**Preliminary: Do not quote.**

# Executive Options and Stock Liquidity*

Kuan-Hui Lee, Carrie H. Pan, and Christo A. Pirinsky

February 1, 2016

**Abstract**

We study the impact of executive stock options on the trading environment of a firm's stock by utilizing exogenous variation in option compensation due to the revision of the Statement of Financial Accounting Standards No. 123 in 2006. We find that the negative shock to options compensation reduces stock market liquidity, measured by a wide range of liquidity measures as well as by their principal component. We also find that the drop in executive options compensation tends to decrease the breadth of equity ownership and equity trading activity and exhibits no significant impact on the informational environment of the firm, suggesting that executive options increase stock liquidity predominantly through their impacts on investor behavior.

*JEL classification*: D14, G10, G02, R21

*Keywords*: Executive options, market microstructure, liquidity, price pressure

* Lee is with Seoul National University Business School, Korea, kuanlee@snu.ac.kr, +82-2-880-6924.; Pan is with the Department of Finance, Santa Clara University, chpan@scu.edu, (408) 551-7188; Pirinsky is with Cornerstone Research,1919 Pennsylvania Avenue NW, Suite 600, Washington, DC20006-3420, USA. Lee greatly appreciates support from the Institute of Management Research and the Institute of Finance and Banking at Seoul National University. The views expressed in this article are solely those of the authors, who are responsible for the content, and do not necessarily represent the views of Cornerstone Research.

## 1. Introduction

An increasing number of academic studies have shown that the trading environment of firms' stock could significantly affect firm financing and investment decisions (see e.g., Butler et al., 2005; Fang et al., 2009; Holden et al., 2013). However, major corporate decisions may also exhibit an impact on capital markets, which could further feedback into the real economic activities of firms. The interactions between firms' corporate decisions and the trading environment of their stocks, while potentially important, remain relatively understudied in the academic literature.

In this paper, we investigate how option-based executive compensation affects equity market liquidity . In order to establish a *causal* link from options compensation towards capital markets, we use as a natural experiment the revision of the Statement of Financial Accounting Standards No. 123 (FAS123(R)) in 2006. Prior to 2006, executive options were not explicitly reported in financial statements.[1] The FAS123(R) modification required companies to report options as an expense on the income statement along with salaries and other expenses, which effectively increased the costs of stock option awards to the firm (Aboody at al. 2004; Choudhary et al. 2009). Not surprisingly, the amount of options in executive compensation declined significantly following the revision, especially among firms that used a large amount of options (high-option group). The differential exposure of high-option firms (treatment group) and the rest (control group) to the exogenous regulatory shock allows us to assess the impact of options compensation on stock liquidity using a difference-in-difference methodology.

Executive options could exhibit either a negative or a positive impact on stock liquidity. One channel through which options could reduce liquidity is risk-taking. Risk-averse managers with more stock options have stronger incentives to increase firm risk in order to maximize the value of their options (Haugen and Senbet 1981; Smith and Stulz 1985).[2] An increased firm risk could lead to an increase in

[1] Firms could expense stock options at their intrinsic value, which is often zero since almost all option are granted at-the-money.

[2] See Guay (1999) and Cohen et al. (2000). Guay (1999) and Coles et al. (2006) find that firms with higher options compensation adopt riskier policies. Low (2009) shows that firms increase the use of options compensation to motivate mangers to take more risks after a court ruling that decreased takeover threats. Armbstrong and Vashishtha (2012) find that managers with stock options prefer to increase systematic risks but not idiosyncratic risks.

inventory holding cost for market makers, who in turn, could reduce liquidity supply, resulting in a *reduction* of stock liquidity (Stoll 1978; Amihud and Mendelson 1980; Ho and Stoll 1981, 1983; O'Hara and Oldfield 1986). Another channel through which options could reduce liquidity is adverse selection. Managers with more options could be more willing to manipulate stock price in order to increase the moneyness of the options (Bartov and Mohanram 2004; Peng and Roell 2008; Axelson and Baliga 2009). This elevated risk of price manipulation could deteriorate the information environment of the firm, increase information asymmetry, and as a result, reduce stock liquidity (Glosten and Milgrom 1985; Kyle 1988).

On the other hand, executive options could enhance the liquidity of the underlying stock by improving corporate governance.[3] Options compensation ties executives' wealth to the stock price, which aligns the executives' interests with the interests of their shareholders. Mitigated agency problems could increase stock liquidity through two channels – managerial channel and investor channel. On the one hand, stock options could motivate managers to improve the informational environment of their firms in order to boost valuations. This could be achieved, for example, by increasing the amount and quality of investment information (Leuz, Nanda and Wysocki 2003; Balakrishnan et al. 2014).[4] As the cost of information collection for investors declines, more investors would be willing to participate in the stock market and stock liquidity improves.[5] Improved liquidity raises firm value by lowering its cost of capital (Diamond and Verrecchia 1991; Bloomfield et al. 2000; Butler et al. 2005).

On the other hand, executive options could improve stock liquidity by inducing changes in investor behavior. As noted above, options compensation mitigates the conflict of interests between managers and shareholders. As agency costs decline, the value of outside control decreases, ownership

[3] Consistent with this idea, Chung, Elder, and Kim (2014) find that firms with better corporate governance exhibit greater liquidity, suggesting that firms can improve stock market liquidity by adopting better corporate governance practices that mitigate information asymmetry and reduce the agency costs.

[4] Leuz, Nanda and Wysocki (2003) find that the quality of accounting earnings is lower in countries where corporate insiders have more incentive to conceal firm performance to protect their private benefits. Balakrishnan, Billings, Kelly, Ljungqvist (2014) show that managers voluntarily disclose more information to compensate for a sudden loss of public information, which enhances liquidity and firm value.

[5] See e.g., Admati and Pfleiderer (1988), Kyle (1984), Holden and Subrahmanyam (1992), Holmstrom and Tirole (1993), Subrahmanyam and Titman (2001), and Chordia, Roll and Subrahmanyam (2008).

becomes more diffused, and trading volume increases. Increased trading volume enables faster diffusion of information into stock prices, resulting in an increased in liquidity due to lower risk of adverse selection (Glosten and Milgrom 1985; Kyle 1985; Easley and O'Hara 1987; Ferreira and Laux, 2007).[6]

Liquidity is a complex concept encompassing various aspects of the capital markets, such as the cost and speed of trading, the availability of abundant orders, and the speed of correcting order imbalances, among others (e.g., Kyle 1985). We therefore employ a wide range of liquidity measures that have been proposed in the academic literature to capture various dimensions of liquidity. In particular, we use the zero-return based measures proposed by Lesmond et al. (1999) and Liu (2006); the price impact measures based on trading volume and returns by Amihud (2002), Pastor and Stambaugh (2003), and Brennan et al (2013); and a proxy for the effective spread developed by Corwin and Schultz (2013). While these liquidity measures capture different aspects of liquidity, prior studies suggest that they also share common components (Korajczyk and Sadka 2008, Kim and Lee 2014). As a result, we also use in our analysis the first principal component across all of these measures as an additional liquidity variable.

Our empirical results broadly support the view that executive options tend to increase stock liquidity. We find that, based on all liquidity measures, stocks with the largest decrease in executive options after the implementation of FAS123(R) experience a disproportionally larger decrease in liquidity relative to the control sample, suggesting that executive options have a positive impact on stock liquidity. We also find that both firm valuation and performance decrease significantly more for the high-option group after the implementation of FAS123(R), consistent with the idea that stock option compensation increases firm value.

To better understand the channels through which executive options enhance stock liquidity, next we study how the exogenous shock to options compensation affects firms' informational environment,

[6] Previous literature shows that stock liquidity enhances corporate governance by incentivizing block holders to monitor by providing them with an opportunity to recoup the cost of monitoring (Norli et al, 2015), and by making block formation easier, which links to credible threat of exit by block holders (Maug 1998; Admati and Pfleiderer, 2009; Bharath, Jayaraman, and Nagar, 2013; Edmans, Fang, and Zur, 2013; Roosenboom, Schlingemann, and Vasconcelos, 2014). Diamond (1985) theoretically shows in a general equilibrium setting that firm's voluntary disclosure reduces information asymmetry by reducing incentives to collect private information.

stock price efficiency, equity ownership structure, and trading activity. First, we examine how options compensation affects investor information by studying the voluntary disclosures of firm managers and the properties of equity analyst forecasts. As discussed above, managers could improve stock liquidity by increasing both the amount (Diamond and Verrecchia, 1991; Bloomfield et al., 2000) and the informativeness of voluntary disclosures (Leuz, Nanda and Wysocki, 2003; Balakrishnan et al., 2013). We find that firms are less likely to issue guidance and issue fewer guidance post 2006, but high-option users are significantly more likely to issue guidance and issue more guidance after 2006 than firms in the control sample. Our results suggest that stock options induce managers to provide *less* information through voluntary disclosures. We also find no difference in changes in analyst forecast error and forecast dispersion between the high-option group and the control group following the exogenous shock to options compensation in 2006. Taken together, our results suggest that the positive impact of executive options on liquidity is unlikely driven by managers' desire to improve the information environment of their firms to enhance valuations.

Next, we examine changes in firms' ownership structure and investors' trading activities around the negative shock to executive compensation. We find that firms in the high-option group experience a significantly larger decrease in both the number of institutional investors as well as the aggregate institutional ownership after the implementation of FAS123(R) relative to the control sample. Furthermore, the institutional ownership for firms in the high-option group becomes significantly more concentrated than that in the control sample after 2006. While firms on average experience a significant increase in their trading activity post-2006, as measured by average turnover and total volume, the increase is approximately 40% smaller for firms in the high-option group relative to those in the control sample. These results suggest that executive stock options diffuse stock ownership and intensify trading activity in the underlying stock. We conclude that executive options enhance stock market liquidity by changing investor behavior.

Our results are robust to different measures of stock liquidity and alternative specifications. First, we separate Nasdaq firms from non-Nasdaq firms, given that the trading volume for Nasdaq stocks

includes inter-dealer trading volume while the trading volume for stocks listed on other venues does not. We find qualitatively similar results for these two subsamples. Although FAS123(R) became effective in 2006, the revision of the statement was proposed in 2004. Since the market in 2004 already knew that the revision would be implemented, it is possible that many firms started changing their compensation packages in 2004 in anticipation of the revision. To account for this possibility, we replicated all tests by ranking firms based on their use of options compensation at the end of 2003. All major inferences in the paper remain unchanged under this alternative specification. Third, to control more strongly for industry effects in compensation (note that all of our models have industry fixed effects), we re-performed all tests in the paper by defining the treatment and the control groups within industries. Our results are again robust to this alternative specification.

Our results have implications for our understanding of stock liquidity. The liquidity literature has viewed liquidity as a largely exogenous characteristic. Along this vein, numerous papers have studied the implications of liquidity for asset pricing (Amihud, 2002; Brennan et al., 1996; Chordia et al., 2000; Pastor and Stambaugh, 2003; Acharya and Pedersen 2005; Lee, 2011; Karolyi et al. 2012; Kim and Lee 2014 among others). Much less attention has been given in the literature to the endogenous aspects of liquidity and to the link between liquidity and corporate finance (Holmström, B., Tirole, J., 1993; Garvey, 1997; Fang, Noe, and Tice, 1999; Jayaraman, S., Milbourn, 2012).[7] Our paper contributes to this liquidity-literature by showing that one wide-spread corporate practice, executive stock option awards, exhibits a significant impact on equity market liquidity.

