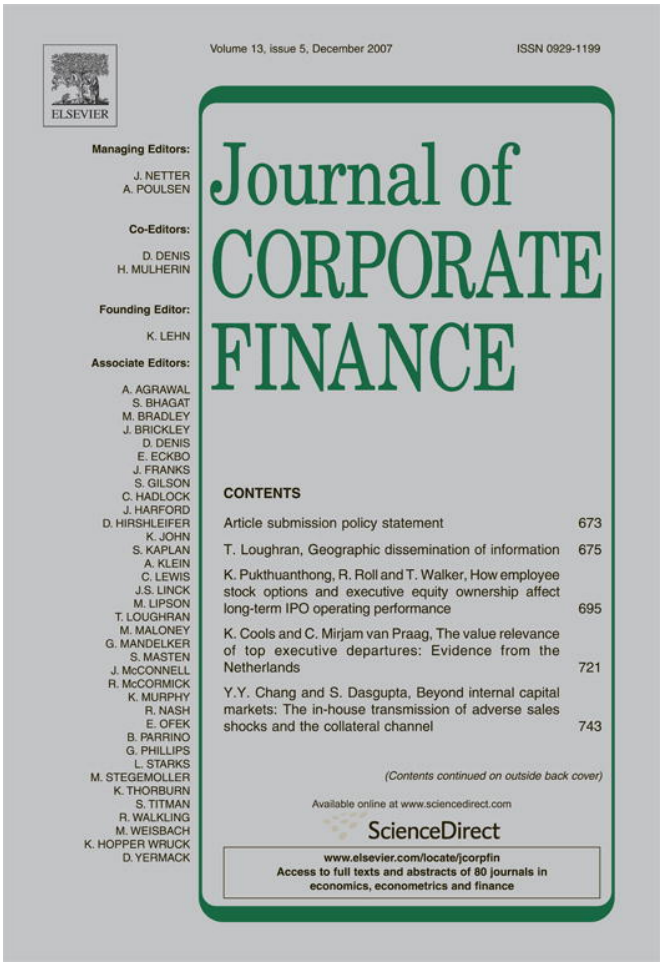

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How employee stock options and executive equity ownership affect long-term IPO operating performance ☆

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Abstract

To ascertain whether the form of managerial compensation affects a firm's long-term operating performance, we track IPOs for 5 years after the expiration of the stabilization period. New public companies perform better when managers receive a balanced combination of stock option grants and equity ownership. Firms with unbalanced compensation arrangements, large option grants and little equity ownership or vice versa do not perform as well. This empirical finding is consistent with a theoretical explanation based on managerial risk aversion and the alignment of managerial and owner incentives.

JEL classification: G12; G32; J33
Keywords: Initial public offerings; Stock options; Executive compensation

1. Introduction

In the United States, equity-based compensation represents a substantial and increasing fraction of the total remuneration received by top corporate executives (Conyon and Murphy, 1999). Equity-based compensation comes in a variety of forms, but the two most common are

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undoubtedly awards of shares and grants of options on the firm's stock; both of which are commonly subject to various restrictions on reselling, vesting, etc.

Agency theory suggests that firms endow employees with equity to create incentives and align the interests of managers and owners.[1] Stock-based compensation plans can also assist a firm in bringing talented new staff on board (Oyer, 2004; Oyer and Schaefer, 2004) or in retaining that staff (Carter and Lynch, 2001; Callaghan et al., 2003; Subramanian et al., 2007). Stock options might be a particularly effective form of compensation when cash availability is limited in cash-poor start-up firms (Inderst and Müller, 2005). This might be especially important for high-technology firms that have intangible assets but little cash (Yermack, 1995; Dechow et al., 1995; Core and Guay, 2001).

In recent years, however, stock option plans have drawn the attention of many critics who claim that they have become too costly, that their costs are not properly reported under current GAAP rules, and that they provide employees with an incentive to abuse the system.[2] But despite recent publicity about supposed backdating and corporate scandals involving such high-profile firms as WorldCom, Enron, and Adelphia Communications, the use of employee stock options is still widespread, particularly by high-technology firms.

The scholarly literature about compensation arrangements and their specific features has also blossomed in recent years.[3] But although the very prevalence of equity-based compensation argues for its efficacy, there has not been much hard empirical evidence about costs nor about incentives, risk taking, and other managerial behavior presumably influenced by the form of compensation.

Our purpose is to augment the evidence by studying equity and option usage by new public companies. After an IPO, insider holdings are diluted and the secondary market makes it easier for insiders to sell their ownership shares; yet the use of equity-based compensation such as stock options increases significantly (Frye, 2002). For several reasons, IPOs represent a particularly fertile laboratory for studying managerial compensation; top managers often hold substantial equity positions and the success of start-up firms is undoubtedly more sensitive to good managerial practices. Consequently, if the form of managerial compensation really does play a role in fostering success, it seems likely to be more easily and quickly discernable among IPOs.

We study the form of equity compensation and operating performance for 5 years after an IPO using a comprehensive sample of 897 firm-commitment IPOs filed between January 1997 and December 1999. We find that a particular compensation form is associated with superior performance for at least 3 years.[4] Performance is better when there is a balanced compensation scheme, a mix of equity and options as opposed to unbalanced scheme (lots of options and little equity or vice versa.)

[1] See also Jensen and Meckling (1976), Haugen and Senbet (1981), Smith and Stulz (1985), Lambert (1986), Copeland and Weston (1988), Lambert et al. (1991), Hirshleifer and Suh (1992), and Hemmer et al. (1999). Other researchers such as Demsetz and Lehn (1985), Himmelberg et al. (1999), Core and Guay (1999), Rajgopal and Shevlin (2002), and Hanlon et al. (2003) base their analyses on the premise that option granting is consistent with firm value maximization.

[2] Murphy (2002, 2003) proposes that compensation policies are based on the "perceived cost" of options rather than their true economic cost. Until the recent FAS123 ruling by the Financial Accounting Standards Board (FASB), option grants involved no accounting charges. Also, they resulted in no direct cash outlay. Consequently, many firms may have perceived that option compensation was a low cost alternative to cash compensation.

[3] Bizjak et al. (1993), Jolls (1998), Guay (1999), Cohen et al. (2000), Rogers (2002a,b), Ryan and Wiggins (2002), and Coles et al. (2006a).

[4] See Demsetz and Lehn (1985), Demsetz and Villalonga (2001), Himmelberg (2002), and Coles et al. (2005) for firm performance and corporate governance mechanisms.

Our paper differs from previous papers that have investigated the relation between executive pay and future firm performance. Several studies correlate compensation measures with ex-post stock price performance (e.g., Masson, 1971; Abowd, 1990; DeFusco et al., 1991; Core et al., 1999; Kedia and Mozumdar, 2002; Ittner et al., 2003). A major difficulty with this approach is that stock prices have embedded shareholder expectations. Option grants and other equity-based forms of compensation are clearly intended to affect the distribution of stock returns for the company. In an efficient market, the forward-looking nature of stock prices likely incorporates this shift in the distribution of returns prior to executives taking any particular action induced by their compensation contract.

In sorting out the impact of executive compensation arrangements on subsequent managerial performance after IPOs, one could become embroiled in the general controversy surrounding post-IPO stock price patterns, which was engendered by results in Ritter (1991) and in Loughran and Ritter (1995). Their empirical findings seem to call into question market efficiency itself, because post-IPO stock price performance was strongly negative, supposedly too negative to be explained by risk or other influences.

Later researchers attempted to explain the Loughran and Ritter results while rescuing market efficiency. There have been two main approaches. First, Brav and Gompers (1997), Brav (2000), and Eckbo et al. (2000) present large-sample evidence that negative post-IPO returns are consistent with multifactor pricing models, and tend to be exaggerated in small growth stocks. A second explanation was offered by Schultz (2003), who argues that if more firms go public after stock prices have risen, event-time analyses may indicate that IPOs underperform, even if the ex ante expected return of these offerings is zero. Therefore, the low post-issue returns may be a manifestation of the more general finding of Fama and French (1993) that small growth stocks tend to exhibit low returns during the post-1963 period.

We are not sure, however, whether either explanation is correct or accepted by most scholars. In the case of Schultz' explanation, if returns are adjusted for contemporaneous market movements and other factor movements after the IPO, the fact that IPOs *follow* bull markets should not introduce any particular bias. (Of course, the estimated coefficients in the adjustment model might be systematically biased for some reason; this is always a potential problem.) In the case of adding additional "risk" factors, one might ultimately be able to explain any pattern by employing enough extra variables; and some of them, such as the leverage risk factor used by Eckbo and Norli (2005), seem theoretically questionable.

Our approach, as a consequence, is simply to avoid the controversy. Whether or not the stock market is sufficiently efficient to account for compensation arrangements in advance, we hypothesize that there could still be a pronounced pattern of *operating* performance (such as in sales, profits, etc.) related to managerial compensation. This suggests that operating performance is actually a better vehicle for examining any possible influence of compensation because it avoids the controversy surrounding market efficiency, or the lack thereof, in post-IPO stock price patterns.

2. Stock options and executive equity ownership: a theoretical perspective

If investors believe that stock options provide effort-enhancing incentives they should respond more favorably to IPOs when stock options are an important part of employee compensation. Interestingly, previous research has generally treated stock options and equity ownership as equivalent incentive structures (Beatty and Zajac, 1994; Yermack, 1995; Shleifer and Vishny, 1997), but equity ownership and stock options have different risk properties (Certo et al., 2003).

Returns on options are more volatile than returns on the underlying equity, so holding an undiversified position in options is more risky than holding an equal dollar amount of equity. On the other hand, adopting more risky investment projects increases the value of option grants, though it will not increase the value of equity grants and could even decrease their value. This suggests that investors might favor diverse combinations of options and equity grants to different levels of employees. All employees are motivated to exert extra effort by options, but top decision makers must be restrained from taking on too many risky projects; such a restraint is effectuated when top executives hold significant undiversified equity positions.

