0.506	0.1051

Table 6. Regressions of different measures of option grant on book-to-market, volatility and control variables

$$\text{Log(Option grant)}_t = \beta_0 + \beta_1 \,\text{BE}_{t-1}/\text{ME}_{t-1} + \beta_2 \,\text{VOL}_{t-1} + \beta_3 \,\text{KZ}_t + \beta_4 \,\text{RD}_t/\text{A}_{t-1} + \beta_5 \,\text{TAX}_t + \beta_6 \,\text{RET}_t + \beta_7 \,\text{RET}_{t-1} + \beta_8 \,\text{Log(SALES)}_{t-1} + \beta_9 \,\text{Log(\#EMP)}_{t-1} + \text{fixed effects}.$$

OPTINC, OPTAMT, OPTINCPE and OPTAMTPE are used as proxies for option grant. Only Fama-MacBeth (FM) regressions are reported in this table. The mean coefficients of all annual regressions are reported. Time series t-statistics (mean coefficient divided by its standard deviation and multiplied by the square-root of the number of cross sections) are in parentheses. The coefficients and statistics associated with fixed effects are not reported.

	Log(OPTINC)	Log(OPTAMT)	Log(OPTINCPE)	Log(OPTAMTPE)
Intercept	-2.953	2.231	6.721	11.496
	(-7.42)	(4.55)	(21.51)	(32.07)
$\text{BE}_{t-1}/\text{ME}_{t-1}$	-1.17	-0.674	-0.958	-0.466
	(-25.20)	(-17.54)	(-29.42)	(-13.66)
VOL_{t-1}	1.0758	2.4376	1.2696	2.6229
	(10.86)	(30.62)	(12.68)	(27.19)
KZ_t	0.0219	0.0352	-0.007	0.0063
	(2.02)	(5.29)	(-0.66)	(0.65)
$\text{RD}_t/\text{A}_{t-1}$	4.0855	3.4335	4.8129	4.1232
	(18.84)	(18.37)	(23.65)	(22.70)
TAX_t	-0.004	-0.403	0.1686	-0.244
	(-0.06)	(-7.46)	(4.17)	(-5.03)
Log(SALES)_{t-1}	0.734	0.5134	-0.134	-0.318
	(30.27)	(16.42)	(-6.10)	(-12.92)
$\text{Log(\#EMP)}_{t-1}$	0.0194	0.0602		
	(1.74)	(5.40)		
RET_t	0.2403	0.1037	0.1705	0.0353
	(3.60)	(2.19)	(1.82)	(0.48)
RET_{t-1}	0.1092	-0.25	0.0691	-0.293
	(1.28)	(-4.38)	(0.62)	(-3.37)
Fixed effect	industry	industry	industry	industry
Adj. Rsq.	0.6002	0.4513	0.4644	0.5285

Table 7. **Regressions of option grant on different value-price ratios, volatility and control variables**

$$\text{Log(Option grant)}_t = \beta_0 + \beta_1 \text{Value-price ratio} + \beta_2 \text{VOL}_{t-1} + \beta_3 \text{KZ}_t + \beta_4 \text{RD}_t/\text{A}_{t-1} + \beta_5 \text{TAX}_t + \beta_6 \text{RET}_t + \beta_7 \text{RET}_{t-1} + \beta_8 \text{Log(SALES)}_{t-1} + \beta_9 \text{Log(\#EMP)}_{t-1} + \text{fixed effects}.$$

OPTVAL and OPTVALPE are used as proxies for option grant. Only Fama-MacBeth (FM) regressions are reported in this table. The mean coefficients of all annual regressions are reported. Time series t-statistics (mean coefficient divided by its standard deviation and multiplied by the square-root of the number of cross sections) are in parentheses. The coefficients and statistics associated with fixed effects are not reported.