Our paper also contributes to the literature on executive compensation. Option-based compensation has become an essential part of corporate culture and compensation packages for most modern firms.[8] Yet, the real implications of executive options are still a topic of intense debate. While

[7] One exception is Eisfeldt (2004), who theoretically shows that the stock liquidity is determined by productivity.
[8] Jensen, Murphy, and Wruck (2004) document a significant increase in the use of stock options in compensation packages for CEOs at S&P500 companies. Stock options increase from 24 percent of CEO compensation in 1992 to 54 percent in 2002. While the use of options has declined in recent years, currently 480 firms of the S&P500 firms still include stock options in CEO compensation packages. Booth (2010) estimates that in 2009, CEOs at the 200

some have argued that options promote value-enhancing risk-taking behavior and value creation (e.g., Smith and Stulz, 1985; Guay, 1999; Low, 2009), others have pointed out that executive options could induce opportunistic behavior such as short-termism and corporate fraud (e.g., Stein, 1989; Edmans et al., 2013). We show that the structure of executive compensation could exhibit far-reaching consequences for the capital markets of the underlying firm.

The remainder of the paper is organized as follows. Section 2 describes the sample and the methodology. Section 3 presents the main empirical results. Section 4 presents the tests, and Section 5 concludes.

## 2. Empirical Strategy

### *2.1. Identification*

Option-based compensation and liquidity can be correlated for a variety of reasons. To establish a *causal* relation from compensation towards stock liquidity, a source of exogenous variation in executive compensation is necessary. We use as such the revision of the Statement of Financial Accounting Standards No. 123 (FAS123(R)), which requires companies to expense the fair value of option grants over the vesting period for all fiscal years starting June 15, 2005. Prior to the revision, executive options were reported in the notes section of the financial statements in accordance with the Generally Accepted Accounting Principles (GAAP). FAS123(R) requires companies to disclose the costs of these options as employee compensation along with salaries and other expenses on the income statement.

FAS123(R) increases the costs of executive options to the firm. Not surprisingly, the amount of options in executive compensation declined significantly after the revision (e.g., Carter et al., 2007; Cadman et al., 2013). However, the shock did not affect all firms equally. As Figure 1a indicates, companies with the largest fraction of executive options in 2005 (top 33 percent) decreased their option

largest U.S. corporations are likely to gain about $8mil from their options, which accounts for more than half of their total pay.

compensation from 60% in 2005 to around 20% in 2012, while the rest of the firms maintained a steady fraction of option compensation around 15%.

We use FAS123(R) as an exogenous shock to options compensation to study the impact of executive options on liquidity. Our identification strategy is a difference-in-difference methodology. Specifically, we rank all firms based on their fractions of options compensation in 2005, the year prior to the implementation, and use the rankings to define high-option compensation firms (the treatment group) and other firms (the control group). We then compare the behaviors of the two groups of firms before and after the shock. In particular, using firm-level data, we estimate the following basic regression:

$$y_{jit} = \alpha_i + \beta X_{jit} + \gamma HOPT_j + \delta Event + \phi HOPT_j * Event + \varepsilon_{jit} \quad (1)$$

where *j* indexes firm, *i* indexes industry, and *t* indexes time. $y_{jit}$ is various measures of illiquidity. $X_{jit}$ is a vector of firm-level control variables. $HOPT_j$ is an indicator variable that equals one for firms with high fraction of executive options in 2005 (top 33 percent). $Event$ is an indicator variable that equals to one for year 2006 and later, and zero otherwise. $\varepsilon_{jit}$ is the error term. The estimate of $\phi$ captures the differential impact of FAS123(R) on the high-option group following its implementation in 2006.

*2.2. Measuring executive compensation*

We draw our sample from the ExecuComp database, which provides compensation data for the top five executives at the S&P 1500 companies. We obtain CEO compensations for firms in the ExecuComp universe from 2000 to 2012, centered around 2006 when FAS123(R) took effect. From this initial sample we exclude financials and utilities as well as companies with missing CEOs' appointment dates. We then remove companies that have no CEO compensation data in 2005. We apply this restriction because in our analysis, we rank firms based on the value of option compensation as a percentage of total compensation in 2005, the year immediately before the implementation of FAS123(R).

We further require data in Compustat and the Center for Research in Security Prices (CRSP) to measure various firm characteristics. To be included in our sample, a firm needs to have at least six months of daily stock returns over the fiscal year, and valid accounting information in the previous fiscal year. Following the convention in the liquidity literature, we apply the following screening rule to compute liquidity measures. Stocks are required to have at least 100 positive trading volume days over the sample period. To prevent any disruptive influence from extremely large or small stock prices, a stock is dropped from the sample for that year if the previous year-end stock price was less than or equal to $5 or greater than or equal to $1,000. Firm-years in which a firm's stock changed trading venues are also excluded from the sample. For stocks that are delisted (CRSP delisting codes beginning with the number five), we also drop all observations from the delisting year. When building the monthly liquidity measures, we also require stocks to have at least 15 days with valid observations in a given month. Our final sample consists of 1,319 unique firms for a total of 12,629 firm-year observations.

[INSERT TABLE 1 HERE.]

In addition to CEO total compensation, we also compute the value of stock options as a percentage of total compensation (*%Options*), the value of restricted stocks as a percentage of total compensation *(%Rstocks*), and salary as a percentage of total compensation *(%Salary*). Table 1 reports the time trend of CEO compensation structure over time. In 2000, at the start of our sample period, the average CEOs' total compensation was $5.13 million. Total compensation declined in the early 2000s, but has increased gradually since 2004. The average total compensation peaked at $ 6.6 million in 2011. At the beginning of our sample period, options accounted for 40.9% of total CEO compensation. The average value of *%Options* declined over time, dropping to 16.8% in 2012, with the largest annual decline of 7.7 percentage point in 2006. Firms have increased the use of restricted stocks in CEO compensation structures, especially since 2006, suggesting that the decline in executive stock options has been partially

offset by an increase in restricted stock grants. Table 1 also shows that the *%Salary* declined over the sample period as well, but at a much lower rate than stock options.

[INSERT TABLE 2 HERE.]

The use of stock options varies greatly not only across industries but also within each industry. To assess the importance of industries for executive option compensation, we regress *%Options* on industry fixed effects based on the 49 industry classification by Fama and French. Table 2 summarizes the results. Over the period of 2000-2012, pharmaceutical products, medical equipment, computer software, business services, and electronic equipment are the top five industries with heavy use of stock options in the compensation packages of their CEOs. However, industries alone explain 54% of the total variations in *%Options*, suggesting that there is a substantial variation in option compensation within industries. The use of options changes significantly post 2006. The industry fixed effects were more significant prior to 2006, explaining as much as 65% of the total variations in *%Options*, compared to the 48% figure in the post-2006 period. We control for industry fixed effect in all of the subsequent analyses.

*2.3. Measuring liquidity*

Liquidity, the ability to trade a significant quantity of a security quickly and at a low cost, is a multifaceted and complex phenomenon. The empirical literature has proposed numerous liquidity measures, but no single measure is sufficient to capture all dimensions of liquidity (Goyenko, Holden and Trzcinka, 2009; Korajczyk and Sadka, 2008; Kim and Lee, 2014). We therefore employ seven liquidity measures and discuss each one in detail below. For all of our liquidity measures, a higher value indicates poorer liquidity. As such, the measures are effectively measuring *il*liquidity rather liquidity.

• **Amihud measure (*RV*)**: the price impact measure proposed by Amihud (2002) is defined as an absolute return scaled by dollar trading volume.

$$RV_{i,d,t} \equiv \frac{\left|r_{i,d,t}\right|}{P_{i,d,t} \cdot VO_{i,d,t}} \times 10^{6}, \tag{2}$$

where $P_{i,d,t}$ and $VO_{i,d,t}$ are the price and daily share trading volume (in one share unit) of stock *i* on day *d* in month *t*, respectively. This measure is defined only for days with positive trading volume. The monthly illiquidity measure is constructed as an equally weighted average of daily *RV*s in a given month.

• **Turnover-based Amihud measure (*RVT*)**: Since the dollar trading volume in the Amihud measure can be computed as the product of market capitalization and share turnover, the measure has been criticized for being tainted by size. Hence, we also use the "turnover-based" Amihud measure, which uses share turnover (number of shares traded divided by the number of total shares outstanding), *TV*, in the denominator instead of dollar trading volume (Brennan et al (2013)).

$$RVT_{i,d,t} \equiv \frac{\left|r_{i,d,t}\right|}{TV_{i,d,t}} \tag{3}$$

The monthly illiquidity measure is constructed as an equally weighted average of daily *RVT*s in a given month.

• **Zero-return (*ZR*)**: Zero return measure is computed as the number of days with no changes in return relative to the total trading days in a month.

$$ZR_{i,t} = N_{i,t} / T_t \tag{4}$$

where $T_t$ is the number of trading days in month *t* and $N_{i,t}$ is the number of zero-return days of stock *i* in month *t*. The intuition behind this measure is that zero return days are a manifestation of high trading cost as informed investors would choose not to trade on a day with high trading cost, resulting in observed zero return on that day (Lesmond, Ogden, and Trzcinka (1999)).

• **Liu (2006)'s measure (*LM12*)**: One potential caveat of *ZR* is that it may produce the same value for many stocks many times. To overcome this problem, Liu (2006) proposes a turnover-adjusted zero-return measure,

$$LMx_{i,t} = \left[ N_Z + \frac{1/TVx}{DF} \right] \times \frac{21x}{N_x}, \tag{5}$$

In the above formula, $N_Z$ denotes the number of zero-volume days in the previous $x$ months, $N_x$ is the total number of trading days over the previous $x$ months, and $TVx$ is the sum over the previous x months of daily trading volume divided by the number of shares outstanding. We use *LM12*, which is based on the previous 12 months of data. *DF* is a deflator that constrains, for all sample stocks, the second term in the square brackets of Eq. (5) to be located between zero and one (not inclusive). We use 11,000, which satisfies the boundary condition for *DF* for our sample. The last term in Eq. (5) is used to adjust the measure to be comparable to other monthly measures.

• **Pastor and Stambaugh measure (*PS*)**: We estimate the price impact measure by Pastor and Stambaugh (2003) based on the following regression:

$$r_{i,d+1,t} - r_{M,d+1,t} = \alpha_{i,t} + \beta_{i,t} r_{i,d,t} + \gamma_{i,t} sign(r_{i,d,t} - r_{M,d,t}) \bullet dvol_{i,d,t} + \varepsilon_{i,d,t}. \tag{6}$$

where $r_{i,d,t}$ is the return of stock $i$ on day $d$ in month $t$, $r_{M,d,t}$ is the market return (CRSP value-weighted index return) on day $d$ in month $t$, and $dvol_{i,d,t}$ is the dollar trading volume in million-dollar unit. Reflecting price reversals due to a large trading volume, the coefficient of the signed dollar trading volume, $\gamma_{i,t}$, is more negative for higher reversal (higher price impact). That is, it is a measure of liquidity rather than illiquidity. Hence, to make it comparable to all other measures, we multiply the estimated sensitivity coefficient by (-1) and obtain the illiquidity measure, *PS*:

$$PS_{i,t} \equiv \gamma_{i,t} \times (-1). \tag{7}$$

• **High-low Spread (*HLSPRD*)**:

Corwin and Schultz (2012) develop an estimate of bid-ask spread based on the ratio of daily high and low prices by focusing on the empirical regularity that the daily high (low) prices are almost always buy (sell) trade.[9] The closed form solution for their spread estimator is:

[9] We choose not to use TAQ data to compute bid-ask spread because intraday data are tainted by increased high frequency trading in recent years (see e.g., Goyenko et al. 2009, Hasbrouck 2009, and Easley, Lopez de Ptrdo 2012).

$$HLSPRD = \frac{2(e^K - 1)}{1 + e^K} \tag{8}$$

$$K = \left(\sqrt{2E\left\{\sum_{j=0}^{1}\left[ln\left(P_{t+j}^{H}/P_{t+j}^{L}\right)\right]^2\right\}} - \sqrt{E\left\{\sum_{j=0}^{1}\left[ln\left(P_{t+j}^{H}/P_{t+j}^{L}\right)\right]^2\right\}}\right)/\left(3 - 2\sqrt{2}\right) -$$

$$\sqrt{\left[ln\left(P_{t,t+1}^{H}/P_{t,t+1}^{L}\right)\right]^2/\left(3 - 2\sqrt{2}\right)}, \tag{9}$$

where $P_t^H$ and $P_t^L$ are the observed high and low stock price at day *t*, respectively. Corwin and Schutlz show that when benchmarked against TAQ effective spreads, the high-low spread estimator outperforms other alternative low-frequency measures in capturing the cross-sections of both spread levels and month-to-month changes. We follow their methodology to compute daily high-low spread and use the average of daily values over each fiscal year in the analysis. We use the average of daily spread over the fiscal year in the regression in Eq. (1).

