Managerial Compensation and Stock Price Informativeness

Benjamin Bennett*, Gerald Garvey†, Todd Milbourn‡, and Zexi Wang£

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Abstract

This paper studies the effect of stock price informativeness (SPI) on the level, complexity, and efficiency of executive incentive pay. The private information in stock prices provides principals more information on agents' effort. This implies a lower amount of both total pay and equity-based pay because less risk of loss needs to be imposed on executives to induce a given level of effective incentives. This argument assumes that executive compensation is chosen efficiently; we find our effects are stronger in firms with better governance. We also find that the stock price informativeness reduces pay complexity: firms with more informative stocks have shorter pay duration, higher percentage of cash pay, and are less likely to use compensation consultants. In a multi-task setting, even a highly efficient and informative stock price can inefficiently aggregate information across tasks; consistent with this we find weaker results for multidivisional firms. Lastly, SPI increases the efficiency of compensation through its effect on the pay performance sensitivity, convexity of equity pay, CEO perquisites, and pay for luck/skill.

Keywords: executive compensation, stock price informativeness, managerial incentives

* Fisher School of Business, Ohio State University, 840 Fisher Hall, 2100 Neil Ave, Columbus OH 43210, USA, bennett.210@osu.edu

† University of New South Wales, Australia Business School, College Rd, Kensington NSW 2052, Australia, gerald.garvey@blackrock.com

‡ Olin School of Business, Washington University, Campus Box 1133, 1 Brookings Dr, St. Louis, MO 63130, USA, milbourn@wustl.edu

£ University of Bern, Institute for Financial Management, Engehaldenstrasse 4, CH-3012 Bern, Switzerland, zexi.wang@ifm.unibe.ch

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Introduction

In recent years, the level of executive compensation has soared, and compensation packages have become increasingly complex. In 2015, the median CEO total compensation of S&P 500 firms reached $10.4 million as compared to $7 million in 2009. Additionally, the complexity of compensation packages continues to increase as well. For example, many pay plans include contingencies or long-term performance goals that make them unwieldy, as commented by Bengt Holmstrom in his 2016 Nobel Prize press conference and echoed by the concerns of investors in practice.[1] Informational asymmetries between agents and principals play a fundamental role (Holmstrom, 1979; Shavell, 1979) in executive compensation designed to address the underlying agency problems (Jensen and Meckling, 1976). Different information sources can decrease information asymmetry. In this study, we focus on stock prices which incorporate the latest firm-specific information, including that reflecting managerial effort. Stock price informativeness improves the observability of managerial efforts, which suggests that the informativeness of stock prices affect executive compensation design. In this paper, we study the effect of *stock price informativeness* on executive compensation.

Stock prices reflect both public and private information on corporate fundamentals. Accordingly, the price informativeness includes the public component and the private component. In this study, we concentrate on the private component of the price informativeness, which is crucial to our empirical design. The motivation is as follows. Generally, managers have the capacity to affect the public component of price informativeness. For example, managers can release more information through the annual reports, or communicating more frequently with the

[1] See the article in Financial Times at https://www.ft.com/content/1c1bebe8-37b2-11e0-b91a-00144feabdc0

financial analysts and media. This creates an endogeneity concern on the empirical design for the relationship between managerial compensation and stock price informativeness.

In contrast, private information in the stock prices is less likely to be manipulated by managers. Private information on firms is incorporated into stock prices through informed trading (Hayek, 1945; Grossman and Stiglitz, 1980; Kyle, 1985). The informed traders can be widely spread in the economy, while corporate managers are legally restricted from informed (insider) trading by US laws.[2] Relying on the private component of price informativeness makes our empirical design much cleaner. Throughout the paper, we denote the private component of stock price informativeness simply as stock price informativeness (SPI).

Existing literature shows that the stock prices have real effects on corporate decisions, such as investment and corporate governance (Bond, Edmans, and Goldstein, 2012; Chen, Goldstein, and Jiang, 2007; Ferreira, Ferreira, and Raposo, 2011), due to the private information in the prices. Following the literature, we rely on two measures of the amount of private information in stock prices. One is the probability of informed trading (PIN), which is developed by Easley, Kiefer, and O'Hara (1996, 1997), and Easley, Hvidkjaer, and O'Hara (2002), and widely used in academic research. PIN is derived from a structural market microstructure model, and directly measures the likelihood of informed trading in a stock.[3] The other measure is the *price nonsynchronicity*, an R^2-related measure (Roll, 1988, Durnev, Morck, and Yeung, 2004). The logic for this measure is that when the stock return less commoves with market return and industry return (i.e. nonsynchronous), more firm-specific information should be in the stock

[2] Specifically, the following laws are related to insider trading: Securities Exchange Act of 1934, Insider Trading Sanctions Act of 1984, Insider Trading and Securities Fraud Enforcement Act of 1988 and Stop Trading on Congressional Knowledge (STOCK) Act of 2012.

[3] We are mindful of the active debate surrounding PIN, and therefore, we also use the Adjusted PIN proposed by Duarte and Young (2009). The results are robust and shown in the Section 9.1.

price. This measure has been showed to have little correlation with public news (Roll, 1988). More detailed information on these two SPI measures is available in the following session.

More private information in prices can decrease the information gap between agents and principals, and increase the observability of agents' effort. For example, higher talent and more effort of agents increase the probability of value-maximizing decisions and actions, which can be observed or investigated by informed traders and reflected in stock prices before such information is publicly known. The higher obervability of agents' efforts decreases risk sharing towards the first best solution (Holmstrom, 1979). It implies that less equity-based pay is needed as the compensation for risk sharing. Accordingly, the risk-averse agents require less total compensation, which benefits the principals.

Corporate governance plays an important role in the effect of SPI on the level of total compensation. Lower compensation benefits the principals, but it hurts the managers' income. It is intuitive that the negative effect of SPI on executive compensation should be stronger for firms with better governance. For firms with weaker governance, it is more difficult to cut the compensation even if the observability is improved by the SPI. We find the evidence for the complementary effect of the corporate governance. SPI has significant effect on compensation only in firms with better governance.