	Log(OPTVAL)		Log(OPTVALPE)	
Intercept	0.7657	-0.115	9.8767	9.1152
	(2.16)	(-0.31)	(36.77)	(33.06)
$\text{VR}_{t-1}/\text{P}_{t-1}$	-0.273		-0.189	
	(-7.16)		(-4.68)	
$\text{VF}_{t-1}/\text{P}_{t-1}$		-1.149		-1.009
		(-17.11)		(-16.04)
VOL_{t-1}	2.2152	2.5925	2.5223	2.697
	(11.64)	(20.39)	(18.42)	(20.02)
KZ_t	0.0091	0.0573	-0.007	0.0343
	(0.52)	(5.13)	(-0.53)	(3.43)
$\text{RD}_t/\text{A}_{t-1}$	4.9576	4.4487	5.6169	5.1682
	(15.61)	(14.44)	(23.55)	(22.21)
TAX_t	0.1446	-0.065	0.389	0.1778
	(1.98)	(-0.96)	(5.01)	(2.27)
Log(SALES)_{t-1}	0.6857	0.7503	-0.152	-0.081
	(27.30)	(27.76)	(-10.13)	(-4.23)
$\text{Log(\#EMP)}_{t-1}$	0.0494	0.0667		
	(3.85)	(3.62)		
RET_t	0.2556	0.1739	0.0778	0.1313
	(2.13)	(2.87)	(0.58)	(1.70)
RET_{t-1}	0.3239	0.1215	0.2235	0.063
	(2.58)	(1.67)	(1.69)	(0.69)
Fixed effect	industry	industry	industry	industry
Adj. Rsq.	0.5224	0.6151	0.4604	0.5364

Table 8. **Regressions of option grant on long term average value-price ratios, temporary deviations, volatility and control variables**

$$\text{Log(Option grant)}_t = \beta_0 + \beta_{1m}\,\text{Mean V/P} + \beta_{1d}\,\text{Dev. V/P} + \beta_2\,\text{VOL}_{t-1} + \beta_3\,\text{KZ}_t + \beta_4\,\text{RD}_t/\text{A}_{t-1} + \beta_5\,\text{TAX}_t + \beta_6\,\text{RET}_t + \beta_7\,\text{RET}_{t-1} + \beta_8\,\text{Log(SALES)}_{t-1} + \beta_9\,\text{Log(\#EMP)}_{t-1} + \text{fixed effects}.$$

OPTVAL and OPTVALPE are used as proxies for option grant. Only Fama-MacBeth (FM) regressions are reported in this table. The mean coefficients of all annual regressions are reported. Time series t-statistics (mean coefficient divided by its standard deviation and multiplied by the square-root of the number of cross sections) are in parentheses. The coefficients and statistics associated with fixed effects are not reported.

	Log(OPTVAL)			Log(OPTVALPE)		
Intercept	0.7952	0.4962	0.0279	10.341	9.808	9.2632
	(1.95)	(1.25)	(0.08)	(32.97)	(35.63)	(34.47)
Mean BE_t/ME_t	-1.185			-1.001		
	(-30.70)			(-38.18)		
Dev. BE_{t-1}/ME_{t-1}	-0.852			-0.695		
	(-11.19)			(-15.63)		
Mean VR_{t-1}/P_{t-1}		-0.386			-0.256	
		(-14.71)			(-9.03)	
Dev. VR_{t-1}/P_{t-1}		-0.078			-0.087	
		(-1.24)			(-1.27)	
Mean VF_{t-1}/P_{t-1}			-1.375			-1.229
			(-17.10)			(-15.69)
Dev. VF_{t-1}/P_{t-1}			-0.508			-0.372
			(-7.44)			(-5.92)
VOL_{t-1}	2.2509	2.3625	2.6237	2.4494	2.5891	2.7418
	(21.39)	(10.91)	(19.06)	(23.02)	(15.81)	(18.88)
KZ_t	0.0328	0.0051	0.0644	0.0042	-0.01	0.0426
	(2.69)	(0.29)	(5.29)	(0.44)	(-0.71)	(4.60)
RD_t/A_{t-1}	4.0613	4.6618	4.2877	4.7456	5.4206	4.9945
	(21.28)	(19.86)	(13.91)	(26.74)	(27.61)	(21.21)
TAX_t	0.0125	0.1837	-0.07	0.173	0.4126	0.1705
	(0.24)	(2.22)	(-1.24)	(4.42)	(4.81)	(2.53)
Log(SALES)_{t-1}	0.7208	0.7076	0.7497	-0.134	-0.145	-0.082
	(27.26)	(28.71)	(27.66)	(-5.74)	(-10.99)	(-3.99)
$\text{Log(\#EMP)}_{t-1}$	0.034	0.0386	0.0652			
	(3.52)	(3.22)	(4.14)			
RET_t	0.1975	0.2479	0.1041	0.132	0.0745	0.0623
	(2.71)	(2.08)	(1.56)	(1.36)	(0.58)	(0.76)
RET_{t-1}	0.1728	0.4192	0.2292	0.1187	0.2781	0.1702
	(1.82)	(3.75)	(3.05)	(1.02)	(2.48)	(1.85)
Fixed effect	industry	industry	industry	industry	industry	industry
Adj. Rsq.	0.5819	0.5255	0.62	0.5042	0.4614	0.5413