Previous research shows that liquidity measures, while capturing different aspects of liquidity, tend to be positively correlated (Goyenko et al, 2009; Hasbrouck, 2009), and therefore can be viewed as having a common component together with measure-specific component (Korajzyk and Sadka, 2008; Kim and Lee, 2014). In our sample, the Spearman correlation coefficients range from 0.06 between *HLSPRD* and *PS* to 0.77 between *RVT* and *LM12*. To capture the common component across the measures, we also estimate their first principal component (*PC1*).

• **Principal Component (*PC1*)**: We compute the first principal component of the six monthly measures for each firm each month. Then, we average for each firm the principal component over the fiscal year to obtain the variable, *PC1*. Figure 2 shows the eigenvalue proportion of the six principal components averaged across firms. We see that the first principal component explains approximately 43% of the total variation of the six liquidity proxies, indicating that there indeed exists a common systematic component across the different measures in our sample, a finding consistent with Korajczyk and Sadka (2008) and Kim and Lee (2014).

[INSERT FIGURE 2 HERE.]

*2.4. Summary statistics*

Table 3 reports descriptive statistics of our sample. The average sample firm has total assets of $6.2 billion, a market-to-book equity ratio (*M/B*) of 3.3, a leverage ratio of 0.17, and a Tobin's Q of 1.93. Approximately 35% of our sample firms are listed on Nasdaq, and 31% are constituents of the S&P500 index. Institutional investors hold a significant amount of common shares with an average of 78% ownership.

[INSERT TABLE 3 HERE.]

We then compare firms in the high-option group with all other firms in the sample. A firm belongs to the high-option group (*HOPT*=1) if its *%Options* in 2005 is in the top 33 percent of the sample. On average, firms in the high-option group have significantly better liquidity than other firms (*Others*). In all illiquidity measures considered, we see that the values are lower (i.e., more liquid) for stocks in *HOPT* group than for the control groups in both sub-periods. Liquidity is better in the second sub-period than the first. However, the increase in liquidity after 2006 is significantly smaller for the high-option group than that for the control sample, suggesting a differential impact of FAS123(R) on the high-option group. Moreover, firms in the high-option group tend to be smaller, have higher market-to-book ratios and Tobin's Q, exhibit better performance, use less debt, and are more likely to be listed on Nasdaq and be part of the S&P500 index. These firms also have significantly higher institutional ownership (*%Inst. Ownership*), more institutional investors (*# of Inst. owners*), and less concentrated intuitional ownership (*Inst. own. Concentration*). On average, our sample firms experience a significant reduction in risk, as proxied by stock return volatility, subsequent to the negative shock to options compensation in 2006, especially for the high-option group.

**3. Results**

*3.1. Executive options and stock liquidity*

Table 4 reports the basic difference-in-difference results from the estimation of Eq. (1). The dependent variables are various measures of illiquidity. *HOPT* is an indicator variable for high-option firms in 2005 (top 33 percent). *Event* is an indicator variable for the post-revision period (2006-2012). The right-hand-side of the models also includes firm-characteristics and industry fixed effects. All standard errors are adjusted for clustering at the firm-level.

[INSERT TABLE 4 HERE.]

The most important variable for us is the interaction term between *HOPT* and *Event*. It captures the time-series difference of the cross-sectional differences in performance between high-option firms and the rest of the sample. We find that the coefficient on the interaction term is significantly positive for all illiquidity variables except *PS*, suggesting that firms in the high-option group experience disproportionally larger decreases in liquidity post 2006. The effect is also economically significant. As an illustration, consider the high-low spread estimator (*HLSPRD*) in the first model. We find that prior to 2006, firms in the high-option group exhibit significantly higher liquidity than control firms, as evidenced by the significantly negative coefficient of -0.041 on *HOPT*. On average, firms experience a decrease in liquidity post 2006 as measured by *HLSPRD*, but the decrease is 80% larger for the high-option group than the control sample (=0.020/0.025). We find similar results for the other five liquidity measures, *RV*, *RVT*, *LM12*, *ZR*, and *PS* in columns 2 through 6, respectively. While liquidity improves post 2006 for the control sample, liquidity deteriorates significantly for the high-option group, suggesting that liquidity declines following a negative shock to executive stock options.

The control variables have the expected signs. Firm-level illiquidity is strongly related to the level of market illiquidity. Larger firms have better liquidity. Liquidity level is generally greater for firms with higher *M/B* and better stock performance in the recent past (*Momentum*). On the other hand, liquidity level is generally lower for firms with more volatile stock returns, and liquidity worsens during financial crisis period. S&P500 constituent firms also have more illiquid equity markets. [IS THIS STRANGE?]

*3.2. How do executive options improve liquidity?*

Our baseline results show that using more options in executive compensation increases stock liquidity. We now explore the channels through which executive options enhance stock liquidity. As discussed in the introduction, executive options mitigate the agency problems within the firm, which could increase stock liquidity through two channels – managerial channel and investor channel.

According to the managerial channel, executives with outstanding options are motivated to improve liquidity by actively improving their firm's information environment in order to boost valuations. According to the investor channel, since executive options reduce the value of outside control, they lead to more diffused equity ownership structure and intensify trading activity. Consequently, liquidity improves due to lower adverse selection risk as more information is impounded into stock prices faster (Glosten and Milgrom 1985; Kyle 1985; Easley and O'Hara 1987; Ferreira and Laux 2007).

To shed more light on the above channels, we examine the impact of FAS123(R) on firm value, performance, information environment, and ownership structure using a similar difference-in-difference setting. We use Tobin's Q to measure firm valuation and industry-adjusted returns, defined as returns in excess of the returns on the value-weighted portfolio of firms from the same Fama-French 49 industry, to measure stock market performance. . We measure accounting performance using industry-adjusted ROA, defined as return-on-assets in excess of industry-median. Table 5 summaries these results.

[INSERT TABLE 5 HERE.]

Column 1 shows that firms in the high-option group exhibit significantly larger declines in firm value post 2006 than other firms. Prior to 2006, firms in the high-option group exhibit significantly better valuation, with an average Tobin's Q being 0.247 greater than that of the control firms. This valuation premium completely disappears post 2006. While firms in the control group experience no change in

valuation, Tobin's Q drops by 0.231 among firms in the high-option group, completely wiping out the valuation difference between the two groups. We find similar results for firm performance in columns 2 and 3. Both stock performance and accounting performance deteriorate significantly more among firms in the high-option group relative to those of the control sample in the post 2006 time period, consistent with the idea that the use of stock options can lead to better performance and higher valuation.

To understand what drives these changes, we explore the impact of FAS123(R) on firms' information environment and investor behavior. One possibility is that stock options motivate executives to increase firm value by actively improving their firm's information environment, which enhances stock liquidity and lowers the cost of equity capital. Balakrishnan et al. (2014) show that firms can improve liquidity by voluntarily disclosing more information than is mandated by market regulations. We therefore examine management voluntary disclosures. In particular, we construct two variables using management earnings guidance – *Guidance*, an indicator variable that equals one if a sample firm provides any earnings guidance in the year, and zero otherwise; *# of Guidance*, the total number of guidance provided in the year. To capture firms' information environment, we look at analyst forecast error and forecast dispersions. Analyst forecast error is calculated as the difference between the average forecast across all analysts following the firm and the actual earnings, scaled by the absolute value of the actual earnings. Analyst forecast dispersion is defined as the standard errors of analyst forecasts over the absolute values of the average analyst forecast. We require a minimum of three analyst forecasts when calculating forecast dispersion. We measure the speed of information diffusion using the price delay measure in Hou and Moskowitz (2005), which computes how much return variation is explained by past returns. Table 6 summarizes results from our difference-in-difference analysis.

[INSERT TABLE 6 HERE.]

In column 1, we report marginal effects from a probit regression that estimates the probability of providing guidance. We find that firms in high-option group are significantly more likely to issue

earnings guidance post 2006 relative the control sample, suggesting that managers with more stock options are less likely to disclose information. In column 2, we focus on the number of guidance managers provide. We find that high-option firms offer significantly more guidance post 2006 compared to the other firms, suggesting managers with more stock options not only are more likely to disclose, but they also disclosure more frequently. However, we see no difference between high-option group and the control group in analyst forecasts. As columns 3 and 4 show, while both analyst forecast error and forecast dispersion increase in the post-2006 period, there is no difference between firms in the high-option group and others. Taken together, these results suggest that an increase in the use executive stock options enhances firm value, but unlikely through improving the information environment of the firm.

Interestingly, column 5 shows that price delay becomes significantly larger for high-option firms post 2006 relative to the control group, indicating a negative shock to executive stock options leads to much slower information diffusion into share price. To understand what drives the positive relation between executive stock options and the speed of information diffusion, we next turn to changes in investor behavior around the implementation of FAS213R.

To investigate the importance of the investor channel, next we how investors' composition and their trading activities respond to the shock in executive compensation. We examine three dimensions of ownership structure – percentage of common shares held by institutional investors (*%Inst. Ownership*), number of institutional investors (*# of Inst. Owners*), and ownership concentration (*Inst. Own. Concentration*), which is the Herfindahl-Hirschman Index computed using the ownership of all institutional investors. We consider two measures of investors' trading activity – *Ln(Avg. turnover)*, the natural logarithm of the average monthly turnover in a fiscal year, where turnover is defined as the sum of daily trading volume in a month divided by the number of shares outstanding at the end of the month, and *Ln(Volume)*, the natural logarithm of the sum of a stock's daily trading volume over the fiscal year. Table 7 summarizes our results.

[INSERT TABLE 7 HERE.]

Columns 1 to 3 report ownership results. Relative to the control group, firms in the high-option group experience a significantly larger decline in both institutional ownership and the number of institutional investors in the post-2006 period. Our estimate shows that institutional ownership declines by 1.9% more for firms in the high-option group after 2006 than other firms, and the difference is statistically significant at the 1% level. High-option firms also experience a significant decrease in the number of institutional investors as well as a significant increase in ownership concentration post 2006 than other firms.

Columns 4 and 5 present results on investors' trading activities. While firms on average experience a significant increase in both average turnover and total trading volume post 2006, the increase is significantly smaller for firms in the high-option group. Our estimates indicate that the increase in average turnover is 37% smaller for the high-option group than for the control group (=0.171/0.466), and the increase in trading volume is 43% smaller for the high-option group (=0.192/0.444). Therefore, more stock options in executive compensation leads to more diffused ownership, higher turnover, larger trading volumes, and faster information diffusion into share price.

Overall, our results suggest that executive stock options have a positive impact on liquidity, most likely because executive options lead to less adverse selection, more diffused ownership, and more active trading in the capital market that leads to better price efficiency.

