Stock liquidity and CEO equity-based incentive compensation: Feedback effect of CEO on the market

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Abstract

This paper examines the direction of causal relationship between CEO pay-for-performance sensitivity (delta) and stock liquidity. I find that the causal relationship from delta to stock liquidity and from stock liquidity to delta is bi-directional. Jayaraman and Milbourn (2012) document that as stock liquidity goes up, CEO's delta increases. Therefore, this study focuses on feedback effects of CEO's delta on influencing stock liquidity. The empirical evidence shows that stock liquidity is increasing in CEO's delta. Finally, I conclude that risk averse CEOs reduce their undiversified risk to the firm as a consequence of higher equity-based incentive compensations by influencing stock liquidity.

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I. Introduction

Recently, Jayaraman and Milbourn (2012) examine stock liquidity effects on CEO's (herein referred to as either CEO or manager) pay-for-performance sensitivity(delta). They document a positive correlation between delta and stock liquidity. Jayaraman and Milbourn (2012) mention that stock liquidity affects CEO's delta. They make this hypothesis based on the assumption that as stock liquidity increases, the reduced trading costs encourage informed traders to impound more information about managers' actions in the stock price (Chordia et al. 2008). Furthermore, managers of firms with greater liquidity will value the liquidity, and this greater stock liquidity increases their preferences for stock-based compensations relative to cash-based compensations. This would imply relatively lower cash-based compensations and higher stock-based compensations in greater liquidity firms. It is now well recognized that stock liquidity is crucial for determining managers' compensation structure (e.g., Jayaraman and Milbourn, 2012; Lin et al., 2013). However, researchers have not yet examined a potential causal relationship from CEO's delta to stock liquidity. Therefore, this is my focus in this paper. The main hypothesis of this paper, motivated by Amihud and Mendelson(2000), is that risk averse managers have feedback effects on stock liquidity to mitigate their undiversified risk of higher equity-based incentive compensations. I expect managers with high delta positions to mitigate some of the their equity incentive effects by increasing investor base and disclosing more information to the public.

I suggest and provide evidence for the other direction of the causal relationship that managers with higher delta position tend to improve stock liquidity, which was not considered by Jayaraman and Milbourn (2012) and Lin et al. (2013). That is, as acceptance of the higher equity-based incentive compensations, risk averse managers tend to mitigate some of their undiversified risk of higher equity-based incentive compensations by influencing firms' policies. I hypothesize that managers with higher delta prone to offset the risk of equity-based incentive compensations by increasing liquidity of the firms. Amihud and Mendelson (2000) suggest that most of the factors that affect stock liquidity are driven by outsiders, such as investors, brokers, dealers etc. rather than the issuing company itself. However, managers still have enough impact on their own firms' stock liquidity. They can improve their firms' stock liquidity by increasing investor base and disclosing more information to the public. I expect managers to affect firms' stock splits decisions to increase investor base. Similarly, I expect managers disclosure more information to the public by attracting more analysts coverage firms.

Consistent with Jayaraman and Milbourn (2012), I adopt the fact that managers in firms with greater stock liquidity will get higher equity-based incentive compensations. Further, I plan on test whether managers with higher delta position tend to improve stock liquidity. Consistent with Jayaraman and Milbourn(2012) and Lin et al.(2013), I reconfirm that delta and stock liquidity are positively related. Furthermore, managers with higher equity-based incentive compensations can also improve their firms' stock liquidity by increasing the investor base and disclosing more information to the public. Consistent with my hypothesis, I find that the causal relationship from delta to stock liquidity and from stock liquidity to delta is bi-directional. This

relationship is robust after controlling the endogeneity using a two-stage-least squares regression.

The rest of the paper is organized as follows. I provide recent literatures of CEO delta, stock splits, and analyst coverage in the next section. Section III develops my hypotheses, describes my sample selection and research methodology. Section IV focuses on results presentation. I make a conclusion in Section V.

II. Related literature

A. CEO delta

Equity-based incentive compensation now accounts for a very significant portion of total CEO compensation. Bergstresser and Philippon (2006) document that average CEO equity-based incentive compensation increased six times from 1980 to 2000. Equity-based incentive compensation is an appropriate and significant resource to solve the agency problem by linking compensations of managers with benefits of shareholders and bondholders. However, increased equity-based incentive compensations also create problems. First, some recent literature argues that, with increased equity incentive compensations, managers are more likely to affect earnings management and the share price (e.g. Bartov and Mohanram, 2004, Bolliger et al., 2013). Second, Coles et al. (2006) finds that managers with higher equity-based incentive compensations will tend to reduce their firms' number of risky investments because the managers have a relatively higher ratio of wealth in their own companies than market investors. Based on their special positions, managers cannot diversify their investment in the company as easily as other shareholders can. These results will affect managers' behaviors. Furthermore, managers may appropriately mitigate their incentive compensations by affecting