Table 9. **Logistic regressions of option grant decision on value-price ratios, volatility and control variables**

$$\text{Option grant choice}_t = \beta_0 + \beta_1 \text{V/P} + +\beta_2 \text{VOL}_{t-1} + \beta_3 \text{KZ}_t$$
$$+\beta_4 \text{RD}_t/\text{A}_{t-1} + \beta_5 \text{TAX}_t + \beta_6 \text{RET}_t + \beta_7 \text{RET}_{t-1}$$
$$+\beta_8 \text{Log(SALES)}_{t-1} + \beta_9 \text{Log(\#EMP)}_{t-1} + \text{fixed effects}.$$

Both pooled logistic and Fama-MacBeth logistic regressions are reported in this table. Coefficients and t-statistics are reported for pooled logistic regressions. In Fama-MacBeth type logistic regressions, logistic regression is run each year. The mean coefficients of all annual regressions are reported. Time series t-statistics (mean coefficient divided by its standard deviation and multiplied by the square-root of the number of cross sections) are in parentheses. The coefficients and statistics associated with fixed effects are not reported.

	Option grant decision					
	Pooled	FM	Pooled	FM	Pool	FM
Intercept	-0.812	-0.751	-1.186	-1.091	-2.274	-2.506
	(-4.08)	(-2.07)	(-5.48)	(-2.75)	(-5.04)	(-5.95)
$\text{BE}_{t-1}/\text{ME}_{t-1}$	-0.288	-0.309				
	(-13.92)	(-12.60)				
$\text{VR}_{t-1}/\text{P}_{t-1}$			-0.043	-0.068		
			(-2.45)	(-3.26)		
$\text{VF}_{t-1}/\text{P}_{t-1}$					-0.862	-1.04
					(-11.93)	(-4.97)
VOL_{t-1}	2.051	2.0915	2.4691	2.5191	7.1043	7.7408
	(23.16)	(15.46)	(23.80)	(17.68)	(24.57)	(17.44)
KZ_t	0.0444	0.0513	0.0368	0.0441	-0.05	-0.041
	(5.06)	(3.88)	(3.77)	(4.49)	(-2.55)	(-1.19)
$\text{RD}_t/\text{A}_{t-1}$	2.0543	2.218	2.4468	2.5543	1.3272	1.3549
	(5.44)	(4.57)	(5.90)	(6.32)	(1.65)	(1.98)
TAX_t	-0.526	-0.388	-0.404	-0.214	-0.194	-0.23
	(-5.61)	(-4.28)	(-3.94)	(-2.14)	(-1.00)	(-1.29)
Log(SALES)_{t-1}	-0.123	-0.135	-0.116	-0.134	-0.105	-0.103
	(-11.27)	(-9.39)	(-9.68)	(-9.38)	(-4.55)	(-5.43)
$\text{Log(\#EMP)}_{t-1}$	0.1748	0.1846	0.1685	0.183	0.1278	0.1343
	(19.90)	(22.25)	(17.45)	(18.41)	(7.40)	(8.98)
RET_t	0.0542	0.0533	-0.019	-0.017	-0.057	0.0143
	(1.79)	(1.39)	(-0.52)	(-0.27)	(-0.74)	(0.11)
RET_{t-1}	-0.226	-0.286	-0.121	-0.172	-0.58	-0.636
	(-7.00)	(-5.79)	(-3.38)	(-3.69)	(-6.81)	(-3.89)
Fixed effect	industry	industry	industry	industry	industry	industry