We propose that stock option compensation could be particularly effective when executives also own high levels of firm equity. When executives have much personal wealth in the form of both money and human capital invested in their firms, the resulting non-diversified risk exposure may render them reluctant to favor good risky projects. Options could help ensure that executives with large amounts of equity continue to take measured risks.

To formalize this intuition, consider a compensation arrangement for the top-ranking manager/decision making agent of the firm. For simplicity of illustration, we assume that his future wealth derives entirely from a position in the firm's equity plus a grant of options on the same equity. This manager/agent is risk averse. Because of well-known difficulties in monitoring and supervising his investment decisions, the shareholders realize that their manager/agent will essentially be able to select the overall risk of the firm's equity. Because systematic risk alone matters for well-diversified shareholders, again for illustration we presume that the manager can affect market-related risk by choosing a leverage ratio for the firm, thereby fixing the firm's "beta" at a level optimal for himself. The agency problem for the shareholders is to select a compensation arrangement, a mix of options and equity that will motivate the manager. We now show that this is indeed feasible provided that the shareholders understand the risk tolerances of the manager.[5]

Notationally, let S_t denote the firm's stock price at time t and let the current time, $t=0$, be the date when the compensation arrangement is put into effect. Options are granted at-the-money to the manager, so the strike price, K, is S_0. An amount Q is granted in shares of equity while an amount αQ is granted in European call options on the stock. At time $t=T$, the manager sells his stock at S_T, exercises the options if $S_T > S_0$, and then retires from the job. At that point, his wealth is

$$W = Q[S_T + \alpha \max(0, S_T - S_0)] \tag{1}$$

and his expected utility is

$$E[U(W)] = \int_0^{S_0} U(QS_T)df(S_T) + \int_{S_0}^{\infty} U[QS_T + \alpha Q(S_T - S_0)]df(S_T), \tag{2}$$

where $df(S_T)$ is the probability density function of the stock price at T, which is determined partly by the manager's choice of risk level (leverage) for the firm. Shareholders determine α, the relative managerial compensation in the form of options.

[5] Interesting papers that are related to the section on the mix of options and equity include Guay (1999), Ju et al. (2002), Ross (2004), and Lewellen (2006). Lewellen points out that deep in-the-money options will tend to make managers more cautious and induce them to avoid risks rather than the opposite. However, we are assuming that options are granted at-the-money. When the firm does well, these grants will become in-the-money later, which might explain why stockholders make further at-the-money grants over time, to assure that senior executives remain eager to take appropriate risks.

In the numerical illustration solution to follow, we further assume that the stock price at time T is distributed lognormally,

$$\tilde{S}_T = S_0 \exp[R_F + \beta\lambda(\tilde{R}_M - R_F)] \tag{3}$$

where β would be the firm's beta if it had no debt (the unlevered beta), $\lambda \equiv 1 + D/E$ is the leverage ratio, unity plus the market debt/equity ratio (the decision choice variable of the manager), R_F is the risk-free interest rate and $\tilde{R}_M$ is Gaussian. Furthermore, we assume that the manager has a CRRA (constant relative risk aversion) utility function of the form.

$$U(\text{Wealth}) = U(W) = \frac{W^{1-g}}{1-g} \tag{4}$$

where g is the risk aversion parameter. Consequently, the manager's problem is

$$\max_{\lambda} E[U(W|\alpha)] \tag{5}$$

Even for such a simple utility function, a closed-form analytic solution is problematic because of the partial integral involving the option. Moreover, it is not immediately obvious that there exists an internal maximum for λ, the manager's optimal leverage/risk level. For high levels of risk aversion, he might pick minimal risk, $\lambda = 0$, while for very high levels of risk tolerance, improving the value of the option grant might completely override any risk felt from his equity ownership and he would select such high leverage that the firm risks bankruptcy before his tenure expires.

Nonetheless, it is also clear that internal solutions do exist for moderate levels of manager risk aversion and that the manager's problem can easily be solved by numerical integration. Fig. 1 depicts a series of solutions, each for a different level of manager risk aversion, g. The horizontal axis in Fig. 1 gives α, the options granted to the manager as a fraction of the shares granted. The figure assumes an annual market mean return of 7%, a risk-free rate of 5%, market volatility (return standard deviation) of 25% and an unlevered beta of 1.0. Without loss of generality we fix $Q = 1$ and set the option's term to 1 year.[6]

Each curve plots the manager's choice of risk (debt/equity ratio) given his option/stock compensation contract. Higher leverage makes the stock more risky, of course, by altering the firm's beta. Manager risk aversion increases from the top to the bottom curve, so understandably the chosen leverage ratio also falls from top to bottom whatever the compensation arrangement.

The horizontal line is for a debt/equity ratio of 1:1. If stockholders held this to be an optimal risk level from their perspective, they would grant options to managers with different levels of risk aversion ranging from 20% for managers with $g = 1.2$ to about 220% for managers with $g = 1.35$. A 20% grant means, for instance, that for every $1 million in stock granted, the options granted would be worth about $25,000 on the grant date.[7] At the higher end ($g = 1.35$), the options would be worth about $270,000 for every $1 million in stock.

The basic insight of this theoretical illustration concerns the offsetting roles of options and stock in top management executive compensation. By using both options and stock in the

[6] In this illustration, idiosyncratic risk is assumed to be zero. Intuitively, allowing for idiosyncratic risk (without any higher return) should induce managers to select lower leverage levels.

[7] This is based on a rough Black/Scholes calculation, given the option's term and strike, the interest rate, and the stock's volatility. An ESO might be worth less because of vesting and other considerations; of course, if the options were longer term, as they often are in ESO grants, they would be worth correspondingly more.

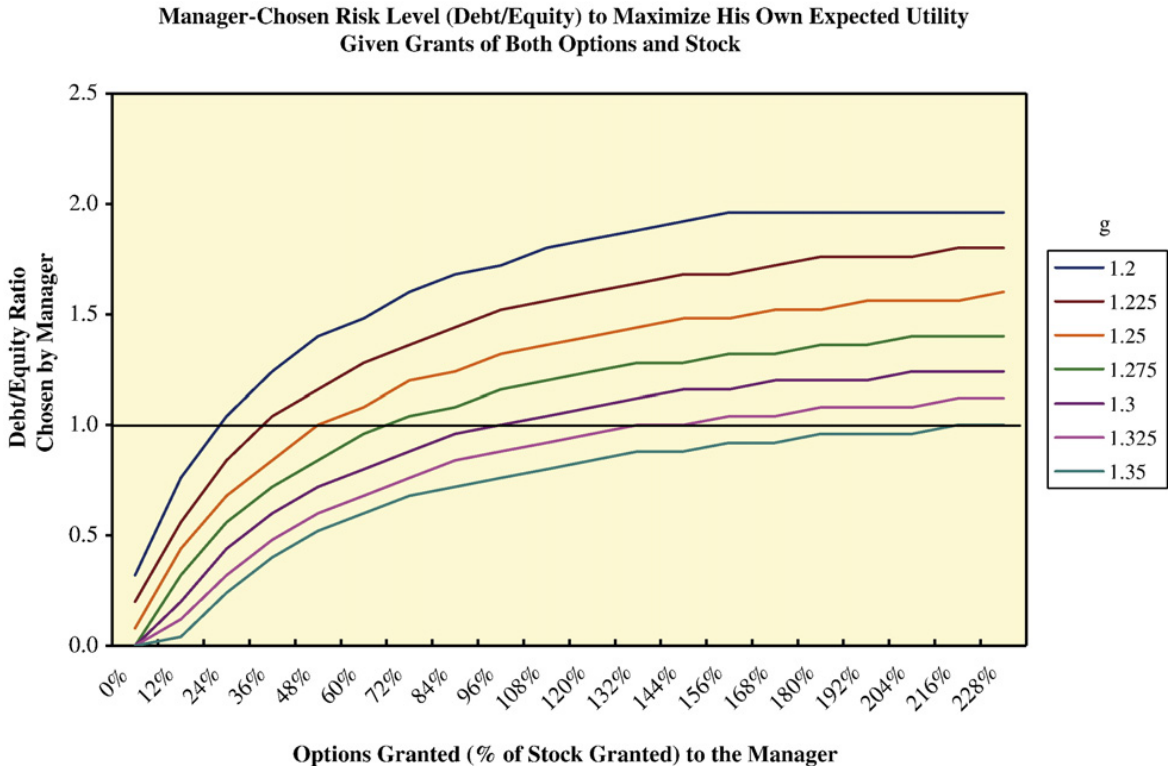

Fig. 1. Combinations of option and stock grants to induce appropriate risk-taking by managers. The figure illustrates how a top-manager's selection of a firm's risk level depends on his compensation arrangement, which is assumed to consist of both option and stock grants. The depicted manager has a CRRA (constant relative risk aversion) utility function with risk aversion g. For simplicity of illustration, options are granted at-the-money with 1 year to expiration; the market-wide mean return is 7%, the risk-free rate is 5%, and the market's volatility is 25%. To fix the firm's risk, the manager is assumed to select a particular leverage ratio, thereby altering the risk relevant for diversified shareholders. The firm's unlevered beta is assumed to be 1.0. If shareholders have a preferred risk level, they can induce the manager to select it for them by altering the proportions of options and stock in his compensation contract. For example, if stockholders desired a debt/equity ratio of 1:1, they would grant 20 options for every 100 shares of stock to a manager with modest risk aversion ($g=1.2$) and 220 options for every 100 shares of stock to a more risk averse manager ($g=1.35$.) A 20% (220%) options grant would be worth roughly $25,000 ($270,000) per $1 million worth of stock granted.

appropriate proportions, shareholders can induce their agent to take on the level of risk *they* desire; this exact same level of risk is optimal from the manager's perspective, given his compensation contract.