board decisions. Similar to Garvey (1997), Jayaraman and Milbourn (2012) investigate the relationship between stock liquidity and equity-based incentive compensation. Jayaraman and Milbourn(2012) document positive relationship between stock liquidity and equity-based incentive compensation. They hypothesize that the positive relationship is consistent with managers' valuation of liquidity and price informativeness about managers' actions(Chordia et al. 2008). Consistent with Jayaraman and Milbourn (2012), Lin et al. (2013) document that as firms' relative stock liquidity increases, compared with market and industry liquidity, managers' equity-based incentive compensations go up. Lin et al. (2013) overall conclusion is that stock liquidity is the cause of change in managers' equity-based incentive compensations. However, I propose another hypothesis of the other direction of causal relationship which earlier researchers do not explore and explain. I make the prediction that managers' acceptance of stock-based incentive compensations will have an impact on stock liquidity. Amihud and Mendelson (2000) suggest that outsiders, rather than issuing companies, affect stock liquidity. However, managers can impact stock liquidity by increasing the investor base and providing more information to the public. Benston and Hagerman (1974) observe that, as investor base increase, stocks' bid-ask spread will decrease. They explain the increase in liquidity by the increase in the small-investor base. Managers can easily affect their own firms' liquidity by influencing stock split decisions. Second, Amihud and Mendelson (2000) argue another way that firms improve stock liquidity is by attracting more financial analyst reports about the firm. I will explain those two methods of improving stock liquidity in the next two sections.

B. Stock Splits:

Several recent researchers have explored the stock splits' effect on stock liquidity. As stock splits have the ability to restore stock price and tick size to an optimal range, the splits will lead to a broader investor base by attracting investors. Most studies find that stock splits are associated with an increase in stock liquidity due to the addition of new investors and the rebalancing by existing investors (e.g., Baker and Gallagher 1980; Maloney and Mulherin 1992; Lin et al. 2009). Lin et al. (2009) provide the evidence that stock splits contribute to decreasing the trading cost and reducing the order size which drive liquidity improvements during post-split period. Consistent with those earlier results, Jayaraman and Milbourn (2012) find that stock splits increase stock liquidity without any associated change in firms' underlying fundamentals by event study method. Further, they document that stock splits are associated with a significant increase in CEO equity-based incentive compensation. Existing literature argues that managers have great influence on her firm's decisions by her CEO power(e.g. Finkelstein,1992; Adams et al. 2005). If I assume that firms are on their own control, I explore feedback effects of managers with higher equity-based incentive compensations on stock liquidity by stock split decisions.

C. Analyst coverage

Financial analysts now account for a key group of information intermediaries in the stock market. Their effects on security valuation and investors' decision making attract much of the recent attention of financial researchers. Smaller investors can benefit from their reports by reducing information asymmetry. Analyst coverage also provides liquidity in the stock market. Further, analysts also affect manager's behaviors by monitoring managers' decisions. As a major source of outside monitoring, they help to save firms' costs by eliminating the agency problem.

Amihud and Mendelson (2000) identify the information disclosure as a source for managers to influence stock liquidity. As analyst coverage leads to improved liquidity, managers with higher equity-based compensations are motivated to attract more analyst coverage.

Recent literature provides evidence that analysts are more likely to follow companies with a more transparent information environment (e.g., Chen et al., 2007). On the other hand, firms with large block holders are unlikely to attract enough analyst coverage (e.g., Lang et al.; 2004). Shiah-Hou (2013) documents that managers' equity-based incentive compensations are positively related with analyst coverage. Furthermore, Jiraporn et al. (2008) argue that managers attract analyst coverage by influencing firms' information environment. Managers have numerous actions in attracting analyst coverage (e.g. Graham et al., 2005). They are even willing to meet the analysts' forecast benchmarks by sacrificing companies' profit. However, managers can also affect analysts' expectation by issuing public disclosures and non-formal communications (Bolliger et al., 2003). Later sections test the relationship between managers' equity-based incentive compensations and their firms' analyst coverages.