[INSERT TABLE 5 HERE.]

**4. Robustness**

Four of our illiquidity measures, *RV*, *RVT*, *PS*, and *LM12*, use trading volume. Since Nasdaq trading volume is defined differently from other trading venues since it includes inter-dealer volume, we re-estimate the same models in Table 4 for Nasdaq firms and non-Nasdaq firms separately. Table 8 summarizes these results. To conserve space, we do not report the control variables in the table. Our results are similar between Nasdaq firms and non-Nasdaq firms. In both sub-samples, we find that relative

to the control sample, firms in the high-option group experience a significant larger decline in liquidity (increase in illiquidity) post 2006, with the results being slightly stronger for Nasdaq firms. Overall, our results are robust to the different venues.

[INSERT TABLE 8 HERE.]

FAS123(R) was published in December 2004, one year before it became effective. Since the market very likely knew about the revision by the beginning of 2004, it is possible that firms started changing their compensation structure in anticipation of the revision in 2004. To control for this possibility, we estimate a version of model (1) redefining the high-option group based on the fraction of option compensation in 2003. As an alternative robustness test, we also estimate a version of model (1) by redefining the high-option group within each one of the Fama-French 49 industries.

[INSERT TABLE 9 HERE.]

In Table 9, we implement two robustness tests using the alternative definitions of *HOPT*. In Panel A, we define the high-option group (*HOPT*) within each one of the Fama-French 49 industry groups using *%Options* in 2005. Our results are qualitatively similar to the baseline results in Tables 4, suggesting that our findings are not driven by industries. The result is even a bit stronger in that now the interaction of HOPE and Event is significant for *PS*. In Panel B, we define the high-option group using *%Option* in 2003. As noted earlier, while FAS123(R) took effect in 2006, the Financial Accounting Standards Board published the revision to the Statement of FAS123 in 2004. It is possible that some firms started changing their CEO compensation structure in 2004 in anticipation of FAS123(R) . Consistent with this idea, Choudhary et al. (2009) document that several firms accelerated the vesting of their ESOs prior to the implementation of FAS123(R) to avoid recognizing existing unvested ESO grants at fair value in future

financial statements. Panel B of Table 6 shows that our results are again robust to this alternative specification.

## 5. Conclusion

The academic literature has been focusing predominantly on the implications of liquidity for asset pricing (Amihud, 2002; Brennan et al 1996; Pastor and Stambaugh 2003; Acharya and Pedersen 2005), portfolio performance (Korajczyk and Sadka 2004; Lesmond et al, 1999), market efficiency (Chordia et al 2008), and corporate finance (Holmström, B., Tirole, J., 1993; Garvey, 1997; Fang, Noe, and Tice, 1999; Jayaraman, S., Milbourn, 2012). However, relatively less research has been done on the endogenous aspects of liquidity.

We study the impact of executive stock options on the trading environment of the firm's stock by utilizing exogenous variation in option compensation due to the revision of the Statement of Financial Accounting Standards No. 123 in 2006. We show that one wide-spread corporate practice, executive stock option awards, exhibits a significant impact on various aspects of stock liquidity. We find that the stock option positively affects stock liquidity, measured by a wide range of liquidity measures as well as by their principal component. Our subsequent finding that executive options tend to increase the breadth of equity ownership while they exhibit no significant impact on the informational environment of the firm suggests that executive options increase stock liquidity through their impact on investor behavior.

**Appendix: Sampling procedure**

| | # firm-years | # firms |
|---|---|---|
| All firms in Execucomp from 2000 to 2012 | 23,929 | 2,696 |
| After removing all Financials and Utilities | 18,877 | 2,102 |
| After removing obs. for missing CEO option compensation data in 2005 | 14,924 | 1,354 |
| After removing obs. for missing other CEO info | 14,495 | 1,342 |
| After removing obs. with missing CRSP and Compustat data | 12,629 | 1,319 |

**References**


Aboody, D., Barth, M., and Kasznik, R., 2004. Firms' voluntary recognition of stock-based compensation expense. Journal of Accounting Research 42 (May): 123-150.Admati, A.R., Pfleiderer, P., 2009. The "Wall Street Walk" and Shareholder Activism: Exit as a Form of Voice. Review of Financial Studies 22, 2645-2685

Amihud, Y., 2002. Illiquidity and stock returns: cross-section and time-series effects. Journal of Financial Markets 5, 31-56

Armstrong, C.S., Core, J.E., Guay, W.R., 2014. Do independent directors cause improvements in firm transparency? Journal of Financial Economics 113, 383-403

Armstrong, C.S., Vashishtha, R., 2012. Executive stock options, differential risk-taking incentives, and firm value. Journal of Financial Economics 104, 70-88

Axelson, U., Baliga, S., 2009. Liquidity and Manipulation of Executive Compensation Schemes. Review of Financial Studies 22, 3907-3939

Bakke, T.-E., Whited, T.M., 2010. Which Firms Follow the Market? An Analysis of Corporate Investment Decisions. Review of Financial Studies 23, 1941-1980

Balakrishnan, K., Billings, M.B., Kelly, B., Ljungqvist, A., 2014. Shaping Liquidity: On the Causal Effects of Voluntary Disclosure. Journal of Finance 69, 2237-2278

Bartov, E., Mohanram, P., 2004. Private Information, Earnings Manipulations, and Executive Stock-Option Exercises. Accounting Review 79, 889-920

Bebchuk, L., Spamann, H., 2010. Regulating banker's pay. Georgetown Law Review 98, 247–287.

Beltratti, A., and Stulz, R.M., 2012. The credit crisis around the globe: Why did some banks perform better? Journal of Financial Economics 105, 1-17.

Benerjee, A., 1992. A simple model of herd behavior. Quarterly Journal of Economics 107, 797–817.

Bertrand, M., Mullainathan, S., 2003. Enjoying the quiet life? Corporate governance and managerial preferences. Journal of Political Economy 111, 1043–1075.

Bharath, S.T., Jayaraman, S., Nagar, V., 2013. Exit as Governance: An Empirical Analysis. Journal of Finance 68, 2515-2547

Bikhchandani, S., Hirshleifer, D., and Welch, I., 1992. A theory of fads, fashions, custom and cultural change as informational cascades. Journal of Political Economy 100, 992–1026.

Bloomfield, R.J., Wilks, T.J., 2000. Disclosure Effects in the Laboratory: Liquidity, Depth, and the Cost of Capital. Accounting Review 75, 13

Brandes, P, Hadani, M., and Goranova, M., 2006. Stock options expensing: An examination of agency and institutional theory explanations. Journal of Business Research 59: 595–603.

Brennan, M., Sahn-Wook, H., Subrahmanyam, A., 2013. An analysis of the Amihud illiquidity premium. Review of Asset Pricing Studies forthcoming

Brogaard, J., Li, D., Xia, Y., 201508. The Effect of Stock Liquidity on Default Risk. Available at SSRN: http://ssrn.com/abstract=2649084 or http://dx.doi.org/10.2139/ssrn.2649084

Butler, A.W., Grullon, G., Weston, J.P., 2005. Stock Market Liquidity and the Cost of Issuing Equity. Journal of Financial and Quantitative Analysis 40, 331-348

Cadman, B., Rusticus, T., and Sunder, J., 2013. Stock option grant vesting terms: economic and financial reporting determinants. Review of Accounting Studies 18, 1159-1190.

Garter, M., Lynch, L., and Tuna, I., 2007. The role of accounting in the design of CEO equity compensation. The Accounting Review 82, 327-355.

Cassell, C., Huang, S., Sanchez, J., and Stuart, M., 2012. Seeking safety: The relation between CEO inside debt holdings and the riskiness of firm investment and financial policies. Journal of Financial Economics 103, 588-610.

Chen, Q., Goldstein, I., Jiang, W., 2007. Price Informativeness and Investment Sensitivity to Stock Price. Review of Financial Studies 20, 619-650

Chevalier, J., Ellison, G., 1999. Are some mutual fund managers better than others? Cross-sectional patterns in behavior and performance. Journal of Finance 54, 875–899.

Chordia, T., Roll, R., Subrahmanyam, A., 2008. Liquidity and market efficiency. Journal of Financial Economics 87, 249-268

Choudhary, P., Rajgopal, S., and Venkatachalam, M., 2009. Accelerated vesting of stock options in anticipation of SFAS 123R. Journal of Accounting Research 47, 105–146.

Chung, K.H., Elder, J., Kim, J.-C., 2010. Corporate Governance and Liquidity. Journal of Financial and Quantitative Analysis 45, 265-291

Coase, R. H., 1937. The Nature of the Firm. Economica 4, 386–405.

Cohen, R., Hall, B., Viceira, L., 2000. Do executive stock options encourage risk-taking? Working Paper, Harvard Business School.

Coles, J., Daniel, N., Naveen, L., 2006. Managerial incentives and risk-taking. Journal of Financial Economics 79, 431-468

Corwin, S.A., Schultz, P., 2012. A Simple Way to Estimate Bid-Ask Spreads from Daily High and Low Prices. Journal of Finance 67, 719-760

Diamond, D.W., 1985. Optimal Release of Information By Firms. Journal of Finance 40, 1071-1094

Diamond, D.W., Rajan, R.G., 2009. The credit crisis: conjectures about causes and remedies. American Economic Review 99, 606–610.

Diamond, D.W., Verrecchia, R.E., 1991. Disclosure, Liquidity, and the Cost of Capital. Journal of Finance 46, 1325-1359

Edmans, A., Fang, V.W., Zur, E., 2013. The Effect of Liquidity on Governance. Review of Financial Studies 26, 1443-1482

Faccio, M., Marchica, M., and Mura, R., 2011. Large shareholder diversification and corporate risk-taking. Review of Financial Studies 24, 3601–3641.

Fahlenbrach, R., Stulz, R. M., 2011, Bank CEO Incentives and the Credit Crisis. Journal of Financial Economics 99, 11-26.

Fang, V.W., Noe, T.H., Tice, S., 2009. Stock market liquidity and firm value. Journal of Financial Economics 94, 150-169

Ferreira, M.A., Laux, P.A., 2007. Corporate Governance, Idiosyncratic Risk, and Information Flow. Journal of Finance 62, 951-989

Glosten, L.R., Milgrom, P.R., 1985. Bid, ask and transaction prices in a specialist market with heterogeneously informed traders. Journal of Financial Economics 14, 71-100

Goyenko, R.Y., Holden, C.W., Trzcinka, C.A., 2009. Do liquidity measures measure liquidity? Journal of Financial Economics 92, 153-181

Graham, J., 1999. Herding among investment newsletters: Theory and evidence. Journal of Finance 54, 237-268.

Guay,W.,1999. The sensitivity of CEO wealth to equity risk: an analysis of the magnitude and determinants. Journal of Financial Economics 53, 43–71.

Hart, O., 1983. The market mechanism as an incentive scheme. Bell Journal of Economics 13, 366–382.

Haugen, R.A., Senbet, L.W., 1978. The insignificance of bankruptcy costs to the theory of optimal capital structure. Journal of Finance 33, 383-393.

Haugen, R.A., Senbet, L.W., 1981. Resolving the agency problems of external capital through options. Journal of Finance 36, 629–647.

Hayes, R.M., Lemmon, M., Qiu, M., 2012. Stock options and managerial incentives for risk taking: Evidence from FAS 123R. Journal of Financial Economics 105, 174-190

Ho, T., Stoll, H.R., 1981. Optimal dealer pricing under transactions and return uncertainty. Journal of Financial Economics 9, 47-73

Holden, C.W., Jacobsen, S., Subrahmanyam, A., 2013. The Empirical Analysis of Liquidity. In: Foundations and Trends in Finance. Now Publishers, pp. 263-365.