3. Data description

We are grateful to Mark Taranto for collecting the IPO data; 897 issues were filed between January 1997 and December 1999. Of these 897 firms, 257 firms went public in 1997, 210 firms in 1998, and 430 firms in 1999. REITs, closed-end funds, financial firms, unit offerings, ADRs, and issues priced at less than five dollars are excluded from the data set. Although many previous studies also exclude financial institutions, they are not dropped here, since there is no theoretical reason to do so. All IPOs are US firms and started trading on the NYSE, AMEX or NASDAQ. Foreign companies are excluded since tax laws may differ. These sample selection criteria are consistent with previous studies by Ritter (1991), and Krigman et al. (1999). All IPO information including shares offered, offer price, and the initial offering range are collected from SEC filings made available through the EDGAR database and from the SDC. Since Ljungqvist and Wilhelm

Table 1
Summary statistics

Variable	Full sample	Venture-capital-backed IPOs	Non-venture-capital-backed IPOs	IPOs with founder CEO	IPOs with non-founder CEO
Underpricing	46.1% (78.7%)	73.1% (99.0%)	27.6% (53.8%)	46.5% (82.8%)	45.7% (74.0%)
Existing options ratio	47.7% (54.2%)	68.0% (60.8%)	33.7% (44.1%)	49.7% (56.3%)	45.4% (51.8%)
Concurrent options ratio	7.2% (18.9%)	5.3% (14.5%)	8.5% (21.3%)	6.2% (17.2%)	8.3% (20.6%)
Warrant ratio	13.7% (37.8%)	18.5% (33.1%)	10.3% (40.4%)	14.2% (43.7%)	13.1% (30.0%)
Fraction of firm sold at IPO	26.4% (11.9%)	22.7% (9.6%)	29.0% (12.7%)	26.0% (10.9%)	26.9% (12.9%)
Percent backed by venture capital	40.7%	100.0%	0.0%	42.6%	38.6%
Percent with founder CEOs	52.4%	54.8%	50.8%	100.0%	0.0%
Percent priced below lower limit of offering price range	17.9%	15.3%	19.7%	19.1%	16.6%
Percent priced between lower limit and 120% of upper limit of offering price range	66.9%	59.5%	72.0%	65.5%	68.4%
Percent refiled with price above 120% of upper limit of offer price range	15.2%	25.2%	8.3%	15.3%	15.0%
Percent with existing options	87.7%	98.4%	80.5%	90.9%	84.3%
Percent with concurrent options	34.4%	24.7%	41.2%	33.6%	35.4%
Percent with options	99.3%	100.0%	98.8%	99.6%	99.1%
Percent with warrants	57.2%	79.7%	41.7%	59.8%	54.3%
Percent with concurrent private offerings	3.3%	5.2%	2.1%	3.2%	3.2%
Percent with secondary offerings	28.5%	23.3%	32.1%	28.3%	28.3%
Sample size	897	365	532	470	427

Below are summary statistics for our sample of 897 IPOs issued between January 1997 and December 1999. Underpricing is the one-day percentage return from the SDC offer price to the CRSP closing price at the end of the first day of trading. All other variables were gathered directly from IPO prospectuses. The 'Existing options ratio' is the number of existing options outstanding at the IPO relative to the number of shares offered in the IPO. The 'Concurrent options ratio' is the number of options granted concurrently with the IPO relative to the number of shares offered in the IPO. The 'Warrant ratio' is the number of warrants outstanding relative to the number of shares offered in the IPO. In each cell, the sample mean is reported first followed by the standard deviation in parentheses.

(2003) document that there are significant errors in SDC's variables for venture backing and share outstanding pre- and post-IPO, we hand-collect these variables as well.

Mark Taranto's data include the number stock options owned by venture capital firms, the numbers of outstanding options, concurrently issued options, and warrants, whether the firm's founder is the CEO, and other IPO variables. For missing data, we hand-collected the number of stock options and warrants outstanding as of the issue date, the number of new options issued concurrently with the IPO, and executive cash compensation (salaries and bonuses) from prospectuses. There are 309 firms in the sample that offer new options at the IPO. Managers, employees and directors of the firm hold the majority of these options. In the sample, 365 firms are backed by venture capital. From prospectuses, we obtain the number of shares held by venture capitalists and financial institutions. We hand-fill gaps in compensation data from the ExecuComp database, including the number of shares and options owned, the number of shares

sold, options granted, and options exercised, the CEO's holdings, the number of restricted shares held at the time of the IPO, and executives' cash compensation.

Accounting items, such as book value, total assets, EBITDA, and sales are obtained from Compustat and further data not available on Compustat are compiled from the financial reports on EDGAR. Some SDC accounting data (the book values of assets and equity, sales, and EBITDA) are used purely for illustrative purposes or to check for outliers.

The ratio of accruals to total assets reported in the first annual statement after the firm goes public is considered a measure of earnings quality. Using the cash flow statement, we construct accruals as income before extraordinary items (Compustat item 123) minus cash flow from operations (item 308 minus item 124). Forecast earnings data are obtained from the I/B/E/S database. Lastly, underwriter quality is based on modifications of the Carter and Manaster (1990) and Carter et al. (1998) rankings as developed by Loughran and Ritter (2004); the rankings are between 0 (low) and 9.1 (high).

Finally, we hand-fill gaps in the SDC's coverage of company founding dates and manually check all firms that according to SDC were 0 to 3 years old at the IPO; this is motivated by Loughran and Ritter (2004), who note that the SDC frequently reports the most recent incorporation date rather than the founding date. As in Loughran and Ritter, the founding date is defined here as the date when operations commenced. In IPOs that had been divisions of public corporations, we attempt to determine the date when the division commenced operations. This date normally precedes the date of the division's incorporation. In roll-ups and similar acquisition-based IPOs, the founding date of the IPO is taken as the earliest founding date of any of its constituent firms.

Matching firms are selected from currently listed firms that have been public for at least 3 years. Industry classifications are taken from Kenneth French's website;[8] they are groupings of various 4-digit SIC codes. SIC codes are obtained from the SDC for both IPOs and matching firms.[9] In contrast to many other studies, we do not exclude IPOs that have negative earnings, book values or EBITDA during the last reporting year before the issue; they actually represent a large part of the sample. Most such companies are high-growth, high value, and technology firms that dominated the 1997–1999 IPO market.

4. Methods and empirical results

Table 1 provides information on the underpricing and option usage of 365 venture-capital-backed deals and 532 non-venture-capital-backed deals. Since Ljungqvist and Wilhelm (2003) find that venture-backed firms experience higher underpricing during the late 1990s, we report data for venture-capital-backed firms and those not backed by venture capital separately. Moreover, we break down the data into 470 firms with founder CEOs and 427 firms without founder CEOs.

Some attributes differ materially between venture-backed firms and other firms. Underpricing, for example, the percentage difference between the first-day closing price and the IPO offer price, is 73.1% for venture-backed IPOs and 27.6% for others. The existing options ratio, existing options outstanding at the IPO relative to the number of shares offered in the IPO, is much higher on average for venture-backed firms; but the concurrent options ratio, options offered

[8] http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/Data_Library/changes_ind.html.

[9] The source of SIC codes is crucial since the SIC codes reported by SDC, CRSP, and Compustat for the same firm have surprisingly little correlation. We do not use SIC codes from CRSP because CRSP reports SIC codes as of today, not historical SIC codes from the time a firm went public.

Table 2
Filing price range, venture capital backing, and CEO status

Panel A: filing price range

Filing price range	Low	Medium	High
Underpricing	9.2%	32.3%	150.8%
	(51.6%)	(48.0%)	(119.3%)
Existing options ratio	36.0%	40.7%	92.3%
	(38.8%)	(46.3%)	(76.3%)
Concurrent options ratio	7.3%	7.4%	6.3%
	(13.4%)	(20.5%)	(16.8%)
Warrant ratio	10.1%	13.0%	20.9%
	(19.4%)	(40.6%)	(40.5%)
Sample size	161	600	136

Panel B: venture capital backing

Filing price rage	Low		Medium		High	
	Venture-capital-backed	No venture capital backing	Venture-capital-backed	No venture capital backing	Venture-capital-backed	No venture capital backing
Underpricing	8.3%	9.7%	50.8%	21.8%	165.1%	120.8%
	(25.0%)	(61.4%)	(64.6%)	(30.8%)	(128.9%)	(90.4%)
Existing options ratio	53.4%	26.8%	59.4%	30.1%	97.0%	82.4%
	(43.6%)	(32.6%)	(52.6%)	(38.6%)	(77.0%)	(74.6%)
Concurrent options ratio	3.8%	9.1%	5.1%	8.6%	6.7%	5.5%
	(10.9%)	(14.2%)	(13.9%)	(23.4%)	(17.5%)	(15.3%)
Warrant ratio	14.2%	7.7%	18.7%	13.2%	21.9%	18.7%
	(21.1%)	(16.9%)	(40.9%)	(40.7%)	(42.1%)	(37.1%)
Sample size	56	105	217	383	92	44

Panel C: CEO status

Filing price rage	Low		Medium		High	
	Founder CEO	Non-founder CEO	Founder CEO	Non-founder CEO	Founder CEO	Non-founder CEO
Underpricing ratio	11.6%	6.1%	31.6%	33.0%	153.7%	147.4%
	(66.1%)	(22.5%)	(44.9%)	(51.2%)	(130.2%)	(106.7%)
Existing options ratio	41.3%	29.4%	43.4%	37.9%	87.3%	97.9%
	(42.2%)	(33.1%)	(50.3%)	(41.6%)	(77.6%)	(74.9%)
Concurrent options ratio	5.6%	8.4%	6.0%	8.9%	7.8%	4.6%
	(9.7%)	(16.9%)	(19.1%)	(21.8%)	(15.7%)	(17.9%)
Warrants ratio	10.8%	9.3%	16.4%	14.0%	18.8%	23.2%
	(19.9%)	(18.9%)	(46.3%)	(0.1%)	(31.5%)	(48.8%)
Sample size	90	71	308	292	72	64