We further investigate the variations of the SPI effect on equity-based compensation along firm characteristics. We consider the roles of financial constraints, product market competition, and corporate diversification. Financially constrained firms suffer from inaccessible external financing, which brings more uncertainty on firms' growth and makes the firm's equity less attractive to managers. As a result, managers of financially constrained firms are more reluctant to accept equity as part of their compensation. If they have to accept equity, they will

charge a premium, which makes the pay more costly for the principals. This gives principals a stronger motive to decrease equity-based pay for a given level of SPI. We find that the negative effect of SPI on the equity-based pay is stronger for financially constrained firms.

The degree of product market competition also impacts SPI's effect on the equity based pay. Product market competition can also make the managerial effort more observable to principals (Hart, 1983), implying that SPI and competition are substitutes. Generally, stocks of firms with less product market competition tend to be more informative (Peress, 2010), and therefore more reliable for the signaling purpose. We expect the SPI effect on equity-based pay to be stronger for firms facing less product market competition. We measure competition by the product market fluidity (Hoberg, Phillips and Prabhala, 2014), product similarity, and HHI (Hoberg and Phillips, 2016). The empirical results of all three measures consistently verify that low competition in the product market amplifies the SPI effect on equity-based pay.

Corporate diversification can also affect the use of equity-based pay. Equity based pay is less efficient for some firms than for others. For example, Paul (1992) shows that equity based pay can be inefficient when firms have multiple projects. The reason is that the equity based pay puts higher weights on the projects where the managers' effort is less observable. The stock price reflects the value of the firm, not the added value by the managers. It implies that the equity based pay is more likely to be inefficient when firms have more projects. We expect the negative effect of SPI on equity pay to be stronger in the firms with more business segments (more diversified). Specifically, the interaction between SPI and the number of segments is expected to have negative impact on the percent of equity based pay in the total compensation.

Stock price informativeness (SPI) can decrease the complexity of compensation. Recently, complex compensation packages make it difficult for investors to understand and

disentangle the real incentives provided to the managers, especially by the long-term incentive plans. SPI improves the transparency of the managers' effort, which makes the complex compensation less necessary. Suppose the efforts of managers are totally transparent to the principals, the managers can be paid wholly in cash for their effort, which is the simplest compensation.

Compensation complexity is measured by the following four dimensions: the percent of cash pay in the compensation, the duration of the compensation (Gopalan, Milbourn, Song, and Thakor, 2014), the dispersion of components in the total compensation (Albuquerque, Carter, and Lynch, 2015), and the usage of compensation consultants. It is intuitive that a higher percent of cash pay implies less complex compensation. Pay duration reflects the vesting periods of different pay components. Shorter duration implies lower complexity. Lower dispersion indicates that only a few components of the compensation dominate the pay package, and the compensation package is less complex. Sometimes compensation consultants are blamed to be responsible to the complex compensation[4]. On the one hand, the consultants may have an incentive to design complex compensation to justify their existence. On the other hand, firms with more complex compensation demands are more likely to hire compensation consultants. The use of compensation consultants should be positively correlated with the compensation complexity. The results of all four measures show that SPI decreases the complexity of executive compensation.

We further focus on the performance-based pay, which increases the complexity of compensation. Performance-based pay makes the manager's compensation conditional on certain performance metrics, such as an earnings or sales target. It has been more and more popular in US firms (Bennett, Bettis, Gopalan, and Milbourn, 2017; Li and Wang, 2016). The main purpose

[4] http://www.reuters.com/article/us-nobel-prize-ceopay-idUSKCN12B2QG

of the performance-based pay is to provide strong incentive to managers. However, the incentive instruments are costly. For example, managers can require risk premium and liquidity premium for equity-based pay or longer pay duration. SPI improves the observability of managers' effort, and thus less incentive instruments are needed to maintain a certain level of managerial effort. We expect SPI decreases the demand for performance-based pay, especially the pay based on the long-term accounting performance. We find evidence that SPI decreases the proportion of performance based pay in total compensation, in particular for pay based on long-term performance, as well as on accounting performance.[5]

Besides the level and complexity of the compensation, we also investigate the effect SPI has on compensation efficiency. As more information is available to firms with higher SPI, we expect SPI to increase the efficiency of the compensation. Our results in previous sections show that SPI decreases the level of equity-based pay, which is a typical incentive instrument. After investigating how SPI affects the level of the incentives used in compensation, we seek to understand how SPI affects the incentives (as opposed to their levels). Will the incentive relationship between equity and managerial effort also be negatively affected by SPI? The answer is no. We find that SPI actually increases the pay performance sensitivity (delta). As more informative stocks serve as a higher quality signal, compensation can rely on stock prices in a more aggressive way. For example, corporate boards can use more options relative to restricted stock, which increases the convexity of the equity based pay, and maintain similar vega even though the level of equity is lower. Option pay provides a stronger incentive for managers to pursue riskier and more profitable projects, which is helpful to maximize shareholder value.

[5] One other cost of performance-based pay tied to specific accounting goals is that it is related to manipulation of firm characteristics (see Bennett, Bettis, Gopalan and Milbourn, 2017).

We find the ratio of option pay to equity pay is positively affected by the SPI. It explains why SPI leads to lower level of equity pay and stronger incentive.

Another channel by which the SPI affects incentives is through performance-based pay tied to stock prices. Higher SPI means useful information is more likely to be contained in the stock price. The informativeness principle implies that stock prices should be used more aggressively in the compensation design for firms with higher SPI (Holmstrom, 1979). We expect SPI to increase the reliance on stock prices in the performance-based pay, where the managers get the certain amount of pay only if the firm's stock return is higher than a specified level. We find that SPI does increase percentage of stock price-related performance-based pay. In this way, SPI increases the sensitivity of pay to the stock performance, and has positive effect on the efficiency of the compensation.