III. Empirical design and data

A. Hypotheses development and methodology

Jayaraman and Milbourn (2012) propose that as stock liquidity increases, managers' cash-based compensations decreas and equity-based incentive compensations increase. Their hypotheses rely on the managers' valuation of stock liquidity and the effects of stock liquidity on stock price informativeness. These tests are unlikely to explain the reverse relationship in which managers' equity-based compensations influence stock liquidity. Given that a substantial portion of managers have the power to influence board decision, it is conceivable that the

causal relationship from equity-based incentive compensation to stock liquidity also exists. I propose that managers' equity-based incentive compensations have a positive effect on stock liquidity. Prior research has shown that stock liquidity of secondary markets will affect the effectiveness of managers' equity-based compensation(e.g., Garvey, 1997). Since the use of equity-based incentive compensations has increased over the last several decades, I make the prediction that managers will attempt to mitigate their equity-based incentive compensationd by adopting decisions to influence stock liquidity in secondary markets, such as stock split decisions and information disclosure. This effect can coexist with the hypotheses of Jayaraman and Milbourn (2012).

My empirical assessment begins with testing if there is a positive causal relationship between managers' equity-based incentive compensations and stock liquidity where I prove the causal relationship opposites from that documented by Jayaraman and Milbourn (2012). A finding of a positive causal relationship between managers' equity-based incentive compensations and stock liquidity would suggest that managers with higher equity-based incentive compensations may have an effect on stock liquidity through expanding firms' investor base and disclosing more information to the public. This provides the initial background for my argument that the positive causal relationship between managers' equity-based incentive compensations and stock liquidity is driven by managers' desire to diversify their extra risk compared with market investors' risk level.

Prior literature suggests that managers have the ability to affect companies' decisions, such as stock splits and information disclosure. However, recent works have not considered the equity-based incentive compensations as the motivation for managers to affect those decisions.

I make predict that managers will make decisions to increase stock liquidity when they accept contracts with higher equity-based incentive compensations. My hypotheses relating to the CEO's delta to firm's market liquidity as follows:

H1*: Managers with higher equity-based incentive compensations will increase stock liquidity.*

H1A*: Managers with higher equity-based incentive compensations will make more stock split decisions to influence stock liquidity.*

H1B*: Manager with higher equity-based incentive compensation will attract more analyst coverage to influence stock liquidity.*

My basic model is modified from the one used in Jayaraman and Milbourn(2012). The basic regression model I estimate is as follows:

$$\mathrm{ILLIQ} = \mathrm{LnDelta} + \mathrm{Controls} + \mathrm{e} \qquad (1)$$

The dependent variable, ILLIQ, is the yearly Amihud illiquidity ratio($* 10^3$). Following Lin et al.(2013), I use the square root of the Amihud measure in my regression.

$$\mathrm{ILLIQ} = 10^3 * \sqrt{\frac{|\mathrm{R}|}{\mathrm{VOL}}} \qquad (2)$$

where R is the daily return of stock on day t and VOL is the dollar volume of trading activity on day t. I calculate the annual Amihud illiquidity ratio, ILLIQ, as the average daily Amihud illiquidity ratio($* 10^3$) (Amihud illiquidity ratio is defined only for positive-volume days) during year t. A higher Amihud illiquidity ratio indicates lower stock liquidity. The primary independent variable, LnDelta, is the dollar value change of the manager's equity-based compensation for a 1% change in stock price. I follow Core and Guay (2002) and Coles et

al.(2006) to construct the delta. To remove skewness, I use log(1+delta) as independent variable in the regression models (e.g. Chava and Purnanandam, 2010; Jayaraman and Milbourn, 2012; Lin et al, 2013). LnDelta stands for log(1+delta). I define cash compensation as the proportion of cash-based compensation (the sum of ExecuComp data items "salary" and "bonus") to total annual compensation (data item "tdc1"). LnCashcomp measures log(1+cash compensation). By H1, the coefficient on LnDelta should be negative. The remaining variables are control variables that prior studies find will affect the stock liquidity (e.g. Fang et al., 2009). Stock splits is defined as the companies' stock split adjustment factor. I define the analyst coverage as the number of unique analysts covering a particular firm in one year period. Analysts is the logarithm of the analyst coverage from I/B/E/S. Idrisk_std is the standard deviation of the OLS regression residuals where the excess return of companies is calculated from the Fama French three factors model. Following Fang et al.(2009), I compute Idrisk_std using 60 monthly observations. I require a minimum of 24 monthly observations of each stock. LnFirmsize is the logarithm of firm's total asset value. Leverage is defined as the market value of equity divided by market value of assets. Institutional blockholdings is the sum of all ownership positions greater than 5% held by institutional investors. I use stock return, OIP, MTB, ROA to capture market performance. Return is defined as the total stock market return. OIP is the ratio of operating income after depreciation divided by market value of the equity. MTB is measured as the market value of equity divided by book value of equity. ROA is calculated as the sum of income before extraordinary items and cash flow from operations divided by total assets. I include indicator variables for industry, based on Fama and Fench (1997) 48 industry

classification and for years based on Compustat fiscal years. I winsorized all continuous variables at the 1st and 99st percentiles to remove the influence of outliers.