Holmström, B., Tirole, J., 1993. Market Liquidity and Performance Monitoring. Journal of Political Economy 101, 678-709

Hong, H., Kubik, J. D., and Solomon, A., 2000. Security analysts' career concerns and herding of earnings forecasts. RAND Journal of Economics 31,121–144

Hou, K., Moskowitz, T.J., 2005. Market Frictions, Price Delay, and the Cross-Section of Expected Returns. Review of Financial Studies 18, 981-1020

Jayaraman, S., Milbourn, T.T., 2012. The Role of Stock Liquidity in Executive Compensation. Accounting Review 87, 537-563

John, K., Litov, L., and Yeung, B., 2008. Corporate governance and managerial risk taking: theory and evidence. Journal of Finance 63, 1679–1728.

Jensen, M.C., Meckling, W.H., 1976. Theory of the firm: managerial behavior, agency costs, and ownership structure. Journal of Financial Economics 3, 305–360.

Jensen, M.C., Murphy, K.J., and Wruck, E.G., 2004. Remuneration: Where we've been, how we got to here, what are the problems, and how to fix them. Harvard NOM Working Paper.

Kashyap, A.K, Rajan, R.G., and Stein, J.C., 2008. Rethinking Capital Regulation. Paper presented at the Maintaining Stability in a Changing Financial System Federal Reserve Bank of Kansas Symposium, Jackson Hole, WY.

Kato, H., Lemmon, M., Luo, M., and Schallheim, J., 2005. An empirical examination of the costs and benefits of executive stock options: Evidence from Japan. Journal of Financial Economics 78, 435-461.

Kindleberger, C. (1978) Maniacs, Panics and Crashes. Cambridge, MA: Cambridge University Press.

Keynes, J. M., 1936. The General Theory of Employment, Interest and Money. London: Macmillan.

Kim, S.-H., Lee, K.-H., 2014. Pricing of liquidity risks: Evidence from multiple liquidity measures. Journal of Empirical Finance 25, 112-133

Korajczyk, R.A., Sadka, R., 2008. Pricing the commonality across alternative measures of liquidity. Journal of Financial Economics 87, 45-72

Kraus, A., Litzenberger, R.H., 1973. A state-preference model of optimal financial leverage. Journal of Finance 33, 911-922.

Lesmond, D.A., Ogden, J.P., Trzcinka, C.A., 1999. A new estimate of transaction costs. Review of Financial Studies 12, 1113-1141

Leuz, C., Nanda, D., Wysocki, P.D., 2003. Earnings management and investor protection: an international comparison. Journal of Financial Economics 69, 505-527

Liu, W., 2006. A liquidity-augmented capital asset pricing model. Journal of Financial Economics 82, 631-671

Maug, E., 1998. Large Shareholders as Monitors: Is There a Trade-Off between Liquidity and Control? Journal of Finance 53, 65-98

Murphy. K., 2002. Explaining executive compensation: managerial power versus the perceived cost of stock options. The University of Chicago Law Review 69, 847-869.

Nalebuff, B., Stiglitz, J., 1983. Information, competition, and markets. American Economic Review, Papers and Proceedings 73, 278–283.

Norli, Ø., Ostergaard, C., Schindele, I., 2015. Liquidity and Shareholder Activism. Review of Financial Studies 28, 486-520

O'Hara, M., Oldfield, G.S., 1986. The Microeconomics of Market Making. Journal of Financial and Quantitative Analysis 21, 361-376

Pástor, Ľ., Stambaugh, R.F., 2003. Liquidity risk and expected stock returns. Journal of Political Economy 111, 642-685

Peng, L., Roel, A., 2008. Manipulation and equity based compensation. American Economic Review 98, 285-290.

Rajan, R.G., 2006. Has Financial Development Made the World Riskier? Paper presented at The Greenspan Era: Lessons for the Future Federal Reserve Bank of Kansas Symposium, Jackson Hole, WY.

Roosenboom, P., Schlingemann, F.P., Vasconcelos, M., 2014. Does Stock Liquidity Affect Incentives to Monitor? Evidence from Corporate Takeovers. Review of Financial Studies 27, 2392-2433

Scharfstein, D., 1988. Product market competition and managerial slack. Rand Journal of Economics 19, 147–155.

Scharfstein, D. S., Stein, J. C., 1990. Herd Behavior and Investment. American Economic Review 80, 465–479.

Smith, C.W., Stulz, R.M., 1985. The determinants of firms' hedging policies. Journal of Financial and Quantitative Analysis 20, 391–405.

Stoll, H.R., 1978. The Supply of Dealer Services in Securities Markets. Journal of Finance 33, 1133-1151

Subrahmanyam, A., Titman, S., 2001. Feedback from Stock Prices to Cash Flows. Journal of Finance 56, 2389-2413

Zwiebel, J., 1995. Corporate Conservatism and Relative Compensation. Journal of Political Economy 103, 1–25.

**Table 1: CEO compensation structure over time**

The table reports the mean and median values of total compensation (in $1,000), stock options as a percentage of total compensation (*%Options*), the value of restricted stocks as a percentage of total compensation (*%Rstocks*), and salary as a percentage of total compensation (*%Salary*) for the CEOs in the ExecuComp Database. The last column presents the total number of firms in each year.

| | Total Compensation | | %Options | | %Rstocks | | %Salary | | |
|---|---|---|---|---|---|---|---|---|---|
| Year | Mean | Median | Mean | Median | Mean | Median | Mean | Median | Nobs |
| 2000 | 5,130 | 2,671 | 40.91 | 41.57 | 4.70 | 0.00 | 29.71 | 22.65 | 796 |
| 2001 | 5,505 | 2,790 | 45.21 | 46.76 | 4.58 | 0.00 | 29.93 | 21.09 | 964 |
| 2002 | 4,902 | 2,785 | 40.90 | 42.84 | 5.57 | 0.00 | 29.47 | 22.53 | 985 |
| 2003 | 4,511 | 2,640 | 34.97 | 33.32 | 7.60 | 0.00 | 30.38 | 24.41 | 1,029 |
| 2004 | 5,161 | 3,329 | 33.51 | 32.63 | 10.36 | 0.00 | 27.03 | 20.61 | 1,060 |
| 2005 | 5,344 | 3,355 | 29.97 | 27.67 | 13.39 | 0.00 | 27.01 | 20.47 | 1,180 |
| 2006 | 5,397 | 3,463 | 22.29 | 17.38 | 18.88 | 8.09 | 27.39 | 20.83 | 1,106 |
| 2007 | 5,528 | 3,775 | 21.50 | 16.08 | 22.62 | 17.89 | 26.71 | 19.81 | 1,073 |
| 2008 | 5,568 | 3,839 | 22.10 | 17.71 | 26.22 | 24.35 | 27.35 | 20.69 | 1,016 |
| 2009 | 5,484 | 3,873 | 20.92 | 17.13 | 25.64 | 23.48 | 27.01 | 20.13 | 870 |
| 2010 | 6,406 | 4,802 | 19.12 | 15.53 | 26.86 | 25.78 | 22.16 | 17.12 | 834 |
| 2011 | 6,594 | 4,986 | 18.93 | 15.41 | 30.69 | 30.36 | 22.35 | 16.79 | 881 |
| 2012 | 6,562 | 5,032 | 16.77 | 12.96 | 33.72 | 34.93 | 21.67 | 16.68 | 835 |
| 2000-2012 | 5,511 | 3,571 | 28.37 | 24.02 | 17.42 | 0.00 | 26.91 | 19.85 | 12,629 |

**Table 2: Industry-factors in CEO option compensation**

The table reports results from OLS regressions of the fraction of options compensation, (*%Options*), on industry fixed effects (based on the Fama-French 49 industry groups). Reported are the ten largest fixed effects and their *t*-values (in parentheses). ***, **, and * indicate statistical significance at the 0.01, 0.05 and 0.10 level, respectively.

| | 2000 - 2012 | | 2000 - 2005 | | 2006 - 2012 | |
|---|---|---|---|---|---|---|
| Number of obs | 14,628 | | 7,092 | | 7,536 | |
| Adjusted R-squared | 0.5381 | | 0.6478 | | 0.4755 | |
| # of industries | 44 | | 44 | | 44 | |
| # of industries with (+) FEs | 44 | | 37 | | 41 | |
| # of industries with (-) FEs | 0 | | 7 | | 3 | |
| Top 10 Industries with the largest FEs | | | | | | |
| Pharmaceutical Products | 0.422*** | (32.14) | 0.318*** | (5.81) | 0.268*** | (16.43) |
| Medical Equipment | 0.392*** | (28.58) | 0.215*** | (3.83) | 0.328*** | (17.37) |
| Computer Software | 0.386*** | (38.34) | 0.266*** | (4.92) | 0.253*** | (19.53) |
| Business Services | 0.385*** | (19.60) | 0.295*** | (4.97) | 0.229*** | (10.78) |
| Electronic Equipment | 0.353*** | (22.97) | 0.204*** | (3.60) | 0.248*** | (12.70) |
| Printing and Publishing | 0.351*** | (16.08) | 0.151** | (2.51) | 0.277*** | (9.20) |
| Beer & Liquor | 0.345*** | (14.70) | 0.180*** | (2.86) | 0.257*** | (10.03) |
| Computer Hardware | 0.340*** | (30.26) | 0.228*** | (4.16) | 0.203*** | (14.68) |
| Healthcare | 0.310*** | (17.11) | 0.192*** | (3.27) | 0.198*** | (9.63) |
| Retail | 0.304*** | (21.02) | 0.119** | (2.12) | 0.232*** | (11.20) |

**Table 3: Summary statistics**

This table presents summary statistics for the full sample (first column) and for the 2000-2005- and 2006-2012-subsamples. *%Options* is the value of stock options as a percentage of total compensation. *HOPT* is an indicator variable equal to one for firms whose *%Options* was in the top 33 percent in 2005, and zero otherwise. *HLSPRD* is the high-low spread estimates computed using high-low price data from CRSP based on the methodology in Corwin and Schultz (2011). *RV* is Amihud (2002) liquidity measure, defined as 1,000,000 x absolute return / dollar trading volume. *RVT* is defined as absolute return / turnover, where turnover is share trading volume over the number of shares outstanding. *LM12* is a masure from Liu (2006), computed using the previous 12-months' data. *ZR* is the ratio of zero return days, defined as the number of days with zero return in a month over the number of trading days in the month. *PS* is (-1) x Pastor and Stambaugh (2003) liquidity measure. All six liquidity measures are the monthly averages over each fiscal year. A higher value indicates lower liquidity. *PC1* is the first principal component of the six liquidity variables. *Assets* is book value of assets in millions of US dollars. *M/B* is market value of equity over book value of equity. *Leverage* is long-term debt over total assets. *Assets, M/B,* and *Leverage* are taken from the previous fiscal year. *Momentum* is cumulative returns over the previous fiscal year. *Volatility* is the standard deviation of daily returns over the previous fiscal year. *Nasdaq* is an indicator variable that equals one for firms listed on Nasdaq, and zero otherwise. *SP500* is an indicator variable if the firm is a member of the S&P500 index, and zero otherwise. *Tobin's Q* is total assets less book value of equity plus market value of equity over total assets. *Industry-adj. return* is return in excess of the return on its corresponding Fama-French 49 industry portfolio. *Industry-adj. ROA* is Return-On-Assets (*ROA*) in excess of the industry-median *ROA* across all firms in the same Fama-French 49 industry, where *ROA* is defined as income before extraordinary items over total assets. *Guidance dummy* is an indicator variable that equals one if a firm provides any earnings guidance in the year, and zero otherwise. *# of Guidance* is the total number of earnings guidance offered by the firm in the year. *Analyst forecast error* is computed as the absolute difference between the average of analysts' earnings forecast and actual earnings divided by the absolute values of the actual earnings. *Analyst forecast disp.* is computed as the standard deviation of analysts' earnings forecast divided by the absolute values of the actual earnings. *Price delay* is the delay variable (D1) in Hou and Moskowitz (2005), averaged over the fiscal year. *%Inst. ownership* is percentage of shares owned by institutional investors. *# of Inst. owners* is the number of institutional investors. *Inst. own. Concentration* is Herfindahl-Hirschman Index, computed using institutional ownerships. Information on institutional ownership are taken from the 13F filings filed immediately before the end of the fiscal year. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