Stock price informativeness can improve the pay efficiency by decreasing the managerial perquisites. Executive perquisites are generally thought of as an agency problem to misuse firm resources (Grossman and Hart, 1980; Jensen and Meckling, 1976; Jensen, 1986). Inappropriate perquisites can have significant effects on stock prices when they are known by outside investors (Yermack, 2006). Higher SPI implies such perquisites are more likely to be known by outsider investors, and makes CEOs less likely to enjoy costly perquisites. We find that SPI has significantly negative effect on the CEO perquisites, which improves the efficiency of compensation.

SPI can also improve efficiency through its effects on pay for luck/skill. Efficient compensation should reward managers for their effort and skills, not for the outcomes outside their control (luck). We measure luck by the firm's return predicted by its industry return, and measure skill by the residual of the same following Garvey and Milbourn (2006). We find that

pay for luck concentrates in the firms with low SPI and pay for skill concentrates in the firms with high SPI. These results indicate that firms with high SPI have more efficient executive compensations.

We address the endogeneity concern through the instrumental variable methodology. As managers have little effect on the private information component in the stock prices, reverse causality is not our main concern. However, an omitted variable is a potential problem and could lead to a simultaneity concern. Our IV results validate the causal effect of SPI on compensation. In addition, to further mitigate the endogeneity concern, we use lagged SPI measures (average of previous 3 years), and additional control variables in later tests. Our results remain robust, regardless of the specification.

Our contributions are as follows. First, the paper contributes to the literature on executive compensation. It finds that the stock price informativeness affects the level, complexity, and efficiency of compensation. Second, it contributes to the literature on the real effect of financial markets. It shows a channel through which the stock market can affect managerial compensation, which in turn has comprehensive effects on corporate behavior. Third, this paper contributes to the literature on informed trading. Stock price infomativeness is positively affected by the informed trading, and decreases the compensation. It implies the informed trading may have positive effect on principals' interests.

The remaining sections are organized as follows. Section 2 introduces the measures of stock price informativeness. Section 3 describes the data sources and the sample. Section 4 shows the effect of SPI on the level of compensation and the complementary effect of corporate governance. Section 5 shows how the SPI effect on equity based pay varies along firm characteristics. Section 6 shows the effect of SPI on the complexity of compensation. Section 7

shows the SPI effect on the performance based pay. Section 8 shows how SPI affects the efficiency of compensation. Section 9 reports the endogeneity tests and other robustness tests. Section 10 concludes.

2. Measures of stock price informativeness

2.1 Stock price informativeness and corporate decisions

Prices can aggregate the information owned by different units in the economy (Hayek, 1945). In fact, production, aggregation and communication of information are some of the most important roles of modern financial markets. When different economic participants own private information related to firms, they can make profits through speculative trading of corporate stocks. When doing so, their private information is incorporated into the stock prices (Grossman and Stiglitz, 1980; Kyle, 1985). Then all participants can share the private information through stock prices, and the information asymmetry among different parties is decreased. This information sharing plays an important role in the real effects financial markets have on the economy (Bond, Edmans, and Goldstein, 2012). In particular, the amount of private information in stock prices can affect corporate decisions. In the literature, the amount of the private information in the stock prices is denoted as the stock price informativeness (SPI). Existing evidence shows that SPI can affect corporate activities such as investment, cash savings, and corporate governance.

Chen, Goldstein, and Jiang (2007) find that SPI has strong effect on corporate investment. The investment of firms with higher SPI is more sensitive to stock prices, because the managers can learn more from stock prices with higher SPI. Consistently, Fresard (2012) finds that SPI affects corporate cash savings. There is also evidence that SPI affects corporate governance. Ferreira, Ferreira, and Raposo (2011) find that SPI decreases the corporate board

independence. SPI makes managers' actions more observable when private information is released through the stock market, and directors could use such information as an input to their monitoring task. They find SPI and board independence are substitutes.

2.2 Measures of stock price informativeness

Following the literature, we use two measures of stock price informativeness, which are annual level measures based on high frequency tick size trading, or daily trading activities. The first is the probability of information-based trading (PIN), which is constructed based on a market microstructure model (Easley, Hvidkjaer, and O'Hara, 2002). The logic is that when there is more informed trading in one stock, new information is more likely to be incorporated into that stock's price, which improves the stock price informativeness. High PIN means high stock price informativeness. The second is the stock price nonsynchronicity (PSI), which is the firm-specific return variation (Durnev, Morck, and Yeung, 2004). The logic is that when there is more firm-specific information in the stock price, the stock return is less correlated with market and industry returns. High PSI means high stock price informativeness. Both measures are widely used as stock price informativeness measures in the relevant literature.

2.2.1 Probability of information-based trading (PIN)

PIN is the measure of the probability of information-based trading. Suppose that on a day the new information appears with probability α, and with probability δ the news is bad, and with probability of $1-\delta$ the news is good. Then the probability of no news on a day is $1-\alpha$. The trading orders follow Poisson distributions. Uninformed traders (with no information advantage) trade no matter new information arrives or not. The arrival rate of uninformed buy (sell) order is $\varepsilon_b(\varepsilon_s)$. The traders with private information only trade when there is new information appears,

and the arrival rate is μ. The informed trader will only buy if the news is good and only sell if the news is bad. Given these parameters $(\alpha, \delta, \mu, \varepsilon_b, \varepsilon_s)$, the probability of information-based trading is

$$PIN = \frac{\alpha \cdot \mu}{\alpha \cdot \mu + (\varepsilon_b + \varepsilon_s)},$$

where the denominator is the arrival rate for all orders and the numerator is the arrival rate of informed orders.

The parameters are estimated by method of maximum likelihood. On day i, we observe the number of buy orders B_i and the number of sell orders S_i.