To test my hypothesis that managers can affect the stock liquidity through processing stock split decisions. I present another regression as follows:

$$\text{ILLIQ} = \text{PrStock splits} + \text{Controls} + \text{e} \quad (3)$$

$$\text{Stock splits} = \alpha + \ \text{LnDelta} + \text{e} \quad (4)$$

The PrStock splits in the regression is calculated predicted value as formula (4). This is the stock splits driven by managers' desire to diversify their extra risk compared with market investors' risk level. Based on H1A, I expect that the coefficient of the PrStock splits term should be negative and significant and the coefficient of the LnDelta term should be positive and significant. This indicates that managers with higher equity-based incentive compensations will process more stock splits to influence stock Liquidity.

I modify regression equation (1) to ensure of my predictions.

$$\text{ILLIQ} = \text{LnDelta} + \text{PrAnalysts} + \text{Controls} + \text{e} \quad (5)$$

$$\text{Analysts} = \alpha + \ \text{LnDelta} \quad (6)$$

The PrAnalysts in the regression is calculated as predicted value in formula (6). Based on my H1B, I expect that the coefficient of the coefficient of the PrAnalysts term should be negative and significant and the coefficient of the LnDelta term should be positive and

significant. This indicates that managers with higher equity-based incentive compensations will attract more analyst coverage to influence stock Liquidity.

B. Data and descriptive statistics

I use the ExecuComp, CRSP, Compustat, Data Stream and I/B/E/S to create my sample. My sample includes S&P 500(large cap), S&P 400(mid cap), and S&P 600(small-cap) indices for the period 1992-2012. I exclude firms in regulated industries including financial services and utilities with the SIC codes 6000-6999 and 4900-4999. My compensation related data are from ExecuComp. All other related data are from CRSP, Compustat and Data Stream.

<Insert Table 1 Here>

Table 1 panel A presents the descriptive statistics of all variables. The sample contains 17,018 firm year observations. The median CEO Delta of 211.529 indicates that average CEO's wealth increases by $211,529 for a 1% increase in stock price. The average illiquidity ratio is 0.039. These results are similar to those reported by recent studies (e.g. Amihud, 2002; Fang et al., 2009; Lin et al. 2009; Chava and Purnanandam, 2010). The median of cash-based compensation is $1,000,000. The average of stock splits and analyst coverage are 1.42 and 5.342. The average Idrisk_std, Firm size, Leverage, Institutional block holding, Stock return, OIP, Mtb, Lnfirmsize, ROA are 0.09, $12,573,930, 0.256, 0.153, 0.164, 0.055, 0.046 which are consistent with recent research (e.g. Fang et al., 2009; Liu and Mauer, 2011; Lin et al., 2013).

Panel B of Table 1 presents Pearson correlations between the dependent variables and independent variables. LnDelta and ILLIQ are negatively correlated with each other (-0.317), suggesting that more equity-based incentive compensations in managers' compensations induces higher stock liquidity. Stock splits and Analysts are positively correlated with managers'

equity-based incentive compensations which is consistent with my prediction in hypothesis. All other control variable correlations are qualitatively consistent with recent reported results (e.g. Fang et al., 2009; Liu and Mauer, 2011; Lin et al., 2013).

IV. Empirical Results

A. Univariate Evidence

I implement the panel vector autoregression(VAR) model on panel linear Granger causality test between Amihud illiquidity ratio and manager's equity-based incentive compensation. The model can be expressed as,

$$\mathrm{ILLIQ}_{i,t} = \mathrm{LnDelta}_{i,t-1} + \mathrm{ILLIQ}_{i,t-1} + e_{1,t} \quad (9)$$

$$\mathrm{LnDelta}_{i,t} = \mathrm{LnDelta}_{i,t-1} + \mathrm{ILLIQ}_{i,t-1} + e_{2,t} \quad (10)$$

<Insert Table 2 Here>

Table 2 reports the results of the Granger causality test. The Granger causality test shows evidence of bi-directional causal relationship between Amihud illiquidity ratio and managers' equity-based incentive compensations. These results are consistent with Jayaraman and Milbourn (2012), who find that stock liquidity influences managers' equity-based incentive compensations. On the other hand, the presence of a negative causal relationship between managers' equity-based incentive compensation and the Amihud illiquidity ratio would imply an alternate explanation that relies on managers' influence on market liquidity.