| | 2000-2012 | 2000 - 2005 | | | 2006 - 2012 | | | |
|---|---|---|---|---|---|---|---|---|
| | Full Sample | HOPT | Others | Difference | HOPT | Others | Difference | Diff-in-Diff |
| %Options | 0.284 | 0.529 | 0.275 | 0.253*** | 0.286 | 0.153 | 0.132*** | 0.121*** |
| HLSPRD | 0.118 | 0.087 | 0.098 | -0.010 | 0.149 | 0.134 | 0.015*** | -0.025*** |
| RV | 0.759 | 0.512 | 1.301 | -0.789*** | 0.361 | 0.651 | -0.29*** | -0.499*** |
| RVT | 0.324 | 0.319 | 0.495 | -0.176*** | 0.196 | 0.249 | -0.053*** | -0.123*** |
| LM12 | 0.875 | 0.834 | 1.253 | -0.419*** | 0.616 | 0.711 | -0.095*** | -0.324*** |
| ZR | 0.149 | 0.156 | 0.217 | -0.062*** | 0.108 | 0.109 | -0.001 | -0.061*** |
| PS | 1.352 | 1.331 | 2.222 | -0.891** | 0.421 | 1.150 | -0.729*** | -0.162 |
| PC1 | -0.077 | 0.360 | 0.555 | -0.195*** | -0.474 | -0.652 | 0.179*** | -0.373*** |
| Assets | 6236.331 | 4498.089 | 5356.189 | -858.1*** | 6392.976 | 7918.377 | -1525.401*** | 667.301 |
| M/B | 3.306 | 4.316 | 3.091 | 1.225*** | 3.439 | 2.855 | 0.584*** | 0.641*** |
| Momentum | 0.142 | 0.228 | 0.173 | 0.055*** | 0.080 | 0.103 | -0.023** | 0.078*** |
| Volatility | 0.028 | 0.032 | 0.028 | 0.004*** | 0.024 | 0.026 | -0.001*** | 0.005*** |
| Leverage | 0.174 | 0.156 | 0.193 | -0.037*** | 0.152 | 0.181 | -0.029*** | -0.008 |
| Nasdaq | 0.348 | 0.473 | 0.257 | 0.216*** | 0.475 | 0.284 | 0.192*** | 0.025 |
| SP500 | 0.307 | 0.326 | 0.257 | 0.069*** | 0.373 | 0.300 | 0.073*** | -0.004 |
| Tobin's Q | 1.931 | 2.468 | 1.829 | 0.639*** | 1.983 | 1.690 | 0.294*** | 0.345*** |
| Industry-adj. return | 0.039 | 0.105 | 0.077 | 0.028*** | -0.007 | -0.003 | -0.004 | 0.032** |
| Industry-adj. ROA | 0.019 | 0.047 | 0.019 | 0.028*** | 0.018 | 0.003 | 0.014*** | 0.014*** |
| Guidance | 0.647 | 0.715 | 0.664 | 0.051*** | 0.689 | 0.559 | 0.13*** | -0.08*** |
| # of Guidance | 3.559 | 3.810 | 3.439 | 0.371*** | 4.100 | 3.186 | 0.914*** | -0.543*** |
| Price delay | 0.105 | 0.091 | 0.113 | -0.021*** | 0.085 | 0.118 | -0.033*** | 0.011 |
| Analyst forecast error | 0.042 | 0.039 | 0.043 | -0.004 | 0.038 | 0.047 | -0.009*** | 0.005 |
| Analyst forecast disp. | 0.256 | 0.303 | 0.345 | -0.042*** | 0.204 | 0.179 | 0.025*** | -0.067*** |
| %Inst. ownership | 0.783 | 0.754 | 0.709 | 0.045*** | 0.853 | 0.813 | 0.041*** | 0.004 |
| # of Inst. Owners | 257.192 | 250.074 | 208.126 | 41.948*** | 304.258 | 270.933 | 33.324*** | 8.624 |
| Inst. own. concentration | 0.049 | 0.047 | 0.055 | -0.009*** | 0.045 | 0.047 | -0.002*** | -0.006*** |

**Table 4: The effect of option compensation on stock liquidity**

The table reports the coefficient estimates and *t*-statistics from stock-level OLS regressions of liquidity measures. *HLSPRD*, the high-low spread estimates computed using high-low price data from CRSP based on the methodology in Corwin and Schultz (2011); *RV*, Amihud (2002) liquidity measure, defined as 1,000,000 x absolute return / dollar trading volume; *RVT*, defined as absolute return / turnover, where turnover is share trading volume over the number of shares outstanding; *LM12* is a turnover-adjusted zero return measure of liquidity from Liu (2006), computed using the previous 12-months' data; *ZR*, the ratio of zero return days, defined as the number of days with zero return in a month over the number of trading days in the month; *PS*, which is (-1) x Pastor and Stambaugh (2003) liquidity measure; and *PC1*, the first principal component of these six liquidity variables. The independent variables are: *HOPT* equals to one for firms whose value of stock options as a percentage of total compensation was in the top 33 percent in 2005, and zero otherwise; *Event* is an indicator variable that equals to one for years 2006 and on, and zero otherwise; *Assets* is total assets; *M/B* is market value of equity over book value of equity; *Momentum* is cumulative returns over the previous fiscal year; *Volatility* is the standard deviation of daily returns over the previous fiscal year; *Nasdaq* is an indicator variable that equals one for firms listed on Nasdaq, and zero otherwise; *SP500* is an indicator variable if the firm is a member of the S&P500 index, and zero otherwise; and *Crisis* is an indicator variable for year 2008. Standard errors are adjusted for clustering at the firm-level. The last two rows report the number of observations and adjusted R-squared in each regression. $^{***}$, $^{**}$, and $^{*}$ indicate statistical significance at the 0.01, 0.05 and 0.10 level, respectively.

| | HLSPRD | RV | RVT | LM12 | ZR | PS | PC1 |
|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| (HOPT) x (Event) | 0.020* | 0.464*** | 0.088*** | 0.200*** | 0.051*** | 0.078 | 0.261*** |
| | (1.65) | (6.28) | (7.10) | (7.10) | (8.45) | (0.18) | (4.80) |
| HOPT | -0.041*** | -0.695*** | -0.127*** | -0.270*** | -0.047*** | -0.611* | -0.116*** |
| | (-3.68) | (-8.81) | (-8.87) | (-8.30) | (-8.69) | (-1.74) | (-3.36) |
| Event | 0.025*** | -0.326*** | -0.008 | -0.444*** | -0.036*** | -0.741** | 0.219*** |
| | (3.00) | (-5.21) | (-0.84) | (-21.03) | (-9.53) | (-2.18) | (6.22) |
| Market illiquidity | 0.417*** | 2.843*** | 0.933*** | 0.000*** | 1.555*** | 0.287 | 0.867*** |
| | (7.71) | (5.14) | (29.27) | (7.44) | (32.10) | (0.60) | (52.01) |
| Ln(Assets) | -0.021*** | -0.596*** | -0.077*** | -0.117*** | -0.020*** | -0.917*** | -0.061*** |
| | (-5.96) | (-14.27) | (-12.97) | (-8.29) | (-10.32) | (-6.32) | (-7.75) |
| M/B | -0.006*** | -0.079*** | -0.013*** | -0.015*** | -0.007*** | -0.160*** | -0.024*** |
| | (-5.44) | (-9.13) | (-9.44) | (-4.54) | (-12.14) | (-5.10) | (-7.26) |
| Momentum | -0.091*** | -0.582*** | -0.087*** | -0.194*** | -0.069*** | -0.889*** | -0.450*** |
| | (-16.27) | (-13.99) | (-16.37) | (-17.35) | (-24.08) | (-3.49) | (-23.29) |
| Volatility | 0.188 | 13.724*** | -0.769** | -13.921*** | 0.382*** | 26.352* | -5.122*** |
| | (0.61) | (6.18) | (-2.20) | (-18.37) | (2.81) | (1.92) | (-4.71) |
| Nasdaq | 0.159*** | -0.110 | -0.044*** | -0.169*** | -0.019*** | -0.834** | 0.088*** |
| | (16.81) | (-1.13) | (-3.23) | (-5.58) | (-4.06) | (-2.47) | (4.40) |
| SP500 | 0.011 | 0.406*** | 0.034*** | 0.089*** | -0.007 | 0.455** | 0.235*** |
| | (1.26) | (5.60) | (2.59) | (2.75) | (-1.38) | (2.09) | (12.18) |
| Crisis | 0.066*** | 0.432*** | 0.011* | -0.228*** | 0.018*** | 1.030** | -0.021 |
| | (7.56) | (6.39) | (1.68) | (-19.55) | (5.14) | (2.09) | (-0.92) |
| Constant | 0.125*** | 4.742*** | 0.636*** | 2.241*** | 0.138*** | 7.665*** | 0.774*** |
| | (3.95) | (13.91) | (13.12) | (18.75) | (7.70) | (6.11) | (10.40) |
| Industry FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Observations | 12,629 | 12,629 | 12,629 | 12,629 | 12,629 | 12,629 | 12,629 |
| Adjusted R-squared | 0.192 | 0.231 | 0.372 | 0.304 | 0.339 | 0.017 | 0.478 |

**Table 5: Firm value and performance**

The table reports the coefficient estimates and *t*-statistics from individual-level OLS regressions of *Tobin's Q*, total assets less book value of equity plus market value of equity over total assets; *Industry-adj. return*, return in excess of the return on its corresponding Fama-French 49 industry portfolio; *Industry-adj. ROA*, Return-On-Assets (*ROA*) in excess of the industry-median *ROA* across all firms in the same Fama-French 49 industry, where *ROA* is income before extraordinary items over total assets. The independent variables are: *HOPT* equals to one for firms whose value of stock options as a percentage of total compensation was in the top 33 percent in 2005, and zero otherwise; *Event* is an indicator variable that equals to one for years 2006 and on, and zero otherwise; *Assets* is total assets; *M/B* is market value of equity over book value of equity; *Leverage* is long-term debt over total assets; *Momentum* is cumulative returns over the previous fiscal year; *Volatility* is the standard deviation of daily reurns over the previous fiscal year; *Nasdaq* is an indicator variable that equals one for firms listed on Nasdaq, and zero otherwise; *SP500* is an indicator variable if the firm is a member of the S&P500 index, and zero otherwise; and *Crisis* is an indicator variable for year 2008. Standard errors are adjusted for clustering at the firm-level. The last two rows report the number of observations and adjusted R-squared in each regression. ***, **, and * indicate statistical significance at the 0.01, 0.05 and 0.10 level, respectively.