Denote the Poisson distribution function as $P(k;\lambda) = e^{-\lambda}\frac{\lambda^k}{k!}$, where k is the number of arrivals and λ is the arrival rate. Then the likelihood function for a trading day is

$$L(\alpha, \delta, \mu, \varepsilon_b, \varepsilon_s | B_i, S_i)$$
$$= (1-\alpha) \cdot P(B_i;\varepsilon_b) \cdot P(S_i;\varepsilon_s) + \alpha \cdot \delta \cdot P(B_i;\varepsilon_b) \cdot P(S_i;\mu+\varepsilon_s) + \alpha \cdot (1-\delta)$$
$$\cdot P(B_i;\mu+\varepsilon_b) \cdot P(S_i;\varepsilon_s)$$

Assume the tradings across different days are independent. Then the likelihood function within a year is

$$V = \prod_{i=1}^{I} L(\alpha, \delta, \mu, \varepsilon_b, \varepsilon_s | B_i, S_i),$$

where I is the number of trading days in a year.

Based on TAQ data and Lee and Ready (1991) algorithm, we calculate the number of daily buy and sell orders of a stock. Then use the maximum likelihood method to calculate the parameters $(\alpha, \delta, \mu, \varepsilon_b, \varepsilon_s)$ based on the data in a year. In turn, PIN can be calculated for a stock in a given year.

2.2.2 Stock price nonsynchronicity (PSI)

The stock price nonsynchronicity, PSI, is a measure of stock price informativeness based on R^2, in line with Roll (1988). In the following regression, the stock return is decomposed into the systematic part explained by market return and industry return, and a firm-specific residual variation. When there is relatively more firm-specific variation, the return co-moves less with market return and industry return, and in turn smaller R^2 (or equivalently larger $1 - R^2$).

$$r_{j,i,t} = \beta_{j,0} + \beta_{j,m} r_{m,t} + \beta_{j,i} r_{i,t} + \varepsilon_{i,j,t},$$

where j is for firm j, i is for industry i, and t is for day t, $r_{j,i,t}$ is the stock return of firm j in industry i (three-digit SIC) on day t, $r_{m,t}$ is the value weighted market return on day t, and $r_{i,t}$ is the value weighted industry return on day t. The weight is market capitalization. When calculating the market and industry value weighted returns for firm j, the return of firm j is excluded to prevent spurious correlations between firm and industry returns in industries that contain few firms.

The regression is run for each firm j within a year, and the R^2 of the regression is used to construct PSI_j for stock j in a given year as follows.

$$\mathrm{PSI_j} = \ln\left(\frac{1 - \mathrm{R}_j^2}{\mathrm{R}_j^2}\right)$$

Therefore, PSI_j is a logistic transform of $1 - \mathrm{R}_j^2$, which is to address the skewness and boundedness of $1 - \mathrm{R}_j^2$. Stock price is more informative when a stock becomes less correlated with the market and industry returns, i.e. smaller R_j^2 and larger PSI_j.

3. Data and Sample

Executive compensation data are from Execucomp and IncentiveLab.[6] Corporate accounting data are from Compustat. We use TAQ data to calculate PIN and daily stock file of CRSP to calculate PSI. Institutional ownership and blockholder data are from Thomson Reuters 13F. E-index is from RiskMetrics. Competition variables used are from Hoberg-Phillips data library.[7]

Our sample only includes firms with non-missing compensation data and non-missing stock price informativeness (we require at least one of PIN or PSI for a firm-year to be included in our sample). PIN is first available in 1993 as that is the first year TAQ data is available. In our analysis, we use the average PIN and PSI of the previous three years (at least one non-missing value in the previous three years). We use such a backward looking approach to avoid any specific shock in a given year and better measure the representative level of SPI for firms. Our sample is from 1994 to 2015 and includes 35,005 firm-year observations.

The control variables used in the main tests are the log of book assets, R&D/assets, return on assets (ROA), Tobin's Q, cash/assets, debt/assets and sales growth. The definitions for all variables can be found in the Appendix.

The summary statistics for the main variables are reported in Table 1. The means of PIN and PSI are 0.18 and 1.28, which are in line with recent, previous studies.[8] The means for CEO total, cash, and equity compensation are also similar to those in recent studies at \$2.7M, \$0.9M, and \$1.0M.[9]

Empirical analysis

[6] For a more thorough discussion of the IncentiveLab data see Bettis, Bizjak, Coles and Kalpathy (2016) or Bennett, Bettis, Gopalan and Milbourn (2016).
[7] The competition data and a descriptions of same can be found here: http://hobergphillips.usc.edu/.
[8] See Chen, Goldstein, and Jiang (2007) and Ferreira, Ferreira, and Raposo (2011).
[9] There are many compensation studies, but a prominent, recent overview is Murphy (2012).

We now discuss and present the results of our main empirical tests. Stock price informativeness is related to the level, complexity, and efficiency of executive compensation. Our empirical analyses verify the relevant hypotheses.

4. Level of compensation

4.1 Level of compensation and SPI

We start with the tests for the level of compensation, especially the equity-based pay. Stock price informativeness (SPI) decreases the information asymmetry between principals and agents, and increases the observability of agents' effort. Such transparency is supposed to decrease the necessity of risk-sharing such as equity-based pay (Holstrom 1979), and in turn decrease the compensation to the risk-averse managers. The SPI is expected to have negative effects on both total compensation and equity-based compensation. The total compensation (equity based compensation) is measured by the logarithm of total compensation (equity-based compensation) of CEOs.

We use 2 measures of SPI in all of our tests: the probability of insider trading (PIN) and the stock price non-synchronicity (PSI).[10] The measures are first calculated for each firm in a year. Then we use the average PIN or PSI across the previous 3 years as the SPI of a firm in a given year. This moving average with 3-year window has at least three advantages. First, it avoids the effect of the large change of SPI in any specific year, and better measures the average level of SPI. Second, executive compensation contracts generally vest over multiple years with three years being the mode (see Bettis et al, 2016), thus using SPI over multiple previous years can be considered when signing a new contract. The results are reported in the Table 2. All

[10] These measures and their construction are discussed in detail in Section 2.

regressions include industry and year fixed effects, and robust standard errors are clustered at the firm level.