Table 10. **Logistic regressions of option grant decision on average V/P ratio, deviation of V/P from average, volatility, and control variables**

$$\begin{aligned}\text{Option grant choice}_t = {} & \beta_0 + \beta_{1m}\,\text{Mean V/P} + \beta_{1d}\,\text{Dev. V/P} + \beta_2\,\text{VOL}_{t-1} + \beta_3\,\text{KZ}_t \\ & + \beta_4\,\text{RD}_t/\text{A}_{t-1} + \beta_5\,\text{TAX}_t + \beta_6\,\text{RET}_t + \beta_7\,\text{RET}_{t-1} \\ & + \beta_8\,\text{Log(SALES)}_{t-1} + \beta_9\,\text{Log(\#EMP)}_{t-1} + \text{fixed effects}.\end{aligned}$$

Both pooled logistic and Fama-MacBeth logistic regressions are reported in this table. Coefficients and t-statistics are reported for pooled logistic regressions. In Fama-MacBeth type logistic regressions, logistic regression is run each year. The mean coefficients of all annual regressions are reported. Time series t-statistics (mean coefficient divided by its standard deviation and multiplied by the square-root of the number of cross sections) are in parentheses. The coefficients and statistics associated with fixed effects are not reported.

	Option grant decision					
	Pooled	FM	Pooled	FM	Pool	FM
Intercept	-0.412	-0.387	-0.581	-0.532	-1.03	-1.156
	(-3.65)	(-1.89)	(-4.76)	(-2.38)	(-4.07)	(-5.07)
Mean BE_t/ME_t	-0.147	-0.165				
	(-12.70)	(-18.68)				
Dev. $\text{BE}_{t-1}/\text{ME}_{t-1}$	-0.055	-0.049				
	(-4.35)	(-1.74)				
Mean $\text{VR}_{t-1}/\text{P}_{t-1}$			-0.006	-0.02		
			(-0.52)	(-1.89)		
Dev. $\text{VR}_{t-1}/\text{P}_{t-1}$			-0.007	-0.018		
			(-0.64)	(-1.11)		
Mean $\text{VF}_{t-1}/\text{P}_{t-1}$					-0.604	-0.691
					(-13.07)	(-7.34)
Dev. $\text{VF}_{t-1}/\text{P}_{t-1}$					-0.062	-0.156
					(-0.95)	(-1.00)
VOL_{t-1}	0.9702	0.9919	1.1755	1.2104	3.4796	3.8384
	(21.22)	(14.07)	(22.42)	(15.50)	(23.86)	(16.20)
KZ_t	0.0209	0.0255	0.0219	0.0255	-0.02	-0.017
	(4.27)	(3.55)	(3.97)	(4.32)	(-1.84)	(-0.96)
$\text{RD}_t/\text{A}_{t-1}$	0.8722	0.9239	1.035	1.0809	0.0293	0.1
	(4.91)	(4.45)	(5.30)	(5.95)	(0.08)	(0.28)
TAX_t	-0.272	-0.197	-0.261	-0.156	-0.07	-0.108
	(-5.10)	(-3.70)	(-4.47)	(-2.71)	(-0.65)	(-1.09)
Log(SALES)_{t-1}	-0.075	-0.08	-0.072	-0.081	-0.062	-0.06
	(-11.88)	(-10.41)	(-10.38)	(-10.69)	(-4.66)	(-5.29)
$\text{Log(\#EMP)}_{t-1}$	0.1028	0.108	0.0998	0.1078	0.0701	0.0741
	(20.10)	(21.73)	(17.78)	(19.15)	(7.05)	(8.30)
RET_t	0.0172	0.0191	-0.017	-0.019	-0.104	-0.034
	(1.05)	(0.87)	(-0.90)	(-0.58)	(-2.44)	(-0.56)
RET_{t-1}	-0.083	-0.107	-0.066	-0.094	-0.21	-0.241
	(-4.74)	(-3.59)	(-3.40)	(-3.64)	(-4.56)	(-2.59)
Fixed effect	industry	industry	industry	industry	industry	industry