<Insert Table 3 Here>

Table 3 shows the Amihud illiquidity ratio, analysts, and stock splits on 10 LnDelta portfolios of value-weighted S&P 500, S&P 400, and S&P 600 stocks. I find that Amihud illiquidity ratio for firms in the highest CEO delta decile is only a quarter of the ratio compared to firms in the lowest CEO delta decile. This result is consistent with H1. The table also shows that firms with higher equity incentive managers tends to have more stock splits and more analyst coverage. These results are consistent with H1A and H1B. These results shed more light on the casual relationship between managers' equity-based incentive compensations and stock liquidity. Consistent with my predictions, managers may influence stock liquidity through processing stock split decisions and attracting analyst coverage.

B. Multivariate Evidence

Consistent with Jayaraman and Milbourn (2012), I adopt the hypothesis that managers in firms with greater stock liquidity will get higher equity-based incentive compensations. Lin et al. (2013) show results of strong negative LnDelta-ILLIQ relationship from their regression models. Following prior literature, I find that manager has strong influence on firm's decisions (e.g. Amihud and Mendelson, 2000; Bartov and Mohanram, 2004; Morse et al., 2011; Bolliger et al., 2013). I next turn to examine the managers' feedback effects on stock liquidity and how this relationship is moderated by firms' decisions in stock splits and information disclosures.

<Insert Table 4 Here>

Table 4 presents contemporaneous estimates, two-stage least squares estimates, and lagged one period estimates of equation (1). Recall that the equation examines the other direction of the causal relationship tested in Jayaraman and Milbourn(2012). These regressions reveal that stock liquidity is positively related to managers' equity-based incentive

compensations. The results are fairly consistent across the various estimation methods. Columns 1-3 present the contemporaneous estimates of the relationship between LnDelta and Amihud illiquidity ratio. Column 3 indicates that increasing Lndelta by 0.1, the firms' annual Amihud illiquidity ratio will decrease $1 * 10^{-4}$.

$$\mathrm{LnDelta}_{i,t} = \mathrm{LnDelta}_{i,t-1} + \mathrm{Controls}_{i,t} + e_{i,t} \quad (9)$$

To correct for endogeneity, I present the second stage least squares estimates of managers' feedback effects on the firms' liquidity in columns 4-6. In the first-stage regression, I estimate PrLnDelta using OLS regression model (9). In model 4-6, LnDelta is replaced by an instrument variable, PrLnDelta, which is the predicted value from the first-stage regression. These findings are consistent with the results presented in models 1-3. I explain this as follows: when managers accept higher equity-based incentive compensations, they are more likely to offset her relatively undiversified risk through increasing stock liquidity. After controlling for endogeneity, managers' feedback effects on stock liquidity are consistent. In columns 7-9, I report the estimated results of lagged one period managers' equity-based incentive compensations feedback effects on stock liquidity. Overall, in all ten models, I find a positive and statistically significant effect of managers' equity-based incentive compensations on stock liquidity. These results are consistent with my hypothesis one. To interpret how managers' equity-based incentive compensations relate to stock liquidity, I use the following empirical regressions in equations (3)-(6).

<Insert Table 5 Here>

Table 5 presents equations (3) and (4) estimates. PrStock splits is calculated as model (4). Column 1 reveals a significant negative correlation between PrStock splits and the Amihud

illiquidity ratio. Column 1 indicates that increasing stock splits, driven managers' equity-based incentive compensations, by 0.1, the firms' annual Amihud illiquidity ratio will decrease $1.2 * 10^{-3}$ .This indicates that managers with higher equity-based incentive compensations will tend to process stock split decisions to increase stock liquidity. This result is consistent with recent study findings (e.g., Baker and Gallagher 1980; Maloney and Mulherin 1992; Lin et al. 2009) and my hypothesis H1A. In order to further examine the relation between stock splits and LnDelta. Column 2 reveals that the LnDelta is significantly positively related to stock splits. The results address that the managers' equity-based incentive compensations may partially drive the stock split decisions. However, Amihud and Mendelson (2000) demonstrate that manager may have other stronger methods to affect stock liquidity other than processing stock split decisions. Furthermore, I examine another method that managers can use to affect stock liquidity, the use of information disclosure by attracting more financial analyst coverage.

<Insert Table 6 Here>

Table 6 contains the estimates of equations (5) and (6). Columns 1-3 present strong negative ILLIQ-Analysts relationship for the sample. These results indicate that analyst coverage will positively contribute to stock liquidity which is consistent with H1B. Column 1 indicates that increasing analyst coverage, driven managers' equity-based incentive compensations, by 1, the firms' annual Amihud illiquidity ratio will decrease $4 * 10^{-3}$. This indicates that the managers' equity-based incentive compensations are important to the stock liquidity. And column 2 reveals that the analyst coverage is the primary driver in the relationship between manager's equity-based incentive compensation and stock liquidity. Furthermore, we report the significantly positive Analysts-LnDelta relationship directly in column 3. The results from Table 6

indicates that analyst coverage and stock splits are two contributing factors in explaining the positive impact of managers' equity-based incentive compensations on stock liquidity.