Columns 1 and 2 of Table 2 report the results on equity based pay. The equity based pay includes the stocks and options in the compensation package. The results show that the coefficients of PIN and PSI on equity pay are both negative and statistically significant at 1% level. The economic effects are also significant. One standard deviation increase of PSI (PIN) decreases equity pay by 27% (8%). Compared to the effects on total compensation, the effects on equity-based pay are even stronger.

Columns 3 and 4 report the results on total pay. Both PIN and PSI have negative effect on total compensation, and the effects are statistically significant at 1% level. The one standard deviation increase of PSI (PIN) decreases total compensation by 7% (3%). The results verify the negative effect of stock price informativeness on executive compensation.

In the Columns 5 and 6, we further investigate the effect of SPI on the cash pay, which includes the salary and bonus. The coefficients of PIN and PSI are both negative, but only the coefficient of PIN is statistically significant. It indicates that SPI also has negative effect on the cash compensation. But the effect is not as strong as the effect on equity based pay. It is consistent with that cash pay, such as salary, may be more rigid than the equity pay, which makes the equity pay the more variable part of compensation.

4.2 Corporate governance and complementary effect

In this section, we study the SPI effects on compensation of firms with different levels of corporate governance. High SPI decreases the information asymmetry, which theoretically should have a negative effect on optimal compensation. Lower total compensation benefits principals. However, it hurts the managerial pocketbook. The negative effect of SPI on total

compensation is expected to be stronger in firms with better governance, where managers have less power with regards to rent extraction.

To test this hypothesis, we divide our sample into strong and weak governance groups. We use two measures of corporate governance: one is the E-index (Bebchuk, Cohen, and Ferrell, 2009), and the other is the presence of blockholder. The blockholder is an institutional investor holding more than 5% of shares outstanding. Large shareholders have stronger monitoring motive and improve the corporate governance (Shleifer and Vishny, 1986). We define the strong-governance group as the firms with at least one blockholder, and weak-governance group as firms without blockholder. Alternatively, based on E-index, the strong (weak)-governance group is defined as the firms with E-index below (above) the median in a year. We then regress the total compensation on the SPI measures separately for strong governance and weak governance groups. The regression settings and control variables are the same as those in Table 2. The results are shown in Table 3.

The results based on the presence of E-index (blockholder) are in the top (bottom) panel of Table 3. We find that SPI mainly affects firms with strong governance. For example, in the top panel of Table 3, PIN is significant in the strong-governance group (E-index below the median), but not the weak governance group. It indicates the complementary role of corporate governance: together with strong governance, SPI affects total compensation and benefits principals.

5. Equity based pay and SPI

In this section, we investigate how the SPI effect on equity-based pay varies with firm characteristics. We consider three firm characteristics: financial constraints, product market

competition, and diversification. The cross-sectional variations of these characteristics are expected to influence the SPI effect on equity-based pay.

5.1 Financial constraints

Financial constraints affect the relationship between SPI and equity-based pay. The previous evidence shows that firms with higher SPI use less equity-based pay. The cost of equity-based pay can be higher in some firms than in others. Given the level of SPI, we expect firms where the equity-based pay is more costly to have stronger motives to cut equity-based pay because it provides a relatively larger benefit to principals. Financial constraints increase the cost of equity-based pay. The reason is as follows. Financial constraints mean that it is more difficult for a firm to access external financing when a valuable investment opportunity appears. To a financially constrained firm, ceteris paribus, its prospects are less likely to be realized, which makes managers more reluctant to accept equity-based pay and/or require a higher premium for accepting equity-based pay. Therefore, the cost of equity-based pay is higher for financially constrained firms. In our main results we find that higher SPI leads to less risk-sharing and higher incentives for the principal to decrease equity-based compensation. Consistent with those results, here we find that the principal will decrease the equity-based compensation to a larger degree when it is more expensive as it is for financially constrained firms. We expect that financial constraint amplifies the negative effect of SPI on equity based pay.[11]

We use four measures of financial constraints: firm size, bond rating, commercial paper rating, and Whited-Wu index (Whited and Wu, 2006). Firm size is measured by the logarithm of total assets. Small firms are more likely to be financially constrained. Firms having no access to

[11] In this section we focus on how financial constraints amplify the effect of SPI on equity-based pay, rather than the effect of financial constraints on equity-based pay. Financially constrained firms might rely more on equity-based pay because of low liquidity. However, the literature shows mixed evidence on it. For example, Core and Guay (2001) show that financially constrained firms use more stock options to pay nonexecutive employees. Ittner, Lambert, Larcker (2003) shows that firms with higher cash flows use more equity-based pay.

the public debt market are more likely to be financially constrained. We define a dummy variable *fc_bond* (*fc_cp*), which equals to 1 if the firm has no S&P bond (commercial paper) ratings, and 0 otherwise (Almeida, Campello, and Weisbach, 2004; Denis and Sibilkov, 2010). The Whited-Wu index is constructed as in Whited and Wu (2006), and firms with larger Whited-Wu index are more likely to be financially constrained. Following the literature on financial constraints, we drop the financial and utility firms (Denis and Sibilkov, 2010) from these tests.

To study the amplification effect of financial constraints, we focus on the interaction between the SPI and the financial constraint measures. The results are shown in Table 4. We have four financial constraint measures and two SPI measures, which provide eight interaction items in total. Accordingly, in all eight regressions, the coefficients of the interaction items indicate that financial constraint amplifies the effect of SPI on equity based, and six out of the eight coefficients are statistically significant at least at 10% level.

Columns 1 and 2 show the results for firm size as the financial constraint measure. The interactions have positive coefficients, which imply that the negative effect of SPI on equity-based pay is weaker for larger firms (financially unconstrained). Put differently, the effect is stronger for smaller firms, which are more likely to be financially constrained. The coefficients on the interaction terms in Columns 3 to 8 are all negative, which shows that the financial constraint amplifies the effect of SPI on equity based pay. For example, Columns 5 and 6 shows the results for the financial constraint dummy based on commercial paper ratings. Its interactions with PIN and PSI are both negative and statistically significant at 1% level. The results in Table 4 provide strong support to the hypothesis that financial constraints amplify the negative effect SPI has on equity-based pay.