Table 11. Regressions of executive option percentage on book-to-market, volatility and control variables

$$\text{Log(PCTEXEC)}_t = \beta_0 + \beta_1 \text{BE}_{t-1}/\text{ME}_{t-1} + \beta_2 \text{VOL}_{t-1} + \beta_3 \text{KZ}_t + \beta_4 \text{RD}_t/\text{A}_{t-1} + \beta_5 \text{TAX}_t + \beta_6 \text{RET}_t + \beta_7 \text{RET}_{t-1} + \beta_8 \text{Log(SALES)}_{t-1} + \beta_9 \text{Log(\#EMP)}_{t-1} + \text{fixed effects}.$$

In pooled regressions and panel regressions, the regresion coefficients are reported. In Fama-MacBeth (FM) regressions, the mean coefficients of all annual regressions are reported. T-statistics are in parenthesis. T-statistics in pooled regressions and panel regressions are computed using White's (1980) robust standard errors. T-statistics in Fama-MacBeth regressions are from the time series distribution of the coefficient (mean coefficient divided by its standard deviation and multiplied by the square-root of the number of cross sections). The coefficients and statistics associated with industry control variables are not reported.

	Log(PCTEXEC)		
	Pooled	FM	Panel
Intercept	2.8046	2.3522	2.3121
	(13.10)	(8.30)	(4.95)
$\text{BE}_{t-1}/\text{ME}_{t-1}$	0.3637	0.3593	0.0962
	(11.72)	(13.50)	(2.21)
VOL_{t-1}	-0.481	-0.437	0.0744
	(-6.22)	(-4.33)	(0.51)
KZ_t	0.0251	0.0184	-0.02
	(2.99)	(1.40)	(-1.59)
$\text{RD}_t/\text{A}_{t-1}$	-2.08	-2.093	-0.967
	(-10.73)	(-20.70)	(-2.92)
TAX_t	-0.148	-0.198	-0.096
	(-2.20)	(-7.72)	(-1.16)
Log(SALES)_{t-1}	-0.196	-0.172	-0.179
	(-13.87)	(-8.32)	(-6.56)
$\text{Log(\#EMP)}_{t-1}$	-0.066	-0.084	-0.041
	(-4.68)	(-5.23)	(-1.59)
RET_t	0.0071	0.039	0.081
	(0.32)	(0.86)	(4.05)
RET_{t-1}	0.0168	0.071	0.0059
	(0.69)	(1.81)	(0.27)
Fixed effect	industry	industry	firm
Adj. Rsq.	0.2124	0.2133	0.1132

Table 12. **Regressions of executive option percentage on different value-price ratios, volatility and control variables**

$$\begin{aligned}\text{Log(PCTEXEC)}_t &= \beta_0 + \beta_1\,\text{V/P} + +\beta_2\,\text{VOL}_{t-1} + \beta_3\,\text{KZ}_t \\ &+ \beta_4\,\text{RD}_t/\text{A}_{t-1} + \beta_5\,\text{TAX}_t + \beta_6\,\text{RET}_t + \beta_7\,\text{RET}_{t-1} \\ &+ \beta_8\,\text{Log(SALES)}_{t-1} + \beta_9\,\text{Log(\#EMP)}_{t-1} + \text{fixed effects}.\end{aligned}$$

Only Fama-MacBeth (FM) regressions are reported in this table. The mean coefficients of all annual regressions are reported. Time series t-statistics (mean coefficient divided by its standard deviation and multiplied by the square-root of the number of cross sections) are in parentheses. The coefficients and statistics associated with fixed effects are not reported.