V. Conclusion

Recent research indicates that higher stock liquidity will affect managers' compensation structure (e.g., Sudarshan and Milbourn, 2012; Lin et al., 2013). Researchers explain this by examining managers' valuation of their equity-based compensation and informativeness in stock price. My findings suggest that managers will have feedback effects on stock liquidity after accepting higher equity-based incentive compensations. I propose that the causal relationship between CEO delta and stock liquidity should coexist. Specifically, when managesr accepts higher equity-based incentive compensations, they may mitigate their own risk by increasing the liquidity of secondary markets. Motivated by Amihud and Mendelson (2000), I provide two explanations of the managers' feedback effects: (1) processing more stock split decisions and (2) disclosing more information to the public by attracting more analyst coverage. So, in other words I assume that managers do have feedback effects on equity-based incentive compensations by influencing stock liquidity. Furthermore, I provide and prove that managers rely on those two methods to influence stock liquidity. The results indicate that analyst coverage is the key contributing factor in the explanation of the positive impact of managers' equity-based incentive compensations on stock liquidity.

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Table 1
Descriptive statistics and correlations of Amihud illiquidity ratio, CEO cash-based compensation, CEO equity-based compensation, stock splits and analyst coverage. The sample includes all firm-years in ExecuComp, CRSP and Compustat databases during the period 1992 to 2012. The sample excludes financial and utility firms. Panel A reports descriptive statistics, and Panel B reports Pearson correlation coefficients. Amihud illiquidity ratio, CEO cash-based compensation, CEO equity-based compensation, stock splits and analyst coverage and all control variables are winsorized at the 1st and 99th percentiles. ***, **, and * in Panel B denote significance at the 1%, 5%, and 10% levels, respectively.

Panel A						
Descriptive Statistics						
Variable	N	Mean	Median	Std. Dev.	1st Quartile	3rd Quartile
ILLIQ	17,018	0.085	0.039	0.156	0.020	0.083
Delta	17,018	634.140	211.529	1427.760	76.085	564.432
Cash compensation	17,018	1,393.750	1,000.000	1,591.250	725.000	1567.500
Total compensation	17,081	5061.65	3268.67	6623.01	1607.46	6270.44
Stock splits	17,018	1.420	1.000	1.121	1.000	1.500
Analyst coverage	17,018	5.342	4.000	5.015	0.000	11.000
Idrisk_std	17,018	0.090	0.081	0.042	0.061	0.107
Firm size	17,018	12,573.930	2533.530	44282.970	920.651	8242.000
Leverage	17,018	0.256	0.248	0.172	0.128	0.360
Institutional blockholdings	17,018	0.153	0.132	0.132	0.056	0.232
Stock return	17,018	0.164	0.116	0.458	-0.088	0.337
OIP	17,018	0.055	0.057	0.037	0.038	0.074
MTB	17,018	1.882	1.420	1.969	1.136	1.995
ROA	17,018	0.046	0.043	0.081	0.016	0.077

Panel B													
	ILLIQ	LnDelta	CashComp	Stock splits	Analysts	Idrisk_std	LnFirmsize	Leverage	Institutional blockholdings	Stock return	OIP	MTB	ROA
ILLIQ	1												
LnDelta	-0.317***	1											
CashComp	0.375***	-0.155***	1										
Stock splits	0.024***	0.094***	0.112***	1									
Analysts	-0.287***	0.103***	-0.327***	-0.060***	1								
Idrisk_std	0.103***	-0.059***	-0.011***	-0.080***	-0.117***	1							
LnFirmsize	-0.498***	0.300***	-0.293***	-0.026***	0.322***	-0.355***	1						
Leverage	-0.023***	-0.066***	-0.027***	-0.066***	0.012	-0.007	0.141***	1					
Institutional blockholdings	-0.102***	-0.133***	-0.115***	-0.073***	0.198***	0.171***	-0.176***	0.042***	1				
Stock return	0.037***	0.137***	0.014	0.093***	-0.036***	0.169***	-0.061***	-0.038***	-0.017***	1			
OIP	-0.038***	0.018***	0.056***	0.045***	0.018**	-0.101***	-0.128***	-0.020**	-0.011***	-0.050***	1		
MTB	0.002	0.212***	-0.053***	0.039***	0.007	0.118***	-0.230***	-0.152***	-0.026***	0.172***	-0.054***	1	
ROA	-0.010*	0.185***	0.004	0.064***	0.040***	-0.114***	-0.096***	-0.167***	-0.036***	0.097***	0.520***	0.091***	1