5.2 Product market competition

The effect SPI has on equity-based pay is expected to be stronger for firms with less product market competition. Product market competition makes the manager's efforts more observable to principals because competition makes firm performance more transparent (Hart, 1983). Managerial effort in firms with less competition is less transparent to principals. This implies SPI plays a more important role in firms with less competition. Said another way, SPI is a substitute for competition. Both of, SPI and competition, make the manager's efforts more visible to the principal.

We expect that the effect SPI has on equity-based pay should be stronger in firms with weaker product market competition (substitution effect). In firms with low competition, the principal cannot learn about the agent's effort through the competition channel, thus being able to do so through the SPI channel becomes more important.

We use three different measures of product market competition. The first is the product market fluidity (Hoberg, Phillips and Prabhala, 2014), which measures how intensively the product market around a firm is changing in each year. The second is industry HHI, and the third is the industry product similarity (Hoberg and Phillips 2016), where the industry is the 10-K text-based network industry classification (TNIC)[12]. We define a dummy variable Low_Fluidity (Low_similarity), which equals 1 if the fluidity (product similarity) is below the median in a year, and 0 otherwise. We define a dummy variable High_HHI, which equals 1 if the HHI is above the median in a year, and 0 otherwise. The value 1 for each of these three dummies indicates that a firm has relatively low product market competition.

To investigate how product market competition influences the SPI effect on equity based pay, we focus on the interactions between the competition dummies and the SPI measures. We expect the coefficients of the interaction terms to be negative, which indicates that the

[12] We are grateful to Hoberg and Phillips for providing the measures at the Hoberg-Phillips data library.

negative effect of SPI on equity-based pay is amplified in firms with less product market competition. The results are shown in Table 5.[13] The regression results provide strong support to our hypothesis on competition. The coefficients of all six interaction items are significantly negative. For example, Column 1 shows the result of the interaction between Low Fluidity and PIN. The coefficient of the interaction is -1.222 and statistically significant at 1% level. It indicates that the effect of PIN on equity-based pay mainly concentrates in low competition firms, while the effect in high competition firms is trivial. The results for PSI also confirm that the SPI effect on equity-based pay is stronger for firms with less product market competition.

5.3 Diversification

Corporate diversification can influence the effect SPI has on equity-based pay. In a multi-project firm, Paul (1992) shows that equity-based pay makes compensation less efficient because equity-based pay puts higher weights on projects where the managers' effort is less observable. The reason is that the stock price reflects the value of the firm, not the value added by the managers. This implies that the equity-based pay is more likely to be inefficient when firms have more projects. Therefore, we expect the negative effect of SPI on equity-pay to be stronger in the firms with more business segments (more diversified). Specifically, the interaction between SPI and the number of segments is expected to have a negative impact on the percent of equity-based pay in the total compensation. The results are shown in Table 6.

Columns 1 and 2 show that both PIN and PSI reduce the percent of equity-based pay. The result for our tests which include the number of segments as a measure of diversification are shown in Column 3 (4). The coefficient of the interaction between PIN (PSI) and the number of segments is negative and statistically significant at 1% (5%) level. It indicates that more

[13] Our results are robust when using the TNIC industry classification for the fixed effect in the regressions. The results are listed in the online appendix Table IA 4.

diversified firms use less relatively equity based pay in the compensation. Diversification amplifies the effect of SPI on the relative equity based pay in the compensation.

6. Complexity of compensation

Stock price informativeness (SPI) can decrease the complexity of the compensation. In recent years, the compensation package becomes more and more complex. This additional and increasing complexity makes it more difficult for investors to understand managerial compensation structure and design. However, as SPI makes the managers' effort more observable, the demand for complex compensation packages is lower. In an extreme case, if a manager's efforts are perfectly observable, he should be paid only using cash as his salary is based only on working hours with no complex incentive structure required. As such, we expect SPI to decrease compensation complexity.

We use four proxies of compensation complexity. The first is the percentage of cash pay in the compensation. Compared to equity-based pay, cash pay is a simpler and more direct method to pay managers. Intuitively, a higher percentage of cash pay is relatively less complex. The second proxy is the duration of executive compensation, which reflects the vesting periods of different pay components (Gopalan, Milbourn, Song, and Thakor, 2014). Generally, the longer the pay duration is, the more complex the compensation package tends to be. The third proxy is *TDC1 complexity*, which is the dispersion of total compensation among different components of pay (Albuquerque, Carter, and Lynch, 2015). First calculate the Herfindahl Index of the proportions of each component of total compensation. A high Herfindahl Index indicates that only a few components dominate the pay package. Then *TDC1 complexity*, the dispersion, is defined as 1 minus this Herfindahl Index. A high dispersion means that more components are used and plan relative important role, which indicates high complexity of the pay. The fourth

proxy is the usage of compensation consultants. Compensation consultants are often criticized to be responsible for the level complexity in compensation packages. We define a dummy variable, which equals to 1 if a firm uses a compensation consultant and 0 otherwise. Firms using compensation consultants are more likely to have more complex compensation.

The results are reported in Table 7. Columns 1 and 2 show the relationship between SPI and the percentage of cash pay. Both PIN and PSI have positive and statistically significant coefficients. They indicate that SPI increases the use of cash as the payment method in the compensation, which makes the compensation less complex. Columns 3 and 4 display results for the relationship between SPI and pay duration. Column 3 shows that PIN has a negative effect on the pay duration, and the coefficient is statistically significant at 1% level. Column 4 shows a consistent result for PSI. These results indicate that SPI decreases pay duration, which in turn makes compensation less complex. Furthermore, executives with longer pay durations have higher total compensation (Gopalan, Milbourn, Song, and Thakor, 2014), the evidence here is consistent with our previous results that SPI decreases the executive compensations. Columns 5 and 6 show the results for the dispersion of total compensation (*TDC1 complexity*). Both PIN and PSI decrease the dispersion, and the coefficients are statistically significant at 1% level. They provide strong support that SPI decreases the compensation complexity. Columns 7 and 8 present the results of logistic regressions which test for a relationship between SPI and the usage of compensation consultants. Both PIN and PSI have negative coefficients, which indicate that firms with high SPI are less likely to use compensation consultants. This is consistent with SPI decreasing compensation complexity.