	Log(PCTEXEC)				
Intercept	2.5887	3.22	2.3303	2.7412	3.1071
	(7.12)	(13.41)	(7.97)	(7.14)	(13.22)
VR_{t-1}/P_{t-1}	0.043				
	(2.96)				
VF_{t-1}/P_{t-1}		0.4252			
		(11.01)			
Mean BE_t/ME_t			0.3675		
			(11.74)		
Dev. BE_{t-1}/ME_{t-1}			0.2123		
			(7.26)		
Mean VR_{t-1}/P_{t-1}				0.0703	
				(5.78)	
Dev. VR_{t-1}/P_{t-1}				-0.039	
				(-1.06)	
Mean VF_{t-1}/P_{t-1}					0.5378
					(11.64)
Dev. VF_{t-1}/P_{t-1}					0.1196
					(1.54)
VOL_{t-1}	-0.265	-0.607	-0.431	-0.342	-0.642
	(-7.29)	(-4.75)	(-4.31)	(-12.84)	(-5.37)
KZ_t	0.012	0.0101	0.0203	0.0129	0.005
	(0.55)	(0.62)	(1.55)	(0.58)	(0.31)
RD_t/A_{t-1}	-2.392	-2.44	-2.066	-2.363	-2.336
	(-19.12)	(-10.22)	(-18.54)	(-16.20)	(-9.20)
TAX_t	-0.31	-0.212	-0.204	-0.33	-0.204
	(-4.80)	(-2.93)	(-7.26)	(-4.93)	(-2.85)
$Log(SALES)_{t-1}$	-0.175	-0.216	-0.171	-0.185	-0.212
	(-5.14)	(-13.67)	(-8.15)	(-5.28)	(-14.38)
$Log(\#EMP)_{t-1}$	-0.08	-0.073	-0.084	-0.075	-0.076
	(-2.78)	(-4.50)	(-5.27)	(-2.54)	(-5.30)
RET_t	0.0449	0.0495	0.0539	0.0571	0.0824
	(0.66)	(1.59)	(1.14)	(0.78)	(2.28)
RET_{t-1}	-0.007	0.1129	0.0376	-0.043	0.0627
	(-0.17)	(2.20)	(0.97)	(-1.13)	(1.19)
Fixed effect	industry	industry	industry	industry	industry
Adj. Rsq.	0.207	0.2428	0.2135	0.2082	0.2475

Table 13. Regressions of option grant on value-price ratio, interaction between value-price ratio and financial constraints indicator, volatility and control variables

$$\text{Log(Option grant)}_t = \beta_0 + \beta_1 \text{V}_{t-1}/\text{P}_{t-1} + \beta_{1i} \text{V/P * I(FC)} + \beta_2 \text{VOL}_{t-1} + \beta_3 \text{KZ}_t + \beta_4 \text{RD}_t/\text{A}_{t-1} + \beta_5 \text{TAX}_t + \beta_6 \text{RET}_t + \beta_7 \text{RET}_{t-1} + \beta_8 \text{Log(SALES)}_{t-1} + \beta_9 \text{Log(\#EMP)}_{t-1} + \text{fixed effects}.$$

OPTVAL and OPTVALPE are used as proxies for option grant. The dummy variable for a financially constrained firm-year (I(FC)) is set to 1 if the firm's KZ index belongs to the top 20% of all sample firms in the year, and 0 otherwise. Only Fama-MacBeth (FM) regressions are reported in this table. The mean coefficients of all annual regressions are reported. Time series t-statistics (mean coefficient divided by its standard deviation and multiplied by the square-root of the number of cross sections) are in parentheses.