| | Tobin's Q | Industry-adj. return | Industry-adj. ROA |
|---|---|---|---|
| | (1) | (2) | (3) |
| (HOPT) x (Event) | -0.231*** | -0.030** | -0.012** |
| | (-6.44) | (-2.45) | (-2.51) |
| HOPT | 0.247*** | 0.026** | 0.012*** |
| | (6.21) | (2.57) | (2.92) |
| Event | -0.028 | -0.066*** | -0.018*** |
| | (-1.38) | (-8.13) | (-6.47) |
| Ln(Assets) | -0.135*** | -0.035*** | -0.005*** |
| | (-9.40) | (-10.51) | (-3.30) |
| M/B | 0.183*** | -0.010*** | 0.009*** |
| | (24.73) | (-8.67) | (13.87) |
| Leverage | -1.669*** | 0.081*** | -0.108*** |
| | (-17.54) | (3.18) | (-10.65) |
| Volatility | -6.089*** | 1.476*** | -1.099*** |
| | (-7.00) | (4.04) | (-7.35) |
| Nasdaq | 0.126*** | -0.026*** | -0.007** |
| | (3.46) | (-3.06) | (-2.04) |
| SP500 | 0.472*** | 0.121*** | 0.027*** |
| | (10.65) | (13.53) | (6.77) |
| Crisis | -0.444*** | -0.001 | 0.006 |
| | (-20.63) | (-0.14) | (1.37) |
| Constant | 2.616*** | 0.153** | 0.075*** |
| | (21.46) | (2.45) | (2.78) |
| Industry FE | Yes | Yes | Yes |
| Observations | 12,573 | 12,567 | 12,577 |
| Adjusted R-squared | 0.542 | 0.040 | 0.172 |

**Table 6: Information environment**

The table reports the coefficient estimates and *t*-statistics from individual-level regressions of *Prob(Guidance)*, the probability of issuing earnings guidance in the year; *Ln(# of Guidance)*, the natural logarithm of total number of guidance issued in the year; *Analyst forecast error*, computed as the absolute difference between the average of analysts' earnings forecast and actual earnings divided by the absolute values of the actual earnings; *Analyst forecast disp.*, computed as the standard deviation of analysts' earnings forecast divided by the absolute values of the actual earnings; *Price delay*, the delay variable (D1) in Hou and Moskowitz (2005), averaged over the fiscal. In column (1), we report marginal effects from a probit model that estimates the probability of issuing guidance. In columns (2) to (5), we report regression coefficients and associated p-values calculated using standard errors adjusted for firm-level clustering. The independent variables are: *HOPT* equals to one for firms whose value of stock options as a percentage of total compensation was in the top 33 percent in 2005, and zero otherwise; *Event* is an indicator variable that equals to one for years 2006 and on, and zero otherwise; *Assets* is total assets; *M/B* is market value of equity over book value of equity; *Leverage* is long-term debt over total assets; *Momentum* is cumulative returns over the previous fiscal year; *Volatility* is the standard deviation of daily reurns over the previous fiscal year; *Nasdaq* is an indicator variable that equals one for firms listed on Nasdaq, and zero otherwise; *SP500* is an indicator variable if the firm is a member of the S&P500 index, and zero otherwise; and *Crisis* is an indicator variable for year 2008. The last two rows report the number of observations and adjusted R-squared in each regression (pseudo R-squared in column 1). $^{***}$, $^{**}$, and $^{*}$ indicate statistical significance at the 0.01, 0.05 and 0.10 level, respectively.

| | Prob (Guidance) (1) | Ln (# of Guidance) (2) | Analyst forecast error (3) | Analyst forecast disp. (4) | Price Delay (5) |
|---|---|---|---|---|---|
| (HOPT) x (Event) | 0.198*** | 0.123*** | -0.005 | -0.001 | 0.061*** |
| | (0.003) | (2.76) | (-0.41) | (-0.14) | (6.66) |
| HOPT | 0.047 | 0.048 | -0.010 | -0.001 | -0.037*** |
| | (0.690) | (1.06) | (-1.05) | (-0.19) | (-5.08) |
| Event | -0.367*** | -0.176*** | 0.012 | 0.006** | -0.157*** |
| | (0.000) | (-6.44) | (1.46) | (2.03) | (-27.32) |
| Ln(Assets) | 0.101*** | 0.088*** | -0.019*** | 0.001 | -0.036*** |
| | (0.000) | (4.70) | (-5.30) | (0.66) | (-14.40) |
| M/B | -0.004 | 0.001 | -0.008*** | -0.002*** | -0.001** |
| | (0.589) | (0.25) | (-8.31) | (-6.45) | (-2.01) |
| Leverage | -0.040 | -0.086 | 0.144*** | 0.068*** | 0.113*** |
| | (0.826) | (-0.71) | (5.18) | (6.03) | (5.97) |
| Volatility | -4.696*** | -6.244*** | 2.463*** | 1.418*** | -0.251 |
| | (0.003) | (-6.06) | (7.92) | (12.82) | (-1.26) |
| Nasdaq | -0.036 | -0.034 | 0.002 | 0.007* | -0.005 |
| | (0.602) | (-0.70) | (0.26) | (1.87) | (-0.88) |
| SP500 | 0.134 | 0.088 | -0.027*** | -0.016*** | 0.026*** |
| | (0.111) | (1.55) | (-3.41) | (-4.78) | (3.86) |
| Crisis | 0.013 | 0.083*** | 0.070*** | 0.017*** | 0.054*** |
| | (0.623) | (4.94) | (6.17) | (5.21) | (8.89) |
| Constant | | 0.610*** | 0.349*** | 0.022* | 0.584*** |
| | | (4.15) | (5.07) | (1.85) | (28.02) |
| Industry FE | Yes | Yes | Yes | Yes | Yes |
| Observations | 11,744 | 11,744 | 10,909 | 9,818 | 12,578 |
| Pseudo/Adj. R-squared | 0.094 | 0.150 | 0.061 | 0.093 | 0.170 |

**Table 7: Ownership structure and trading activities**

The table reports the coefficient estimates and *t*-statistics from individual-level OLS regressions of *%Inst. ownership*, the percentage of shares owned by institutional investors; Ln(1+*# of Inst. owners*), where *# of Inst. owners* is the number of institutional investors a firm has; *Inst. own. Concentration*, Herfindahl-Hirschman Index computed using institutional ownerships; Ln(*Avg. turnover*), the natural logarithm of the average monthly turnover in a fiscal year, where turnover is defined as the sum of daily trading volume in a month divided by the number of shares outstanding at the end of the month; Ln(Volume), the natural logarithm of the sum of a stock's daily trading volume over the fiscal year. The independent variables are: *HOPT* equals to one for firms whose value of stock options as a percentage of total compensation was in the top 33 percent in 2005, and zero otherwise; *Event* is an indicator variable that equals to one for years 2006 and on, and zero otherwise; *Assets* is total assets; *M/B* is market value of equity over book value of equity; *Leverage* is long-term debt over total assets; *Momentum* is cumulative returns over the previous fiscal year; *Volatility* is the standard deviation of daily reurns over the previous fiscal year; *Nasdaq* is an indicator variable that equals one for firms listed on Nasdaq, and zero otherwise; *SP500* is an indicator variable if the firm is a member of the S&P500 index, and zero otherwise; and *Crisis* is an indicator variable for year 2008. Standard errors are adjusted for clustering at the firm-level. The last two rows report the number of observations and adjusted R-squared in each regression. ***, **, and * indicate statistical significance at the 0.01, 0.05 and 0.10 level, respectively.

| | %Inst. ownership (1) | Ln (1+# of Inst. owners) (2) | Inst. own. concentration (3) | Ln(Avg. turnover) (4) | Ln(Volume) (5) |
|---|---|---|---|---|---|
| (HOPT) x (Event) | -0.019** | -0.055*** | 0.006*** | -0.171*** | -0.192*** |
| | (-2.52) | (-4.09) | (4.89) | (-6.35) | (-6.83) |
| HOPT | 0.062*** | 0.106*** | -0.006*** | 0.253*** | 0.263*** |
| | (6.11) | (7.10) | (-4.30) | (8.16) | (8.23) |
| Event | 0.109*** | 0.064*** | -0.005*** | 0.466*** | 0.444*** |
| | (21.24) | (7.00) | (-5.76) | (25.98) | (23.97) |
| Ln(Assets) | -0.008* | 0.370*** | -0.006*** | 0.070*** | 0.062*** |
| | (-1.93) | (54.70) | (-9.06) | (5.33) | (4.67) |
| M/B | -0.001 | 0.042*** | -0.001*** | 0.024*** | 0.028*** |
| | (-1.30) | (18.33) | (-4.09) | (7.53) | (8.24) |
| Leverage | 0.128*** | -0.753*** | 0.015*** | 0.186** | 0.193** |
| | (5.16) | (-19.10) | (4.23) | (2.36) | (2.39) |
| Volatility | -2.033*** | -3.199*** | 0.124*** | 17.114*** | 17.196*** |
| | (-9.24) | (-8.76) | (3.90) | (25.67) | (24.85) |
| Nasdaq | 0.016 | 0.047*** | -0.003** | 0.218*** | 0.220*** |
| | (1.55) | (3.03) | (-2.10) | (7.16) | (7.09) |
| SP500 | -0.035*** | 0.219*** | 0.001 | -0.088*** | -0.075** |
| | (-3.16) | (11.50) | (0.63) | (-2.62) | (-2.16) |
| Crisis | -0.015*** | -0.099*** | 0.005*** | 0.339*** | 0.329*** |
| | (-3.96) | (-13.82) | (7.09) | (31.65) | (28.33) |
| Constant | 0.731*** | 2.424*** | 0.092*** | 3.920*** | 6.505*** |
| | (7.48) | (43.21) | (15.97) | (39.13) | (63.21) |
| Industry FE | Yes | Yes | Yes | Yes | Yes |
| Observations | 11,140 | 11,145 | 11,145 | 12,578 | 12,578 |
| Adjusted R-squared | 0.196 | 0.858 | 0.153 | 0.366 | 0.345 |

**Table 8: The effect of option compensation on systematic risk**

The table reports the coefficient estimates and *t*-statistics from individual-level OLS regressions of *HLSPRD*, the high-low spread estimates computed using high-low price data from CRSP based on the methodology in Corwin and Schultz (2011); *RV*, Amihud (2002) liquidity measure, defined as 1,000,000 x absolute return / dollar trading volume; *RVT*, defined as absolute return / turnover, where turnover is share trading volume over the number of shares outstanding; *LM12* is a turnover-adjusted zero return measure of liquidity from Liu (2006), computed using the previous 12-months' data; *ZR*, the ratio of zero return days, defined as the number of days with zero return in a month over the number of trading days in the month; *PS*, which is (-1) x Pastor and Stambaugh (2003) liquidity measure; and *PC1*, the first principal component of these six liquidity variables, on the independent variables from Table 4. *HOPT* equals to one for firms whose fraction of options compensation was in the top 33 percent, and zero otherwise. In Panel A, we use only firms that are not listed on Nasdaq. In Panel B, we use only Nasdaq listed firms. Standard errors are adjusted for clustering at the firm-level. The last two rows report the number of observations and adjusted R-squared in each regression. ***, **, and * indicate statistical significance at the 0.01, 0.05 and 0.10 level, respectively.