7. Performance based pay

US firms increasingly tie managerial pay to explicit performance metrics, such as a specific earnings or sales target (Bennett, Bettis, Gopalan, and Milbourn, 2016; Li and Wang, 2016). The performance-based pay may offer strong incentives, but it can also have a dark side. In general, investors complain that performance based pay, especially the long-term performance-based pay, makes the compensation too complex to understand.[14] Performance-based pay can also incentivize managerial manipulation of firm characteristics to achieve these performance targets, which is not consistent with maximizing shareholder value (Bennett, Bettis, Gopalan, and Milbourn, 2016). Because SPI improves the observability of managerial effort, fewer incentive instruments are needed in the optimal compensation package. Thus, we expect SPI to reduce the demand for performance-based pay, especially long-term or accounting performance-based pay.

To investigate the effect of SPI on the performance-based pay, we consider the proportion of total compensation that is performance-based, the proportion of long-term performance-based pay, the proportion of the pay based on accounting performance, and finally, the proportion of the pay based on long-term accounting performance. The long-term here refers to the pay that vests in more than one year. We define a dummy *High_PIN* (*High_PSI*), which equals 1 if the PIN (PSI) is in the top quartile and 0 if the PIN (PSI) is in the bottom quartile. The *High_PIN* (*High_PSI*) is expected to have negative effect on the performance based pay. The results are shown in Table 8.

Columns 1 and 2 of Table 8 show the results for the proportion of performance based pay in the total compensation. Column 1 (2) shows that the coefficient of *High_PIN* (*High_PSI*) is negative and statistically significant at 10% (5%) level. It indicates that firms with higher PIN have smaller proportion of performance based pay. Columns 3 and 4 show the results for the

[14] https://www.ft.com/content/9265406a-eaaf-11e4-96ec-00144feab7de

proportion of long-term performance-based pay. Both *High_PIN* and *High_PSI* are negative and significant at 5% level which indicates that the long-term performance-based pay is significantly reduced by SPI. Columns 5 and 6 focus on the proportion of accounting performance-based pay. The coefficients of both SPI measures are negative and statistically significant at 5% level, which indicates that when SPI is higher, the reliance on accounting performance in compensation is lower. Columns 7 and 8 shows the results for the proportion of long-term accounting performance-based pay. The coefficients of the SPI measures are once again negative and statistically significant at 5% (10%) level. In the unreported analysis, we consider the proportion of short-term accounting performance based pay. It turns out that the coefficients of *High_PIN* and *High_PSI* are both insignificant at conventional levels. It implies that the effect of SPI on accounting performance based pay concentrates in the long-term accounting performance based pay. All evidence in Table 8 indicates that SPI decreases the use of performance based pay, especially the long-term and accounting performance-based pay. These findings are consistent with the results in the previous section that SPI decreases the complexity of compensation.

8. Efficiency of compensation

SPI decreases total and equity-based compensation, which may benefit the principals. Does lower equity-based pay have negative effects the incentives of managers? In this section, we study the effect SPI has on compensation efficiency. First, we investigate how delta and vega of the compensation are affected, and the potential reasons. Second, we investigate how the perquisite compensation is affected by SPI. Third, we study how SPI affects pay for luck/skill of the compensation.

8.1 Incentive design

Compensation is designed to align the interest of agents and principals. Equity-based pay generally serves as an incentive instrument. Equity-based pay incentives can be affected by the level and the structure of equity-based pay. The level of the equity-based pay generally strengthens the incentive. Similarly, the structure of the equity-based pay also matters because for the same dollar amount, different components can provide different or stronger incentives. For example, stock options can provide stronger incentives than the same dollar amount of stock. We know, from earlier tests, that SPI decreases the level of equity-based pay. But we are, as of yet, unsure of its effects on the equity-based pay structure.

We first investigate the effect of SPI on pay-performance sensitivity (delta) and the convexity of the compensation (vega). The results are shown in Columns 1 to 4 in Table 9. Column 1 shows that the coefficient of PIN is positive and statistically significant at 1% level. And the result on PSI in column 2 is consistent. These results indicate that SPI increases the pay-performance sensitivity. Columns 3 and 4 show that the SPI effects on vega are weak. The coefficient of PIN is not significantly different from zero, and PSI shows a positive significant effect on vega. This indicates that SPI has relatively weak effect on the convexity of the total compensation, and this effect is likely to be positive. At first glance, these results on delta and vega are not very intuitive. A negative effect on delta and vega might be expected, as SPI decreases the usage of equity based pay. We further investigate this seemly puzzling phenomenon by looking at the different components of equity pay. Specifically, we study the ratio of options granted to the restricted stock awarded. Relatively more options in the equity pay increases the convexity of equity pay. The relevant results are shown in Columns 5 and 6 of Table 9.

The results show that both PIN and PSI have significantly positive effects on the ratio of option pay to restricted stock pay. It indicates that SPI increases the convexity of equity pay by using relatively more options. This explains our results on delta and vega. Higher SPI encourages the board to use option pay more aggressively (because of more informative stock prices); even though the level of the total equity pay is lower. This aggressiveness, or higher convexity of equity based pay, guarantees the convexity of total compensation is unchanged and provides stronger incentive for managers. It strongly supports that the SPI increases the incentive of managers even when the compensation level is lower. It reflects the concerns of the board when decreasing equity pay due to higher SPI. Higher SPI makes it less necessary to share the loss risk with managers. But simply decreasing equity pay may discourage managers to take on riskier projects (lower vega) and make managers concentrate on safer and routine projects. This more conservative path may be less likely to maximize shareholder value. Thus, to encourage managers to pursue risky and more profitable projects, at least to keep similar level of vega in the total compensation, the board has to adjust the structure of equity based pay, i.e. use a higher proportion of options to increase the convexity of equity based pay.