	Log(OPTVAL)			Log(OPTVALPE)		
Intercept	0.813	0.8618	-0.08	10.351	9.9418	9.1401
	(1.98)	(2.38)	(-0.22)	(31.88)	(36.89)	(33.99)
$\text{BE}_{t-1}/\text{ME}_{t-1}$	-1.264			-1.038		
	(-25.65)			(-25.16)		
$\text{BE}_{t-1}/\text{ME}_{t-1}$*I(FC)	0.1578			0.0922		
	(3.38)			(1.40)		
$\text{VR}_{t-1}/\text{P}_{t-1}$		-0.341			-0.258	
		(-7.92)			(-5.07)	
$\text{VR}_{t-1}/\text{P}_{t-1}$*I(FC)		0.1864			0.1887	
		(6.99)			(5.21)	
$\text{VF}_{t-1}/\text{P}_{t-1}$			-1.183			-1.03
			(-19.33)			(-18.09)
$\text{VF}_{t-1}/\text{P}_{t-1}$*I(FC)			0.1247			0.0942
			(2.06)			(1.49)
VOL_{t-1}	2.2402	2.1856	2.5642	2.4383	2.4901	2.6783
	(24.92)	(11.52)	(20.96)	(28.70)	(18.48)	(21.12)
KZ_t	0.0218	-0.022	0.0444	-0.001	-0.039	0.0256
	(1.56)	(-1.11)	(2.91)	(-0.09)	(-2.02)	(1.64)
$\text{RD}_t/\text{A}_{t-1}$	4.0642	4.9697	4.4712	4.7662	5.6287	5.1813
	(19.40)	(16.19)	(14.66)	(24.84)	(23.89)	(22.83)
TAX_t	-0.017	0.1531	-0.061	0.1497	0.397	0.1798
	(-0.28)	(2.02)	(-0.90)	(3.53)	(4.93)	(2.25)
Log(SALES)_{t-1}	0.722	0.6789	0.7489	-0.134	-0.156	-0.082
	(29.44)	(26.66)	(27.33)	(-5.89)	(-10.26)	(-4.30)
$\text{Log(\#EMP)}_{t-1}$	0.0325	0.0522	0.0667			
	(3.21)	(4.18)	(3.68)			
RET_t	0.2451	0.2774	0.1775	0.1735	0.1013	0.1347
	(3.52)	(2.23)	(2.89)	(1.81)	(0.73)	(1.72)
RET_{t-1}	0.0907	0.3196	0.1232	0.0493	0.2197	0.0659
	(1.03)	(2.59)	(1.67)	(0.43)	(1.67)	(0.71)
Fixed effect	industry	industry	industry	industry	industry	industry
Adj. Rsq.	0.5866	0.5243	0.6153	0.5063	0.4621	0.5365

Table 14. Regressions of option grant on value-price ratio, interaction between value-price ratio and extreme overvaluation indicator, volatility and control variables

$$\text{Log(Option grant)}_t = \beta_0 + \beta_1 \text{V}_{t-1}/\text{P}_{t-1} + \beta_{1i}\,\text{V/P * I(OV)} + \beta_2\,\text{VOL}_{t-1} + \beta_3\,\text{KZ}_t + \beta_4\,\text{RD}_t/\text{A}_{t-1} + \beta_5\,\text{TAX}_t + \beta_6\,\text{RET}_t + \beta_7\,\text{RET}_{t-1} + \beta_8\,\text{Log(SALES)}_{t-1} + \beta_9\,\text{Log(\#EMP)}_{t-1} + \text{fixed effects}.$$

OPTVAL and OPTVALPE are used as proxies for option grant. The dummy variable for an extremely overvalued firm-year (I(OV)) is set to 1 if the firm's value-price ratio belongs to the bottom 10% of all sample firms in the year, and 0 otherwise. Only Fama-MacBeth (FM) regressions are reported in this table. The mean coefficients of all annual regressions are reported. Time series t-statistics (mean coefficient divided by its standard deviation and multiplied by the square-root of the number of cross sections) are in parentheses.