Table 2

Model 1-2 reports the results of the linear panel Granger causality test. Model 1 reports regression of ILLIQ on lagged one period ILLIQ, and lagged one period LnDelta. Model 2 reports regression of ILLIQ on lagged one period ILLIQ, and lagged one period LnDelta. All dependent and independent variables are as defined in the data and descriptive statistics section. Industry dummies are based on two-digit Standard Industrial Classification(SIC) codes. t-statistics are in parentheses below parameter estimates. The t-statistics for models are based on heteroskedastic-consistent standard errors. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

	ILLIQ	LnDelta
	(1)	(2)
ILLIQ	0.265***	-0.825***
	(10.85)	(-6.04)
LnDelta	-0.010***	0.854***
	(-10.00)	(126.30)
Firm dummy	Yes	Yes
Year dummy	Yes	Yes
F^{HNC}	120.904	95.411
Number of observations	17,018	17,018
Adj. R^2	0.23	0.79

Table 3 reports Ammihud illiquidity ratio, analyst coverage and stock splits sorting into 10 deciles based on LnDelta for time period 1992-2012.

	ILLIQ	Stock Splits	Analysts Coverage
Lowest	0.104	1.263	3.846
D2	0.088	1.289	4.443
D3	0.073	1.347	4.856
D4	0.065	1.346	5.034
D5	0.060	1.439	5.371
D6	0.049	1.378	5.721
D7	0.046	1.412	6.059
D8	0.041	1.481	6.195
D9	0.036	1.563	6.286
Highest	0.029	1.624	6.566
D10-D1	-0.075	0.361	2.720

Table 4

Model 1-3 report regression of ILLIQ on contemporaneous LnDelta and all other control variables. Model 4-6 report 2 SLS regression of ILLIQ on predicted value of LnDelta which is PrLnDelta and all other control variables. I use lagged one period of LnDelta and all other control variables as the instrument variables. Model 7-9 report regressions of ILLIQ on lagged one period LnDelt and control variables. All dependent and independent variables are as defined in the data and descriptive statistics section. Industry dummies are based on two-digit Standard Industrial Classification(SIC) codes. t-statistics are in parentheses below parameter estimates. The t-statistics for models are based on heteroskedastic-consistent standard errors. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

	Contemporaneous Regression			2 SLS			Lagged 1 period Regression		
	ILLIQ	ILLIQ	ILLIQ	ILLIQ	ILLIQ	ILLIQ	ILLIQ	ILLIQ	ILLIQ
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
LnDelta	-0.001***	-0.0003	-0.001***				-0.002***	-0.001**	-0.001***
	(-4.50)	(-1.16)	(-3.17)				(-6.68)	(-2.30)	(-4.68)
PrLnDelta				-0.001***	0.0001	-0.001*			
				(-3.14)	(0.32)	(-1.91)			
Cashcomp_p	0.078***	0.085***	0.059***	0.072***	0.082***	0.056***	0.071***	0.081***	0.056***
	(47.67)	(48.51)	(32.85)	(43.81)	(45.04)	(31.07)	(43.99)	(45.95)	(31.67)
Idrisk_std	0.172***	0.365***	0.223***	0.150***	0.356***	0.202***	0.165***	0.351	0.214***
	(14.57)	(48.51)	(18.78)	(12.53)	(31.65)	(16.70)	(14.12)	(31.46)	(31.67)
LnFirmsize	-0.016***	-0.007***	-0.015***	-0.016***	-0.006***	-0.015***	-0.015***	-0.006***	-0.014***
	(-50.40)	(-27.50)	(-47.45)	(-46.66)	(-24.91)	(-45.32)	(-47.12)	(-26.00)	(-45.04)
Leverage	0.030***	0.019***	0.022***	0.029***	0.018***	0.021***	0.027***	0.017***	0.019***
	(10.05)	(7.00)	(7.56)	(9.38)	(6.63)	(7.11)	(9.15)	(6.51)	(6.60)
Institutional Blockholdings	-0.002	0.057***	0.026**	-0.0004	0.062***	0.024***	-0.002	0.055***	0.023**
	(-0.68)	(15.92)	(7.48)	(-0.11)	(17.65)	(6.75)	(-0.57)	(15.58)	(6.62)
Stock return	0.006***	0.005***	0.007***	0.005***	0.003***	0.005***	0.003***	0.004***	0.004***
	(6.64)	(5.30)	(6.84)	(4.81)	(2.82)	(4.45)	(3.48)	(3.13)	(3.76)
OIP	0.065***	0.165***	0.043***	0.044***	0.152***	0.023*	0.043***	0.145***	0.021*
	(4.39)	(11.41)	(2.99)	(2.94)	(10.44)	(1.64)	(2.94)	(10.18)	(1.50)
MTB	-0.003***	-0.001***	-0.004***	-0.003***	-0.002***	-0.004***	-0.003***	-0.002***	-0.004***
	(-10.80)	(-5.09)	(-13.05)	(-10.28)	(-5.04)	(-12.64)	(-10.21)	(-5.10)	(-12.67)
ROA	-0.084***	-0.087***	-0.075***	-0.074***	-0.081***	-0.063***	-0.082***	-0.084***	-0.071***
	(-10.81)	(-11.00)	(-9.94)	(-9.17)	(-9.68)	(-8.06)	(-10.59)	(-10.38)	(-9.29)
Industry dummy	Yes	No	Yes	Yes	No	Yes	Yes	No	Yes
Year dummy	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Number of observations	17,018	17,018	17,018	17,018	17,018	17,018	15,060	15,060	15,060
Adj. R^2	0.64	0.62	0.67	0.65	0.62	0.67	0.64	0.62	0.67