The numbers in this table are for our sample of 897 IPOs that were issued between January 1997 and December 1999. Panel A provides summary statistics for the entire sample by filing price range, which is separated into Low, Medium, and High. Low includes IPOs whose offering price is below the low end of the filing price range, Medium includes IPOs whose offering price is between the lowest filing price and 20% above the highest filing price, and High includes IPOs whose offering price is 20% above the highest filing price. Panel B provides summary statistics by filing price range and venture capital backing. Panel C provides summary statistics by filing price range and CEO status. Underpricing is calculated as the one-day percentage return from the SDC offer price to the CRSP closing price at the end of the first day of trading. The 'Existing options ratio' is the number existing options outstanding at the IPO relative to the number of shares offered in the IPO. The 'Concurrent options ratio' is the number of options granted concurrently with the IPO relative to the number of shares offered in the IPO. The 'Warrant ratio' is the number of warrants outstanding relative to the number of shares offered in the IPO. In each cell, the sample mean is reported first followed by the standard deviation in parentheses.

concurrently with the offering relative to the number of shares offered in the IPO, is slightly lower (5.3% versus 8.5%). The warrant ratios are 18.5% and 10.3%, respectively.

The information on CEO founder IPOs versus non-CEO founder IPOs is also insightful. The underpricing averages of the two groups are close to the sample mean and are not statistically different from one another. Their option use is also similar, although firms with non-founder CEOs are more likely to have slightly fewer existing options, which they offset with slightly more options offered concurrently with the IPO.

Price revisions are measured as the percentage difference between the offer price and the mean of the indicative price range. Price revisions are assumed to reflect information acquired from informed investors. Benveniste and Spindt (1989) argue that truthful revelation of positive information requires favoring cooperative investors with preferential allocations of underpriced shares. Thus, underwriters only "partially adjust" the offer price to the information they acquire. Other things equal, revelation of more favorable information requires a greater inducement, implying a positive relation between price revisions and initial returns, as observed by Hanley (1993). According to SEC regulations, IPO prices cannot exceed the highest filing price by more than 20%. Despite this constraint, a firm that wishes to price in a higher range can do so by refiling the offering with the SEC. Refiling with the SEC sends a signal that there is increased demand. On the other hand, setting the offer price below the filing price range indicates a demand lower than what the investment bank initially expected. To study how offer price revisions are related to stock options, we divide our data into three subsamples; the first consists of firms with offer prices below the low end of the filing price range; the second contains firms with offer prices between the low filing price range and 20% above the upper end of the filing price range; and the third contains firms with offer prices more than 20% above the upper end of the filing price.

Table 1 reports that 17.9% (161/897) of the deals were priced below the filing price range. At the same time, 15.2% of the issues were priced more than 20% above the high filing price. There are more ventured-backed IPOs than non-venture-backed IPOs that have offer prices more than 20% higher than the filing range (and hence are refiled.)

As reported in Table 2, IPOs with an offer price below the filing price range have lower average underpricing, existing option ratios, and fewer warrants than the sample average. The use of options and warrants in venture-capital-backed firms is higher than in the other subgroups. Venture-capital-backed firms that have offer prices more than 20% above the high filing price are underpriced by 165.1% on average. This differs significantly from the average underpricing of 120.8% for non-venture-capital-backed firms in the same pricing range (p-value<0.05). Although venture-capital-backed firms display higher underpricing, their ownership dilution is lower because they are selling a smaller percentage of their firms. Option usage for the firms in this group is also considerably higher than for firms that have offer prices below 120% of the high filing price. Over 25% of the venture-capital-backed IPOs are in this high filing price range group, whereas only 8.3% of the non-venture-capital-backed firms are included. Founder firms and non-founder firms have about the same level of underpricing, and options and warrants usage as all firms.

5. Managerial compensation arrangements and long-term IPO performance

Does the long-term performance of IPOs depend on the form of managerial compensation? To answer that question we examine various measures of operating performance. We also looked at long-term stock returns, but those results are quite voluminous and are not reported here; they are available to interested readers in a much longer version of the paper. We will first describe results for returns briefly and then report the operating performance results in detail.

5.1. Long-term stock returns and managerial compensation

The after-issue stock price performance of IPOs is a well-known controversial subject in finance. In seminal studies, Ritter (1991) and Loughran and Ritter (1995) report surprisingly negative performance for several years after IPOs. Indeed, they report such dismal performance that market efficiency itself is called into question. Why do investors seemingly pay premium prices for IPOs only to be disappointed by later stock returns? For our sample of IPOs, we also find very poor post-issue stock returns, which accords with Ritter's and Loughran's findings. We do find, however, that managerial compensation makes a difference. IPOs with a balanced compensation arrangement, options and equity, do less poorly than other IPOs.[10] But this raises even a more troubling question about market efficiency since the compensation scheme is fully disclosed to the market at the time of the IPO. These results are robust to a variety of empirical methods. We find similar long-term patterns with raw returns, market-adjusted returns, returns relative to firms matched by industry, sales and profitability, and excess returns after employing the Fama/French (1993) three-factor model.

Not surprisingly, Ritter's and Loughran's findings have been challenged. One well cited paper is by Eckbo and Norli (2005) who argue that widely employed factor models (such as that of Fama and French) provide inadequate descriptions of IPO risks. Accordingly, more parsimonious models must be augmented with additional factors, particularly factors related to momentum and liquidity. We followed Eckbo and Norli's advice and indeed found little remaining evidence of long-term post-IPO stock price abnormal performance.[11] Using Eckbo and Norli's method, we also found no evidence that the form of management compensation had an impact. Perhaps this is the right approach; we certainly agree that IPOs are less liquid than other stocks.

We also investigated the pseudo market timing phenomenon emphasized by Schultz (2003). Schultz argues that Ritter's and Loughran's results can be explained by the fact that IPOs are much more likely to appear after significant market upswings. He suggests that this induces a bias in post-IPO stock price performance even when no one really possesses market timing ability. We also tried Schultz' approach, which involves simulating the distribution of IPO issuance along with simulated stock price patterns. As Schultz predicts, we find abnormally dismal post-IPO stock price performance. Balanced management compensation schemes are associated with better results, but the difference is not significant. We are not completely convinced, however, by Schultz' explanation. If post-IPO returns are compared against a *correct* factor model, we fail to understand why it should matter that IPOs tend to be issued after bull markets. True, prices might decline after IPOs are issued (and this would be true even if issuers really did possess market timing ability) but the post-IPO market benchmark and possibly other factors should also decline, so it is not apparent that there should be a net adjusted negative return.

Finally, we went to the opposite (very short-term) extreme to seek evidence about whether stock prices are impacted by the management compensation arrangements immediately around an IPO. *If* management compensation has an influence on subsequent operating results and *if* markets are quite efficient, the price effect should occur as soon as the compensation scheme is disclosed. Typically, option grants and managerial equity positions are disclosed concurrently with the IPO itself.

[10] We separate the sample firms into three groups based on the level of option grants as a proportion of the shares offered in the IPO. Each of these groups is then further separated into three equal-sized sub-groups based on the level of equity ownership by top managers. Hence, one-ninth of the firms are in each of nine option/equity categories. Firms with balanced compensation arrangements are defined as those with low/low, medium/medium or high/high combinations of option grants/equity ownership. Firms in the remaining six groups are referred to as having unbalanced compensation arrangements.

[11] Our results are similar when we employ alternative measures of liquidity, one based on turnover and another one based on the approach of Pastor and Stambaugh (2003).

We do find some short-term evidence supportive of efficiency. The IPO offer price scaled by sales[12] is higher when the IPO has balanced management compensation including both equity ownership and option grants. For three different levels of equity ownership, the IPO offer value is highest when option grants are at comparable levels. Unbalanced combinations, e.g., little equity and large option grants, or vice versa, have lower offer prices.

First-day IPO returns are higher when managers receive high levels of both options and equity. This seems to suggest that the underwriters set the offer price more or less in accordance with managerial compensation, but underestimate (relative to the market's opinion on the first trading day) the effectiveness of options. Overall, there seems to be some evidence that compensation arrangements are understood and valued at the IPO issue date, though perhaps not perfectly at the offer itself.

Long-term stock price behavior, though, remains something of a puzzle. We embroiled ourselves in the existing controversy, but after roughly forty extra pages of text and tables (which will be provided to interested readers upon request) we are not sure what to conclude. Fortunately, our theory is really about managers responding to incentives, thereby producing superior *operating* results when they have the proper form of compensation, a balanced mix of options and equity ownership. This allows us to finesse the thorny question of market efficiency, including when, if ever, stock prices reflect differences in operating performance. So we turn now to our fundamental empirical question, do managers produce better operating results when they receive appropriate forms of compensation?

5.2. Operating performance

We track operating performance for five fiscal years after the IPO. For four different measures of operating performance, Table 3 reports post-IPO yearly medians for low, medium, and high stock option IPO groups further classified into low, medium, and high executive equity ownership groups. Due to the skewness of accounting ratios, it is normal to report median values in studies examining operating performance.[13] While we report medians, we also find that the same patterns hold in means (unreported) winsorized by eliminating the top and bottom 1% of the observations.