	Log(OPTVAL)			Log(OPTVALPE)		
Intercept	0.8154	0.8223	-0.113	10.294	9.9118	9.0331
	(2.14)	(2.32)	(-0.32)	(34.95)	(33.88)	(34.82)
$\text{BE}_{t-1}/\text{ME}_{t-1}$	-1.176			-0.938		
	(-25.10)			(-26.30)		
$\text{BE}_{t-1}/\text{ME}_{t-1}$*I(OV)	2.3961			3.5613		
	(4.04)			(5.15)		
$\text{VR}_{t-1}/\text{P}_{t-1}$		-0.297			-0.22	
		(-6.76)			(-5.25)	
$\text{VR}_{t-1}/\text{P}_{t-1}$*I(OV)		1.1273			1.4252	
		(4.21)			(5.13)	
$\text{VF}_{t-1}/\text{P}_{t-1}$			-1.073			-0.912
			(-15.01)			(-12.18)
$\text{VF}_{t-1}/\text{P}_{t-1}$*I(OV)			2.688			3.1707
			(3.58)			(3.98)
VOL_{t-1}	2.2651	2.2556	2.574	2.4476	2.575	2.6695
	(23.14)	(12.07)	(19.58)	(24.22)	(19.69)	(18.41)
KZ_t	0.0338	0.0178	0.0477	0.0044	0.0035	0.0234
	(3.17)	(0.89)	(4.15)	(0.45)	(0.21)	(2.16)
$\text{RD}_t/\text{A}_{t-1}$	3.9131	5.1248	4.2647	4.5383	5.8232	4.9376
	(18.98)	(16.47)	(13.49)	(25.86)	(24.80)	(20.76)
TAX_t	-0.026	0.0965	-0.062	0.1347	0.3306	0.1747
	(-0.48)	(1.19)	(-0.96)	(3.64)	(3.87)	(2.36)
Log(SALES)_{t-1}	0.718	0.6832	0.7441	-0.134	-0.152	-0.081
	(31.30)	(27.90)	(28.48)	(-6.31)	(-10.29)	(-4.46)
$\text{Log(\#EMP)}_{t-1}$	0.0382	0.052	0.0734			
	(3.96)	(4.15)	(4.20)			
RET_t	0.2439	0.2766	0.1647	0.1781	0.1051	0.1199
	(3.51)	(2.31)	(2.61)	(1.89)	(0.79)	(1.51)
RET_{t-1}	0.0698	0.3075	0.0894	0.0194	0.2021	0.0229
	(0.83)	(2.51)	(1.25)	(0.18)	(1.56)	(0.25)
Fixed effect	industry	industry	industry	industry	industry	industry
Adj. Rsq.	0.5876	0.5242	0.618	0.5095	0.4629	0.5409

Table 15. Regressions of option grant on value-price ratio, volatility, individual components of KZ index and control variables

$$\text{Log(Option grant)}_t = \beta_0 + \beta_1 V_{t-1}/P_{t-1} + \beta_{1i} V/P * I(OV) + \beta_2 VOL_{t-1} + \beta_3 KZ_t + \beta_4 RD_t/A_{t-1} + \beta_5 TAX_t + \beta_6 RET_t + \beta_7 RET_{t-1} + \beta_8 \text{Log(SALES)}_{t-1} + \beta_9 \text{Log(\#EMP)}_{t-1} + \text{fixed effects}.$$

OPTVAL and OPTVALPE are used as proxies for option grant. Only Fama-MacBeth (FM) regressions are reported in this table. The mean coefficients of all annual regressions are reported. Time series t-statistics (mean coefficient divided by its standard deviation and multiplied by the square-root of the number of cross sections) are in parentheses.

	Log(OPTVAL)	Log(OPTVALPE)
Intercept	0.1357	9.4627
	(0.39)	(33.97)
BE_{t-1}/ME_{t-1}	-1.203	-0.948
	(-19.16)	(-18.73)
VOL_{t-1}	1.8796	1.9621
	(19.34)	(16.82)
CB_t/A_{t-1}	1.2777	1.7601
	(12.45)	(16.93)
LEV_t	-0.255	-0.148
	(-5.14)	(-2.44)
CF_t/A_{t-1}	0.1843	0.3577
	(0.70)	(1.35)
DIV_t/A_{t-1}	-5.662	-4.569
	(-5.73)	(-4.57)
RD_t/A_{t-1}	3.0438	3.5303
	(17.25)	(20.90)
TAX_t	-0.113	0.075
	(-1.33)	(1.10)
Log(SALES)_{t-1}	0.7597	-0.093
	(37.22)	(-4.48)
$\text{Log(\#EMP)}_{t-1}$	0.0394	
	(4.57)	
RET_t	0.2029	0.0978
	(2.61)	(0.96)
RET_{t-1}	0.0758	0.0207
	(0.83)	(0.19)
Fixed effect	industry	industry
Adj. Rsq.	0.5981	0.5222