Table 5
Model 1 contains predicted stock splits (PrStock splits) by LnDelta. Model 2 reports regression of Stock splits on lagged one period LnDelta and control variables. All dependent and independent variables are as defined in the data and descriptive statistics section. Industry dummies are based on two-digit Standard Industrial Classification(SIC) codes. t-statistics are in parentheses below parameter estimates. The t-statistics for models are based on heteroskedastic-consistent standard errors. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

	ILLIQ	Stock splits
	(1)	(2)
LnDelta		0.073***
		(10.24)
PrStock splits	-0.012***	
	(-4.92)	
CashComp_p	0.054***	0.073*
	(28.71)	(1.80)
Idrisk_std	0.194***	-1.377***
	(15.31)	(-5.07)
LnFirmsize	-0.015***	0.004
	(-41.11)	(0.53)
Leverage	0.020***	-0.273***
	(6.35)	(-4.01)
Institutional Blockholdings	0.026***	0.665***
	(6.97)	(8.45)
Stock return	0.004***	0.238***
	(3.69)	(10.39)
OIP	0.029**	1.005***
	(2.05)	(3.26)
MTB	-0.004***	0.009
	(-11.88)	(1.23)
ROA	-0.063***	0.402**
	(-7.82)	(2.31)
Industry dummy	Yes	Yes
Year dummy	Yes	Yes
Number of observations	15,060	15,060
Adj. R^2	0.68	0.68

Table 6
Model 1 contains predicted financial analysts coverage (PrAnalysts) by LnDelta. Model 2 contains both predicted financial analysts coverage (PrAnalysts) and predicted stock splits (PrStock splits). Model 3 reports regression of financial analysts coverage on lagged one period LnDelta and control variables. All dependent and independent variables are as defined in the data and descriptive statistics section. Industry dummies are based on two-digit Standard Industrial Classification(SIC) codes. t-statistics are in parentheses below parameter estimates. The t-statistics for models are based on heteroskedastic-consistent standard errors. ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

	ILLIQ		Analysts
	(1)	(2)	(3)
LnDelta			0.115***
			(4.09)
PrStock splits		0.004	
		(0.64)	
PrAnalysts	-0.004***	-0.005***	
	(-5.82)	(-6.34)	
CashComp	0.054***	0.051***	-1.642***
	(28.19)	(23.61)	(-10.40)
Idrisk_std	0.194***	0.188***	-8.421
	(15.06)	(13.83)	(-7.92)
LnFirmsize	-0.015***	-0.014***	0.892***
	(-40.27)	(-35.89)	(29.71)
Leverage	0.020***	0.019***	-0.702***
	(6.19)	(5.49)	(-2.63)
Institutional Blockholdings	0.025***	0.026***	5.528***
	(6.73)	(6.66)	(17.94)
Stock return	0.004***	0.003**	-0.319***
	(3.50)	(2.44)	(-3.55)
OIP	0.030**	0.031**	-3.292***
	(2.04)	(1.99)	(-3.55)
MTB	-0.004***	-0.003***	0.293***
	(-11.50)	(-7.21)	(10.27)
ROA	-0.063***	-0.061***	1.947***
	(-7.62)	(-6.97)	(2.87)
Industry dummy	Yes	Yes	Yes
Year dummy	Yes	Yes	Yes
Number of observations	15,060	15,060	15,060
Adj. R^2	0.67	0.66	0.72