The four measures of operating performance are as follows: first is sales growth, a simple indicator of success. Sales growth may not matter much if profits are poor, so we consider two measures of profitability: sales per gross costs[14] and cash flow return on assets. A more commonly used profit indicator, EBITDA, is of little use in our study because it is negative for most IPOs; this is not a problem with sales and gross costs, both of which are always positive. Cash flow return on assets is cash flow from operations (CFO) divided by total assets. CFO is directly obtained from the statement of cash flows (Compustat item number 308 minus 124). Lastly, we report Tobin's q (TQ), the ratio of the market value of assets to their replacement costs. Following Himmelberg et al. (1999), firm value is calculated as the market value of common equity plus the liquidation value of preferred equity plus the book value of total liabilities while replacement cost is the book value of total assets; so our

[12] We do not have a pre-offer valuation, so sales are used as a proxy. This clearly introduces an estimation error, which should result in less statistical power, but there seems to be little reason to suspect a bias. We multiply the offer price by the number of shares outstanding at the close on the offer date, (as reported by CRSP) divided by sales in the year prior to the IPO.

[13] DeAngelo (1988), Kaplan (1989), Healy and Palepu (1990), Degeorge and Zeckhauser (1993), Jain and Kini (1994), McLaughlin et al. (1996), Mikkelson et al. (1997), and Loughran and Ritter (1997), among others, all report median values.

[14] Gross costs are sales less EBITDA.

Table 3
Operating performance for 897 companies that went public during 1997–1999, classified by the form of management compensation

Portfolios	Unadjusted					Adjusted for Industry, Sales, and Sales/Gross Costs				
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 1	Year 2	Year 3	Year 4	Year 5
Panel A: High executive equity ownership										
Sales growth										
High options	40.63%	25.23%	21.71%	13.66%	14.04%	26.78%***	19.77%***	12.73%**	4.63%*	3.50%*
Medium options	27.40%	18.80%	21.42%	9.67%	10.13%	18.92%***	15.64%**	9.43%**	4.52%*	4.14%*
Low options	24.83%	13.73%	13.15%	10.52%	10.37%	11.83%**	11.08%**	4.17%*	3.12%*	0.69%*
High–Low options	15.80%	11.50%	8.56%	3.14%	3.67%	14.95%	8.69%	8.56%	1.51%	2.81%
Z test	3.27***	2.91***	2.40**	1.12	1.40	5.33***	3.31***	2.87***	0.97	1.03
High–Medium options	13.23%	6.43%	0.29%	3.99%	3.91%	7.86%	4.13%	3.30%	0.11%	−0.64%
Z test	2.78***	2.46**	1.14	1.67	1.35	3.50***	3.18***	2.62**	1.27	−0.82
Sales/gross costs										
High options	4.060	2.523	1.746	2.514	1.297	−0.015**	−0.012**	−0.026*	−0.028*	−0.012
Medium options	3.337	1.794	1.590	2.097	0.994	−0.020**	−0.017**	−0.030*	−0.040**	−0.024*
Low options	1.620	0.971	0.990	0.873	0.786	−0.034***	−0.025***	−0.052**	−0.045**	−0.036*
High–Low options	2.450	1.552	0.756	1.642	0.511	0.019	0.013	0.025	0.017	0.024
Z test	3.01***	2.43**	2.17**	2.71**	1.89*	2.40**	1.98*	2.40**	2.00**	2.01**
High–Medium options	0.733	0.729	0.156	0.417	0.304	0.005	0.005	0.003	0.012	0.012
Z test	1.91*	2.18**	0.55	1.07	1.83*	1.78*	1.56	1.39	2.09**	2.10**
Cash flow return on assets										
High options	9.45%	8.29%	7.86%	7.94%	5.61%	−0.69%*	−0.85%*	−1.55%*	1.41%**	1.82%*
Medium options	8.47%	7.86%	6.50%	7.32%	6.74%	−2.02%**	−1.70%**	−2.80%**	1.02%*	1.43%*
Low options	7.02%	6.51%	5.86%	5.14%	5.42%	−2.73%***	−1.63%**	−2.94%**	0.65%*	0.83%
High–Low options	2.43%	1.78%	2.00%	2.80%	0.19%	2.04%	0.78%	1.39%	0.76%	0.99%
Z test	3.21***	2.01**	2.84***	3.67***	1.76*	2.21**	1.85*	2.10**	1.84*	1.89*
High–Medium options	0.98%	0.43%	1.36%	0.62%	−1.13%	1.33%	0.85%	1.25%	0.39%	0.39%
Z test	2.75****	2.68**	1.83*	1.48	−1.23	2.53**	1.98*	2.18**	1.89*	1.92*

(continued on next page)

Table 3 (*continued*)

Portfolios	Unadjusted					Adjusted for Industry, Sales, and Sales/Gross Costs				
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 1	Year 2	Year 3	Year 4	Year 5
Panel A: High executive equity ownership										
Tobin's *q*										
High options	2.375	2.287	2.151	2.058	1.691	0.062***	0.053***	0.053***	0.045**	−0.020*
Medium options	2.261	1.712	1.932	1.765	1.584	0.038***	0.037**	0.034**	0.020**	−0.012
Low options	1.434	1.205	1.311	0.828	0.879	0.020**	0.038**	0.020*	0.012*	−0.033**
High–Low options	0.941	1.083	0.840	1.230	0.812	0.042	0.015	0.033	0.033	0.013
Z test	2.56**	3.44***	2.22**	3.78***	0.92	4.20***	1.35	3.43***	3.62***	1.09
High–Medium options	0.114	0.576	0.219	0.293	0.107	0.024	0.016	0.019	0.025	−0.008
Z test	1.84*	2.27**	1.93*	2.15**	1.40	2.34**	1.60	1.96*	2.59**	−0.55
Panel B: Medium executive equity ownership										
Sales growth										
High options	27.47%	14.58%	16.34%	9.46%	10.86%	14.18%**	16.48%**	7.52%**	4.07%*	1.19%
Medium options	47.72%	28.07%	27.53%	13.56%	11.59%	28.85%****	27.75%***	14.63%***	6.32%*	3.30%
Low options	33.18%	16.09%	13.62%	9.34%	12.15%	20.85%***	14.48%**	9.13%**	5.26%*	4.24%*
Medium–High options	20.25%	13.49%	11.19%	4.10%	0.73%	14.67%	11.27%	7.11%	2.25%	2.11%
Z test	5.98***	2.78***	2.57**	1.94*	1.15	3.88***	3.70***	2.76***	1.18	0.92
Medium–Low options	14.54%	11.98%	13.91%	4.22%	−0.56%	8.00%	13.27%	5.50%	1.06%	−0.94%
Z test	5.49***	3.95***	4.08***	2.01**	−0.18	3.68***	5.27***	3.49***	2.05**	−0.31
Sales/gross costs										
High options	0.870	0.994	2.728	1.686	1.213	−0.040***	−0.023***	−0.025**	−0.037*	−0.019**
Medium options	4.377	2.800	3.610	2.259	1.367	−0.010**	−0.002	−0.010	−0.009	−0.015*
Low options	2.297	1.876	0.975	1.020	0.979	−0.053***	−0.031***	−0.012*	−0.057**	−0.037**
Medium–High options	3.508	1.806	0.881	0.573	0.153	0.030	0.021	0.015	0.028	0.005
Z test	3.46***	2.56**	2.33**	1.72	1.37	1.96*	1.76*	1.04	1.83*	1.08
Medium–Low options	2.080	0.924	2.635	1.240	0.388	0.043	0.030	0.002	0.048	0.022
Z test	2.54**	1.91*	3.10***	2.15**	1.18	2.28**	2.10***	0.44	2.50***	1.81*
Cash flow return on assets										
High options	7.53%	5.75%	5.22%	6.46%	8.52%	−1.07%***	−1.75%***	−1.87%**	0.65%*	1.89%**
Medium options	11.41%	10.98%	10.82%	8.23%	9.89%	−0.51%*	−0.57%*	−0.84%*	1.55%**	3.34%**
Low options	6.45%	5.82%	8.87%	6.82%	7.49%	−1.18%***	−1.22%**	−2.97%***	0.88%*	1.22%**
Medium–High options	3.88%	5.23%	5.60%	1.77%	1.37%	0.56%	1.18%	1.03%	0.90%	1.45%
Z test	2.76***	2.85***	3.69***	1.93*	1.12	1.85*	2.16**	1.93*	1.99*	2.49**