**Panel A: Non-Nasdaq firms**

| | HLSPRD | RV | RVT | LM12 | ZR | PS | PC1 |
|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| (HOPT) x (Event) | 0.015 | 0.421*** | 0.064*** | 0.144*** | 0.040*** | 0.374 | 0.051 |
| | (1.17) | (5.38) | (4.29) | (4.01) | (5.01) | (0.83) | (0.87) |
| HOPT | -0.033*** | -0.563*** | -0.090*** | -0.207*** | -0.044*** | -0.286 | 0.001 |
| | (-2.76) | (-7.14) | (-5.22) | (-4.65) | (-6.38) | (-0.74) | (0.02) |
| Event | 0.064*** | -0.411*** | -0.009 | -0.503*** | -0.038*** | -0.983*** | 0.209*** |
| | (7.43) | (-6.56) | (-0.89) | (-19.97) | (-8.32) | (-2.65) | (5.48) |
| Other controls | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Industry FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Observations | 8,228 | 8,228 | 8,228 | 8,228 | 8,228 | 8,228 | 8,228 |
| Adjusted R-squared | 0.108 | 0.227 | 0.414 | 0.325 | 0.398 | 0.018 | 0.608 |

**Panel B: Nasdaq firms**

| | HLSPRD | RV | RVT | LM12 | ZR | PS | PC1 |
|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| (HOPT) x (Event) | 0.071*** | 0.492*** | 0.100*** | 0.168*** | 0.049*** | -0.595 | 0.275*** |
| | (3.25) | (3.16) | (4.31) | (4.21) | (5.19) | (-0.64) | (2.97) |
| HOPT | -0.076*** | -0.827*** | -0.161*** | -0.292*** | -0.040*** | -0.799 | -0.118** |
| | (-3.66) | (-5.29) | (-6.35) | (-6.40) | (-4.57) | (-1.12) | (-2.00) |
| Event | -0.090*** | -0.160 | 0.004 | -0.245*** | -0.028*** | -0.318 | 0.292*** |
| | (-5.16) | (-1.05) | (0.22) | (-6.44) | (-3.85) | (-0.40) | (4.13) |
| Other controls | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Industry FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Observations | 4,401 | 4,401 | 4,401 | 4,401 | 4,401 | 4,401 | 4,401 |
| Adjusted R-squared | 0.170 | 0.267 | 0.345 | 0.268 | 0.261 | 0.027 | 0.250 |

**Table 9: The effect of option compensation on firm risk: Robustness tests**

The table reports the coefficient estimates and *t*-statistics from individual-level OLS regressions of *HLSPRD*, the high-low spread estimates computed using high-low price data from CRSP based on the methodology in Corwin and Schultz (2011); *RV*, Amihud (2002) liquidity measure, defined as 1,000,000 x absolute return / dollar trading volume; *RVT*, defined as absolute return / turnover, where turnover is share trading volume over the number of shares outstanding; *LM12* is a turnover-adjusted zero return measure of liquidity from Liu (2006), computed using the previous 12-months' data; *ZR*, the ratio of zero return days, defined as the number of days with zero return in a month over the number of trading days in the month; *PS*, which is (-1) x Pastor and Stambaugh (2003) liquidity measure; and *PC1*, the first principal component of these six liquidity variables, on the independent variables from Table 4. *HOPT* equals to one for firms whose fraction of options compensation was in the top 33 percent, and zero otherwise. In Panel A, we rank firms using their fraction of option compensation in 2005 *within* each one of the Fama-French 49 industries. In Panel B, we rank firms using their fraction of option compensation in 2003. *Event* is an indicator variable that equals to one for years 2006 and on, and zero otherwise. Standard errors are adjusted for clustering at the firm-level. The last two rows report the number of observations and adjusted R-squared in each regression. ***, **, and * indicate statistical significance at the 0.01, 0.05 and 0.10 level, respectively.

**Panel A: Ranking firms based on option compensation within industries**

| | HLSPRD | RV | RVT | LM12 | ZR | PS | PC1 |
|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| (HOPT) x (Event) | 0.007 | 0.369*** | 0.064*** | 0.121*** | 0.033*** | 0.203 | 0.113** |
| | (0.56) | (4.93) | (4.97) | (4.09) | (5.24) | (0.46) | (1.98) |
| HOPT | -0.027** | -0.572*** | -0.106*** | -0.218*** | -0.035*** | -0.490 | -0.042 |
| | (-2.45) | (-7.38) | (-7.65) | (-6.86) | (-6.42) | (-1.35) | (-1.15) |
| Event | 0.030*** | -0.274*** | 0.007 | -0.406*** | -0.027*** | -0.780** | 0.287*** |
| | (3.81) | (-4.72) | (0.84) | (-20.51) | (-7.65) | (-2.50) | (8.45) |
| Other controls | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Industry FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Observations | 12,629 | 12,629 | 12,629 | 12,629 | 12,629 | 12,629 | 12,629 |
| Adjusted R-squared | 0.191 | 0.227 | 0.368 | 0.300 | 0.335 | 0.016 | 0.476 |

**Panel B: Ranking firms based on option compensation in 2003**

| | HLSPRD | RV | RVT | LM12 | ZR | PS | PC1 |
|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| (HOPT) x (Event) | 0.021* | 0.555*** | 0.096*** | 0.240*** | 0.060*** | 1.170** | 0.230*** |
| | (1.70) | (6.39) | (7.13) | (8.32) | (9.73) | (2.52) | (4.08) |
| HOPT | -0.039*** | -0.698*** | -0.118*** | -0.277*** | -0.047*** | -0.769** | -0.090*** |
| | (-3.41) | (-7.62) | (-7.97) | (-8.64) | (-8.75) | (-2.14) | (-2.63) |
| Event | 0.024*** | -0.347*** | -0.007 | -0.464*** | -0.037*** | -1.158*** | 0.245*** |
| | (2.96) | (-5.16) | (-0.70) | (-21.03) | (-9.72) | (-3.28) | (7.20) |
| Other controls | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Industry FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Observations | 12,389 | 12,389 | 12,389 | 12,389 | 12,389 | 12,389 | 12,389 |
| Adjusted R-squared | 0.191 | 0.221 | 0.360 | 0.290 | 0.353 | 0.016 | 0.487 |

**Figure 1a: 2005 High-option group vs. Others**

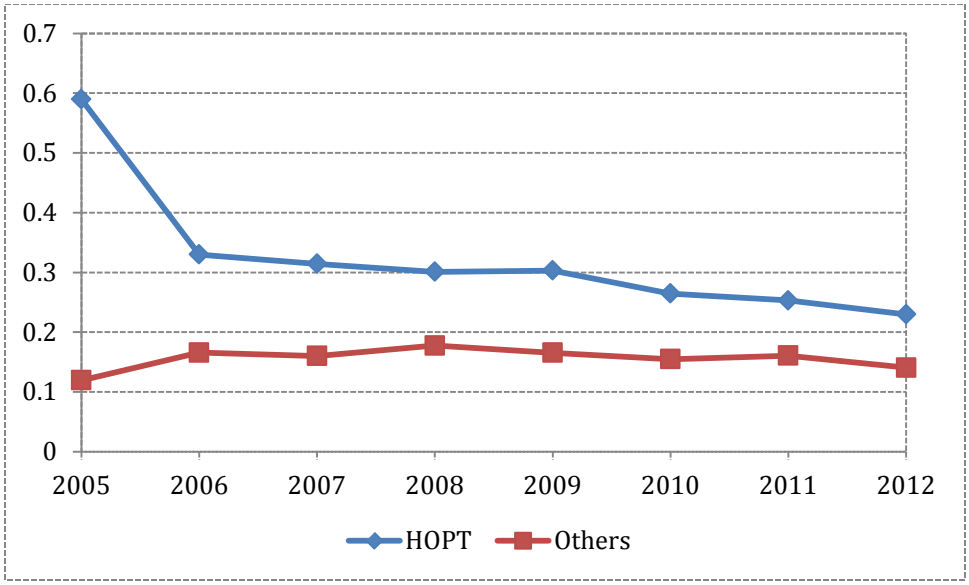


**Figure 1b: 2003 High-option group vs. Others**

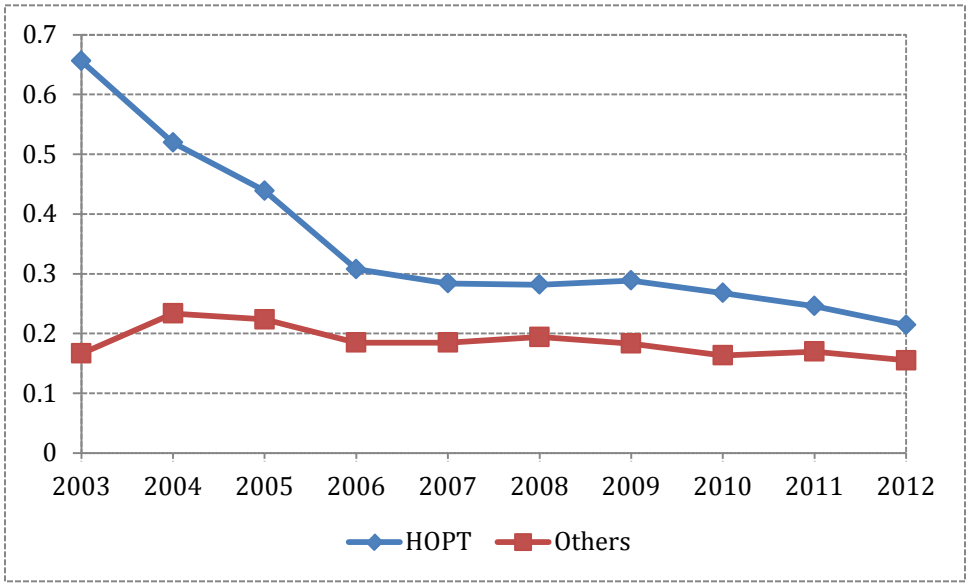


**Figure 1: Fractions of executive options among high-option stocks and the rest**

The figure plots the average values of *%Options* over time for the *HOPT* group and others. In Figure 1a, *HOPT* equals one for firms whose *%Options* was in the top 33 percent in 2005, and zero otherwise. In Figure 1b, *HOPT* equals one for firms whose *%Options* was in the top 33 percent in 2003, and zero otherwise. *%Options* is the value of stock options as a percentage of total compensation.

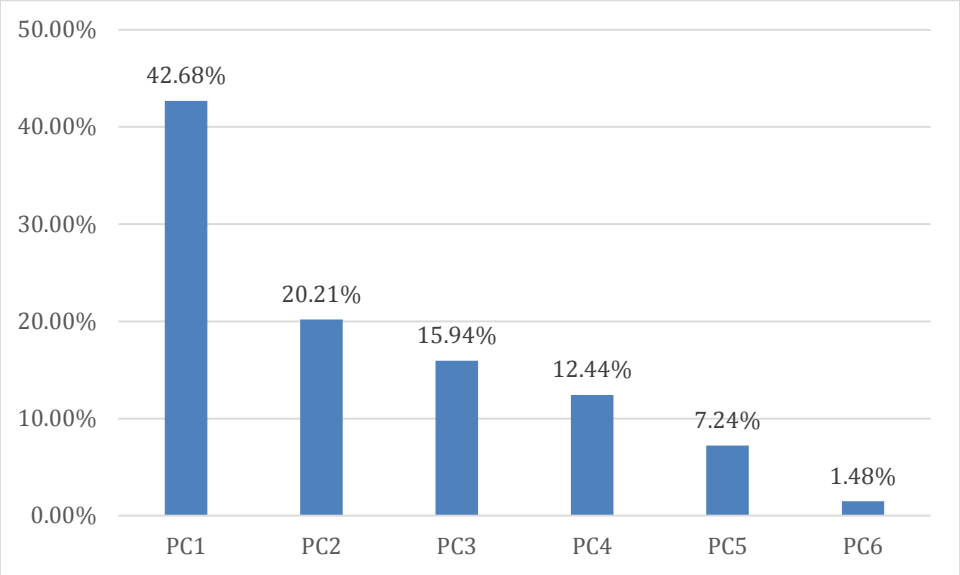


**Figure 2: Eigenvalue proportion of principal components**

We compute the six principal components each month based on the six monthly illiquidity measures for each firm. The figure shows the plot of the eigenvalue proportion, averaged across sample firms, of the six principal components.