Medium–Low options	4.96%	5.16%	1.95%	1.41%	2.40%	0.67%	0.65%	2.13%	0.67%	2.12%
Z test	2.55**	2.91***	1.84*	1.01	2.33**	2.36**	1.87*	2.41**	0.52	2.07**
Tobin's *q*										
High options	2.132	1.884	1.528	1.049	0.841	0.044**	0.037**	0.026*	0.012*	−0.019*
Medium options	2.907	2.523	2.153	1.935	1.836	0.073***	0.062***	0.062***	0.034**	−0.010
Low options	1.739	2.093	1.583	1.263	0.790	0.053**	0.022**	0.021*	−0.004*	−0.009
Medium–High options	0.776	0.639	0.625	0.886	0.995	0.028	0.026	0.036	0.022	0.009
Z test	2.55**	2.21**	1.83**	2.72**	3.93***	3.06***	2.15**	4.09***	1.45	0.45
Medium–Low options	1.169	0.429	0.570	0.672	1.047	0.020	0.041	0.041	0.038	−0.001
Z test	2.72**	1.10	1.88*	1.94*	2.39**	1.13	2.59**	2.95***	2.23**	−0.94
Panel C: Low executive equity ownership										
Sales growth										
High options	29.39%	22.62%	18.84%	8.27%	11.25%	16.14%***	11.71%**	11.42%**	4.23%*	3.47%*
Medium options	35.87%	18.64%	23.86%	9.20%	9.89%	19.05%***	20.03%***	10.76%**	4.71%*	3.58%*
Low options	39.01%	24.89%	24.91%	13.16%	9.51%	27.17%***	24.05%***	13.98%***	6.35%*	4.12%*
Low–High options	9.62%	2.27%	6.07%	4.89%	−1.74%	11.03%	12.34%	2.56%	2.12%	0.65%
Z test	5.04***	2.41**	3.73***	2.78***	−0.89	2.89***	3.12***	2.36**	2.02**	1.36
Low–Medium options	3.14%	6.25%	1.05%	3.96%	−0.38%	8.12%	4.02%	3.22%	1.64%	0.54%
Z test	1.93*	3.88***	1.65	2.10**	−0.66	4.77***	2.57**	2.02**	1.12	0.95
Sales/gross costs										
High options	1.697	1.141	0.899	1.084	0.999	−0.019**	−0.041**	−0.018**	−0.029**	−0.041**
Medium options	2.178	1.478	0.624	1.354	1.370	−0.035***	−0.048***	−0.036**	−0.030**	−0.056**
Low options	3.119	2.173	1.878	2.013	1.358	−0.016**	−0.027**	−0.011*	−0.021**	−0.018*
Low–High options	1.422	1.032	0.979	0.929	0.359	0.003	0.014	0.007	0.008	0.024
Z test	2.95***	2.52**	2.20**	2.08**	1.59	1.12	2.47**	1.84*	2.10**	2.04**
Low–Medium options	0.941	0.695	1.254	0.660	−0.012	0.020	0.021	0.025	0.009	0.038
Z test	2.24**	2.20**	2.47**	1.87*	−0.32	1.86*	1.96*	2.40**	2.19**	2.85***
Cash flow return on assets										
High options	7.05%	7.54%	5.68%	6.19%	4.16%	−1.01%**	−1.76%**	−1.73%**	0.83%	1.28%*
Medium options	8.02%	5.53%	6.51%	6.07%	4.88%	−0.96%**	−1.79%**	−1.36%**	0.77%	1.90%*
Low options	9.37%	10.71%	7.83%	7.61%	7.27%	−0.77%*	−1.11%*	−0.96%	1.44%	2.09%**
Low–High options	2.32%	3.17%	2.15%	1.42%	3.11%	0.24%	0.65%	0.77%	0.61%	0.81%
Z test	2.48**	4.30***	1.98*	1.30	3.77***	1.61	1.93*	3.28***	1.82*	2.53**
Low–Medium options	1.35%	5.18%	1.32%	1.54%	2.39%	0.19%	0.68%	0.40%	0.67%	0.19%
Z test	1.86*	2.77***	1.76*	2.29**	2.36**	0.68	2.15**	1.64	1.94*	0.41

(continued on next page)

Table 3 (*continued*)

Portfolios	Unadjusted					Adjusted for Industry, Sales, and Sales/Gross Costs				
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 1	Year 2	Year 3	Year 4	Year 5
Panel C: Low executive equity ownership										
Tobin's *q*										
High options	1.819	1.040	1.591	1.359	0.878	0.029**	0.010	0.018*	−0.023**	−0.014**
Medium options	2.130	2.020	1.072	1.158	1.045	0.059***	0.020**	0.035***	−0.019*	−0.010
Low options	2.562	2.101	1.765	1.699	1.751	0.072***	0.060***	0.058***	−0.003	−0.022**
Low–High options	0.742	1.057	0.174	0.341	0.873	0.043	0.050	0.040	0.020	−0.008
Z test	2.64**	4.30***	1.90*	2.02**	3.04***	2.09**	2.52**	1.47	1.31	−1.17
Low–Medium options	0.431	0.082	0.693	0.542	0.707	0.013	0.040	0.023	0.016	−0.011
Z test	2.28**	1.06	2.66**	2.45**	2.87***	1.86*	2.59**	2.35**	1.97*	−0.39

This table reports median sales growth rates, profitability measures and other measures of operating performance for high, medium, and low stock option IPOs that are grouped by high, medium, and low executive equity ownership. "High–Low options" is a zero-investment portfolio long IPOs with many executive stock options and short IPOs with few stock options, both value-weighted. Similar definitions apply to other zero-investment portfolio combinations of "high", "medium", and "low" options. Cash flow return on assets is cash flow from operations (CFO) divided by total assets; CFO is directly obtained from the statement of cash flows (Compustat item 308 minus 124). Tobin's *q* (TQ) is the ratio of the market value of assets to their replacement costs. Following Himmelberg et al. (1999), firm value is the market value of common equity plus the liquidation value of preferred equity plus the book value of total liabilities; replacement cost is the book value of total assets, so TQ is really the market/book ratio for total assets. Sales and gross costs are collected from Compustat or hand-collected from proxy statements. The *Z* tests are non-parametric Wilcoxon–Mann–Whitney signed rank statistics for the equality of medians between two IPO groups. The right side of the table reports results for Wilcoxon–Mann–Whitney tests of differences in medians between IPOs and matched firms. The adjusted figures on the right side are the differences between the raw medians and the corresponding medians of non-IPO firms in the same industry (based on Fama and French industries) with similar sales and sales divided by gross costs for the corresponding year. *, **, and *** indicate significance at the 10%, 5%, and 1% level, respectively.

measure of TQ is really the market/book ratio for total assets.[15] Tobin's q is presumably higher for firms with high growth opportunities.

For each year, we compute the annual performance measure for each firm and report the median value across firms. Many IPOs are short-lived, so survivorship bias is a potential problem. To mitigate this problem, any IPO firm that did not survive to the end of a calendar year was traced through its last surviving quarter and its performance measures were then grossed up to a full year. For example, if a firm vanished after the first quarter, four times its performance during the first quarter was used as its annual performance figure.

We also compare each IPO firm's operating performance to a matched publicly traded non-IPO firm. The matched firms are in the same industry and have similar sales and profitability (sales over gross costs.)[16] It is very important to note that matching firms control for characteristics that are likely to affect operating performance; e.g., firm size, market conditions, and industry peculiarities. Hence, the use of matching firms renders cross-sectional controls superfluous.

5.2.1. Measuring statistical significance

We perform two types of non-parametric tests, namely a series of Wilcoxon–Mann–Whitney signed ranked tests to test for the significance of differences between (1) the medians of two groups of IPOs, and (2) the medians of all IPOs versus the medians of a matched sample of non-IPO firms. In each case, the null hypothesis is that the accounting measures for both groups of firms are drawn from the same distribution. For our latter tests, this null hypothesis arises naturally as our IPO firms are matched to firms in the same industry with comparable sales and sales per gross costs.

The significance of differences of median operating performance between IPO groups is reported in the fifth and seventh row of each panel in Tables 3 and 4.[17] The cells on the right side of Tables 3 and 4 provide test results for the significance of differences between the median operating performance of IPOs and their matched firms. These differences may be interpreted as operating performance measures that are adjusted for industry, sales, and sales per gross costs.

5.2.2. Summary of results and an illustration

Each panel of Table 3 reports tests of statistical significance for our maintained hypothesis, which is that a balanced compensation arrangement, equity ownership plus option grants, provides superior incentives to an unbalanced arrangement. For example, with high equity ownership, we test whether the operating performance is better when there are high option grants as opposed to medium and low grants. Similarly, for medium and low equity ownership, we test whether balanced option grants are superior. This implies testing for possible outperformance of the medium–high and medium–low option grant portfolios for medium equity ownership as well as the low–high and low–medium option grant portfolios for low equity ownership.[18]

To illustrate the logic of this approach with an example, Fig. 2 plots the level of cash flow returns in the first year after the IPO for nine groups of firms, three levels of equity compensation

[15] Since we do not have the market value of debt, our measure of Tobin's q is more precisely the market value of equity plus the book value of debt divided by the book value of assets.

[16] For each IPO firm in the sample, its matching firm did not go public within 3 years prior to the subject IPO's issue date, is in the same industry as the IPO firm, and is closest in terms of sales, and sales divided by gross costs in the most recent fiscal year.

[17] In addition, we calculated a Chi-square, a Kruskal–Wallis ANOVA by ranks, and a van der Waerden (normal scores) test; the results (unreported) are robust.

[18] A "medium–high" stock option portfolio is a zero-investment portfolio long IPOs with a medium number of executive stock options and short IPOs with a large number of stock options; the long and short components are themselves value-weighted. Other portfolios are defined in a similar fashion.

Table 4
Operating performance for 897 companies that went public during 1997–1999, for IPOs with balanced management compensation arrangements

	Unadjusted					Adjusted for industry, sales, and sales/gross costs				
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 1	Year 2	Year 3	Year 4	Year 5
Panel A. Sales growth										
HH	40.63%	25.23%	21.71%	13.66%	14.04%	26.78%***	19.77%***	12.73%**	4.63%*	3.50%*
MM	47.72%	28.07%	27.53%	13.56%	11.59%	28.85%***	27.75%***	14.63%***	6.32%*	3.30%
LL	39.01%	24.89%	24.91%	13.16%	9.51%	27.17%***	24.05%***	13.98%***	6.35%*	4.12%*
MM-HH	7.10%	2.84%	5.82%	−0.10%	−2.45%	2.07%	7.98%	1.90%	1.69%	−0.20%
Z test	4.02***	2.56**	2.89***	−1.01	−2.23**	2.62**	3.56***	1.82*	1.33	−1.04
MM-LL	8.71%	3.18%	2.62%	0.40%	2.08%	1.68%	3.70%	0.65%	−0.03%	−0.82%
Z test	5.04***	3.10***	2.34**	0.99	1.95*	2.16**	4.14***	1.84*	−0.52	−1.91*
Panel B. Sales/Gross costs										
HH	4.069	2.523	1.746	2.514	1.297	−0.015**	−0.012**	−0.026*	−0.028*	−0.012
MM	4.377	2.800	3.610	2.259	1.367	−0.010**	−0.002	−0.010	−0.009	−0.015*
LL	3.119	2.173	1.878	2.013	1.358	−0.016**	−0.027**	−0.011*	−0.021**	−0.018*
MM-HH	0.308	0.278	1.864	−0.255	0.069	0.005	0.011	0.017	0.019	−0.003
Z test	2.96***	2.40**	3.64***	−1.61	0.41	1.33	1.82*	2.10**	2.39**	−1.29
MM-LL	1.258	0.627	1.732	0.246	0.008	0.006	0.026	0.001	0.012	0.003
Z test	2.59**	1.95*	2.98***	1.57	0.85	1.95*	2.17**	1.76*	2.11**	1.87*
Panel C. Cash flow return on assets										
HH	9.45%	8.29%	7.86%	7.94%	5.61%	−0.69%*	−0.85%*	−1.55%*	1.41%**	1.82%*
MM	11.41%	10.98%	10.82%	8.23%	9.89%	−0.51%*	−0.57%*	−0.84%*	1.55%**	3.34%**
LL	9.37%	10.71%	7.83%	7.61%	7.27%	−0.77%*	−1.11%*	−0.96%	1.44%	2.09%**
MM-HH	1.96%	2.69%	2.96%	0.29%	4.28%	0.18%	0.28%	0.71%	0.14%	1.52%
Z test	2.74**	2.88***	3.03***	0.05	3.44***	1.90*	2.02**	2.22**	0.08	2.41**
MM-LL	2.04%	0.27%	2.99%	0.62%	2.62%	0.26%	0.54%	0.12%	0.11%	1.25%
Z test	2.14**	1.00	4.54***	1.85*	2.74**	1.76*	2.09**	0.87	0.70	2.41**

Panel D. Tobin's q										
HH	2.375	2.287	2.151	2.058	1.691	0.062***	0.053***	0.053**	0.045**	−0.020*
MM	2.907	2.523	2.153	1.935	1.836	0.073***	0.062***	0.062***	0.034	−0.010**
LL	2.563	2.101	1.765	1.699	1.751	0.072***	0.060***	0.058***	−0.003	−0.022**
MM-HH	0.532	0.236	0.002	−0.123	0.146	0.011	0.009	0.009	−0.011	0.010
Z test	3.61***	2.21**	0.08	−1.70	2.00**	2.05**	1.87*	1.78*	−1.98*	1.82*
MM-LL	0.346	0.422	0.387	0.236	0.085	0.001	0.002	0.004	0.037	0.012
Z test	2.84***	3.89***	2.98***	2.47**	0.83	1.05	1.87*	−1.90*	2.51**	2.16**
Panel E. Accruals per total assets										
HH	1.38%	1.28%	−2.58%	−5.78%	−9.70%	6.94%***	5.29%***	3.73%**	0.38%*	0.30%*
MM	0.32%	0.23%	−2.11%	−4.72%	−4.40%	2.36%**	4.03%***	1.82%*	−0.12%	−0.13%
LL	−0.98%	−0.72%	−1.19%	−3.83%	−5.19%	4.01%***	2.02%**	1.90%*	−0.16%	−0.14%
MM-HH	−1.06%	−1.05%	0.47%	1.06%	5.30%	−4.58%	−1.26%	−1.91%	−0.50%	−0.43%
Z test	−2.09**	2.01**	1.60	2.07**	3.75***	−3.07***	−1.71	−2.90***	−1.32	−1.29
MM-LL	1.30%	0.95%	−0.92%	−0.89%	0.79%	−1.65%	2.01%	−0.08%	0.04%	0.01%
Z test	2.85***	2.75***	−2.71**	−2.65**	2.13**	−2.88***	3.39***	−1.25	0.97	0.11

This table compares median measures of operating performance for IPOs with high executive equity ownership and stock options (HH), medium executive equity ownership and stock options (MM), and low executive equity ownership and stock options (LL). Cash flow return on assets is cash flow from operations (CFO) divided by total assets; CFO is directly obtained from the statement of cash flows (Compustat item 308 minus 124). From the cash flow statement, accruals include income before extraordinary items (Compustat #123) minus cash flow from operations (308 minus 124). Tobin's *q* (TQ) is the ratio of the market value of assets to their replacement costs. Following Himmelberg et al. (1999), firm value is the market value of common equity plus liquidation value of preferred equity plus book value of total liabilities; replacement cost is the book value of total assets, so TQ is really the market/book ratio for total assets. Sales and gross costs are collected from Compustat or hand-collected from proxy statements. The *Z* tests are non-parametric Wilcoxon–Mann–Whitney signed rank statistics for the equality of medians between two IPO groups. The right side of the table reports results for Wilcoxon–Mann–Whitney tests of differences in medians between IPOs and matched firms. The adjusted figures on the right side are the differences between the raw medians and the corresponding medians of non-IPO firms in the same industry (based on Fama and French industries) with similar sales and sales divided by gross costs for the corresponding year. *, **, and *** indicate significance at the 10%, 5%, and 1% level, respectively.

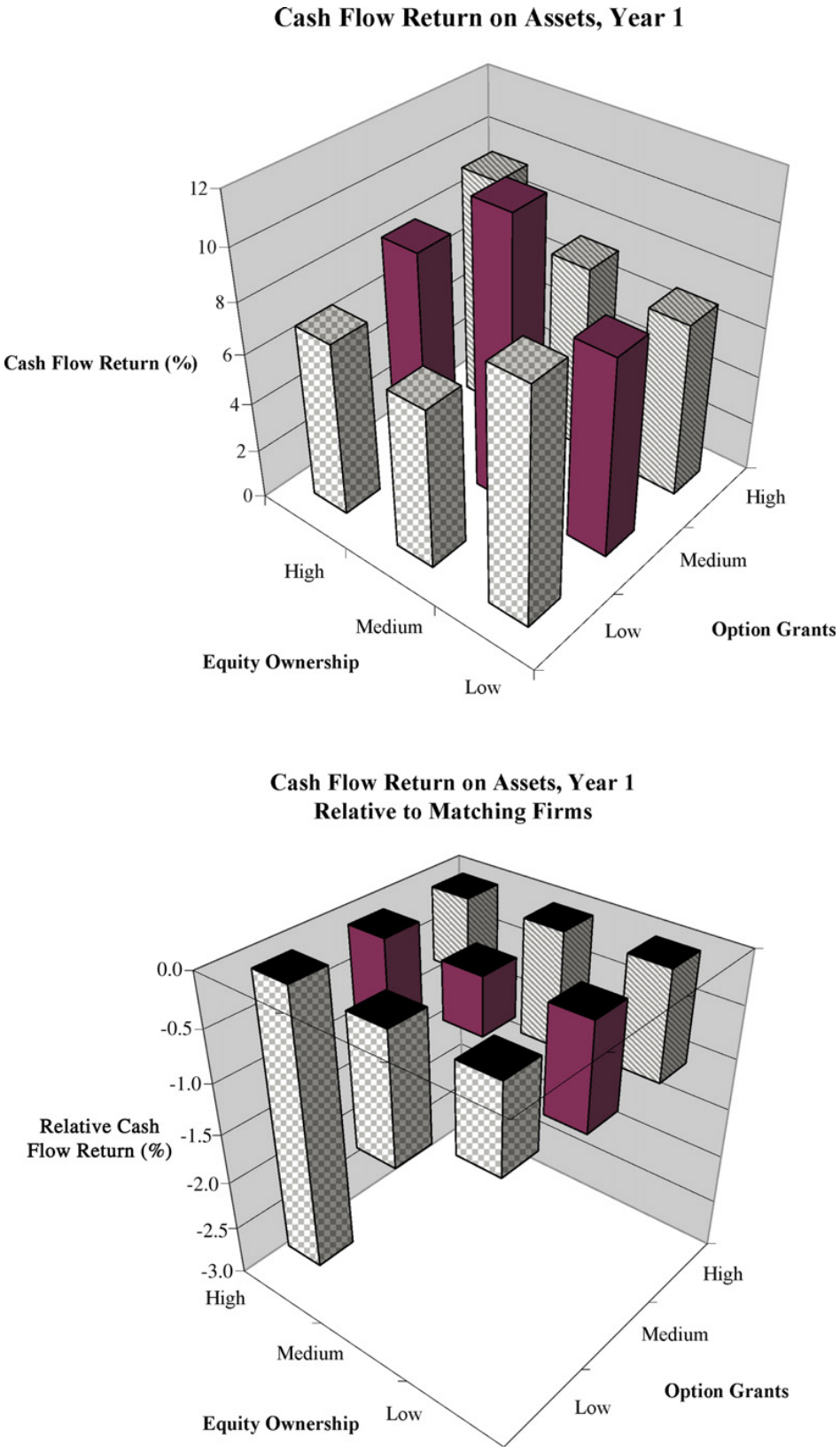

Fig. 2. Performance and the form of managerial compensation: an example. The sample of IPOs described in Table 1 is divided into nine groups depending on the form of management compensation; i.e., three levels of option grants as a proportion of the shares offered in the IPO and three levels of equity ownership percentages by top managers. In the lower chart, operating performance is the cash flow return of the firm during the first year after the IPO adjusted for cash flows within the same industry. The upper chart shows the corresponding raw (unadjusted) cash flow returns. The pattern depicted is typical for other measures of operating performance and other years after the IPO up through the third year.

and three levels of option grants. The pattern in Fig. 2 typifies most of the operating performance measures for at least the first 3 years after IPOs (as might be expected, the pattern becomes attenuated in later years as the firm matures).

The figure shows a sharply non-linear relation between compensation arrangements and performance. When equity compensation is high, performance improves with option compensation. When equity compensation is low, performance falls with option compensation. For medium levels of equity compensation, the relation is humped so that medium levels of option compensation are associated with the best performance. Over the nine categories of compensation arrangements, the highest performance is for medium levels of both options and equity though high levels of options and equity are almost as effective. Not surprisingly, there is a general tendency for improved performance with higher levels of compensation in general, presumably because managers with larger stakes in the firm have interests that are more aligned with shareholder interests. However, the worst performance occurs when options and equity ownership are unbalanced; i.e., for combinations of high options and low equity and vice versa.

5.2.3. Detailed results and tests of the influence of management compensation schemes

Table 3 reports a total of 240 test statistics for compensation group comparisons. For three levels of executive equity ownership, there are four measures of operating performance, both unadjusted raw medians and medians adjusted for matching firms in the same industry and with similar sales and sales/gross costs, all traced over 5 years after the IPO. Within each of the above categories, there are two test statistics for a balanced compensation arrangement compared to unbalanced arrangements.

As an example, consider the industry/sales adjusted cash flow return in the first year after the IPO; this is the same example as that used in the adjusted panel of Fig. 2. Panel A of Table 3 reports that a balanced compensation scheme, in this case a high level of equity and large option grants, is associated with higher cash flow returns than when a high level of equity is combined with either a low or medium level of option grants; the significance level is 5% in both instances. Panel B, which pertains to medium levels of equity ownership, reports that balanced medium levels of equity grants are associated with better cash flow returns than either high or low levels of options grants. Finally, Panel C shows that balanced low levels of both options and equity produce better returns than low levels of equity and either high or medium levels of options (though neither is statistically significant.)

Over all the 240 inter-compensation-group test statistics in the table, only 11 numbers are negative, which occurs when unbalanced managerial compensation produces better operating performance. *All* of these negative numbers occur in year 5 and none is statistically significant. There is not a single negative number during the first 4 years. During the first 3 years, 46 out of 144 are positively significant at the 1% level, 54 are significant at the 5% level, and 28 are significant at the 10% level; only 16 of 144 positive test statistics fail to be significant at the 10% level or better.

The adjusted performance results, which control for industry, sales, and profitability, reveal that IPOs have stronger sales growth than matching firms, particularly in the first 3 years; all are statistically significant. Profitability, however, is altogether another question; both sales/gross costs and cash flow return on assets are generally worse for IPOs than for matching firms and most are significantly worse. Reflecting the market's perception of growth opportunities, Tobin's q is significantly higher for IPOs than for matching firms.

For the statistics comparing managerial compensation groups, the table shows that adjusted medians are generally smaller than their unadjusted counterparts, but they have a similar pattern and comparable levels of significance. The significance of the adjusted medians might seem surprising at first because matched firm performances have been subtracted. The explanation is

probably that the adjusted numbers are less volatile, thereby retaining significance even with smaller values.

We realize, of course, that the 240 statistical comparisons in Table 3 are probably not independent at all. Most likely, if a particular number is positive in year 1, it is also going to be positive in years 2 and 3 or perhaps even longer. The operating performance measures are probably also interdependent. Consequently, though one must not be too aggressive in drawing sweeping conclusions from these results, the overall pattern is certainly consistent with the theory that a combination of equity and options produces better incentives and ultimately better firm performance.

5.2.4. Among the balanced compensation arrangements, are some better than others?

Although the basic theory argues that a *balanced* use of options and equity is best, we can also check whether the *extent* of compensation makes a difference. Denoting by *XY* a management compensation scheme consisting of an *X* level of equity and a *Y* level of options, where both *X* and *Y* take on the values *H*, *M*, and *L* for high, medium, and low, respectively, we know from the results in Table 3 that operating performance superiority, denoted by ➢, is ranked as follows: HH ➢ HL and HM, MM ➢ MH and ML, and LL ➢ and LM. We now look at the better compensation schemes, HH, MM, and LL relative to one another.

In Table 4, Panel A, unadjusted and matched firm-adjusted sales growths of HH, MM, and LL are shown from year 1 to 5 after the issue. The results show that unadjusted sales growth of MM is significantly higher than that of HH and LL for years 1 through 3 and adjusted sales growth of MM is significantly higher than that of HH and LL for years 1 and 2, at a significance level of at least 5%. The difference is highest in the first year after the issue and decreases over time.

Panel B shows that sales per gross cost of MM is significantly higher than that of HH and LL during the first 3 years, but the significance level is only marginal after we adjust for the corresponding sales/gross cost figures of our matching firms. A similar pattern emerges when considering cash flow return on assets (Panel C) or Tobin's *q* (Panel D).

Teoh et al. (1998) show that there is earnings management (through discretionary accruals) around the IPO.[19] This could compromise the *reported* operating profitability of IPOs. The results in Panel E confirm that IPOs have higher accruals (a negative indicator of earnings reliability) than matching firms during the first few years. However, the MM group of IPOs, which has better performance, actually has fewer accruals than the HH and LL groups, which suggests that the superiority of MM could actually be understated.

The abnormally high accruals of MM and LL revert to industry medians by the fourth year whereas the accruals of HH are still positive and marginally significant through the fifth year. The higher accrual of HH IPOs indicates lower earnings quality, which may be the result of aggressive earnings management on the part of managers with extensive equity holdings and stock option grants. Coles et al. (2006b) find evidence of abnormally low discretionary accruals in the period following cancellations of executive stock options until the time the options are reissued.

In conclusion, firms with management compensation arrangements in the middle range, a balanced mix of equity ownership and stock options, appear to perform slightly better for at least

[19] See the standard references on the Jones model and the modified Jones model, such as Jones (1991), Dechow et al. (1995), and Kothari et al. (2005). There is some controversy about whether accruals are a good indicator of the manipulatable or discretionary part of earnings.

3 years after the IPO compared to firms that have balanced arrangements but are either at very high or very low absolute levels. Poorly compensated managers have fewer incentives, so it is easy to see why their firms are sluggish performers. But what about very well paid managers? We thought prior to this research that balanced but quite high levels of compensation might be best. There is some reason, however, that balanced middle levels of management compensation seem to bring better performance. We can only speculate on the explanation; perhaps very rich managers are less motivated because of their wealth. This could be an interesting area for further research.

6. Discussion and conclusions

In our sample of IPOs, post-IPO operating performance is better during at least the first 3 years when managers receive a balanced form of compensation, a mixture of equity ownership and stock option grants. Performance is worse when options and equity are unbalanced; i.e., high equity ownership and few option grants or many option grants and low equity ownership. This result is consistent with our theory that the two forms of compensation must be balanced if managerial decisions are to be compatible with stockholders' perceptions of optimal decisions.

Equity ownership and stock options have different risk properties. Returns on options are more volatile than returns on the underlying equity; thus, holding an undiversified position in options is more risky than holding an equal dollar amount of the equity. On the other hand, adopting more risky investment projects increases the value of option grants, though it will not increase the value of equity grants and could even decrease their value. This suggests that investors should favor a combination of options and equity grants to different levels of employees. All employees are motivated to exert extra effort by options, but top decision makers must be restrained from taking on too many risky projects; such a restraint is effectuated when top executives hold significant equity positions.

For a given level of managerial compensation in the form of stock ownership, there is an ideal option grant that induces a top manager to choose the firm's overall level of non-diversifiable risk commensurate with the desires of shareholders. This translates cross-sectionally into improved long-term performance for firms that have selected balanced compensation arrangements for senior executives.

We also find that not all balanced arrangements produce the same operating results. Not surprisingly, managers who receive few options and little equity do not produce good performance. Less surprisingly, managers who receive many options and a lot of stock, though they do better than poorly compensated managers, do less well than managers who receive both forms of compensation in the middle range. This is a result certainly worthy of further study.

In unreported results, available on request, we investigate both the long- and short-term stock price performance of IPOs. This is a controversial subject, which we hope to avoid by focusing on operating performance, thereby not becoming embroiled in whether or not post-IPO stock returns are consistent with market efficiency. In concurrence with earlier research, we do find that stock prices of firms in our sample decline materially in the post-IPO period, even after controlling for the market, comparable firms, and standard factor models. We find, however, that the stock price performance is less bad for firms managed by executives who are receiving a balanced form of compensation, in the form of both equity and options.

Also in agreement with more recent findings, the long-term negative post-IPO stock price performance of our sample firms is eliminated when additional factors such as momentum and liquidity are employed. Moreover, with augmented factor models, there is no remaining

dependence on the management compensation scheme. Taking into account pseudo market timing, à la Schultz (2003), also eliminates the management compensation differential but not the generally negative stock price trend.

Additionally, we find that underwriters appear to take management compensation into account when establishing the offer price. The IPO offer price reproduces the same pattern across compensation schemes as the pattern of later operating performance, which suggests that operating performance is discounted in advance at the time of the IPO. Returns on the very first day of trading adjust the offer price pattern to some extent, mainly by increasing the values of firms with high levels of options, but the general pattern remains the same, thus suggesting that the market properly takes into account the incentives induced by various forms of management compensation.

A question remains, however, as to why some firms fail to adopt balanced compensation arrangements of options and equity if that would indeed provide the best management incentive structure and ultimately produce superior operating results. One reason might be endogeneity; perhaps, for some firms, other influences drive both operating performance *and* its choice of compensation arrangements, so these firms are not completely free to institute whatever compensation scheme might seem best in isolation.

Another caveat is that our data cover only 1997 to 1999, which might have been an atypical time period for post-IPO performance and compensation. Additionally, since our analysis essentially engages in *ex-post* hindsight, the superior performance of "balanced" firms could conceivably be due to randomness or to other unknown factors (cf. Alchian, 1950), rather than to an optimal compensation policy. Finally, although we motivate the analysis by referring, among others, to Demsetz and Lehn (1985), their paper does not suggest the existence of an optimal compensation policy.

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