Another way SPI may affect equity-based compensation incentives is through stock price-related performance-based pay. For example, the managers can only receive the relevant part of the pay if the stock price (return) is above a certain goal level. When SPI is higher, the stock price provides more useful information and should be relied more in the performance-based pay. We measure this reliance by the proportion of performance-based pay linked to stock price. The results are shown in Columns 7 and 8 in Table 9.

The results show that both PIN and PSI have significantly positive effect on the proportion of performance-based pay linked to the stock price. It indicates that SPI increases the usage of stock price performance-based pay, which increases the pay-performance sensitivity.

8.2 Perquisites

SPI may also improve the efficiency of compensation by cutting the perquisite component of the managerial compensation. Managers can enjoy the perquisites by misusing the resources of the firms, which destroys the shareholder value. SPI improves the observability of managers' actions, and thus makes managers less likely to demand higher perquisites. We expect SPI to reduce CEO perquisites. To test this, we regress the logarithm of perquisites on SPI measures. The results are shown in Table 10.

Column 1 shows the result for PIN. The coefficient of PIN is negative and statistically significant at 5% level. The economic impact is also significant. One standard deviation increase of PIN decreases perquisites by 11%. Column 2 shows the result for PSI, which is consistent with the result for PIN in Column 1. One standard deviation increase of PSI decreases perquisites by 19%. The results indicate that SPI decreases the perquisites by increasing the observability of managers' actions. Once again, SPI increases compensation efficiency while decreasing total compensation.

8.3 Pay for luck/skill

In our next tests, we determine if SPI can increase compensation efficiency by improving the mix of pay for skill and luck. In an efficient compensation package, the manager should only be paid for their efforts or skills, rather than by luck. Higher SPI indicates that more firm-specific information, including the effort and skills of managers, are incorporated in the stock prices. Therefore, as SPI increases the observability of managers' effort and skills, we expect SPI to

decrease pay for luck and increase pay for skill. To test this hypothesis, we classify firms with PIN (PSI) in the top quartile by year as high SPI firms, and firms with PIN (PSI) in the bottom quartile by year as low SPI firms. We investigate the effect SPI has on pay for luck/skill in Table 11.

We measure luck as the predicted firm stock return when regressing firm returns on industry returns, where the industry is defined by 2-digit SIC codes. We measure skill as the residual from the same regression. This method is from Garvey and Milbourn (2006). Column 1 shows the result for firms with high PIN, and Column 2 shows the result for firms with low PIN. These results show compensation of CEOs in firms with high (low) PIN are paid for skill (luck). Columns 3 and 4 show the same analysis for PSI instead of PIN. The results are consistent with those in Columns 1 and 2. Column 3 shows that CEOs in the high PSI firms are paid for skill but not for luck while Column 4 shows that CEOs in the low PSI firms are paid for luck but not for skill. All in all, the evidence in Table 11 shows that SPI improves the efficiency of compensation by encouraging pay for skill and discouraging pay for luck.

9 Endogeneity and further robustness tests

In this section, we run robustness tests for the effect of SPI on executive compensation. First, we apply an alternative PIN measure proposed by Duarte and Young (2009). Second, we run 2SLS regressions based on our instrumental variables of SPI. Third, we further include plausibly relevant variables to alleviate the concern of omitted variables. Our results remain robust in all these tests.

9.1 Alternative SPI Measure

As a widely used SPI measure, PIN was recently challenged by Duarte and Young (2009). They argue that besides the information asymmetry, PIN may include a component of

stock liquidity. Accordingly, Duarte and Young construct a refined version of PIN, which is denoted as adjusted PIN (APIN). APIN removes the liquidity component of PIN so that only the portion related to asymmetric information remains. Following the construction of APIN by Duarte and Young (2009), we calculate APIN for our sample period. As the robustness check for our main results, we replace PIN by APIN in the regressions in Table 2. The results of these robustness tests are shown in Table 12.

The results in Table 12 show that APIN has significantly negative effects on equity-based pay, total pay, and cash pay. They are consistent with the main results in Table 2. Furthermore, the effect of APIN on equity-based pay is the strongest among them, with the coefficient almost four times as large as the coefficient for cash pay. It emphasizes that more informative stock price makes risk-sharing equity pay less important. These results show that our findings are robust to the alternative SPI measure, and further support that the stock price informativeness is the driver of lower compensations.

9.2 Instrumental variables and 2SLS

As managers are unlikely to affect the private information in stock prices, our main endogeneity concern is the omitted variable problem. There might be an omitted variable which could simultaneously drive executive compensation and stock price informativeness. We use the instrumental variable (IV) methodology to address this endogeneity concern. An ideal instrumental variable should be correlated with the endogenous variable (relevance condition), and can only affect the dependent variable through the endogenous variable (exclusion condition). In our study, SPI is the suspicious endogenous variable, and equity based pay is the dependent variable.

We use two IVs in our 2SLS regressions. The first IV is the average SPI in 2-digit SIC industry (excluding a firm's own 3-digit SIC industry average SPI). This IV follows Bennett, Stulz, and Wang (2017), and is constructed as follows. We first calculate the average SPI within all 3-digit SIC industries. We then take the average of the 3-digit SIC industries within each corresponding 2-digit SIC industry. When taking the average, we exclude the 3-digit SIC industry-level SPI for a firm, if the firm is in this 3-digit SIC industry.[15] Then we use the average of this 2-digit SIC industry-level SPI across the previous three years (t-3 to t-1) as our IV. We expect this IV to be positively related to the firm's SPI, because SPI of firms in an industry tends to have common components. In the meanwhile, this IV excludes the possible SPI learning/spillover effect among close competitors, which makes it unlikely to affect the equity based pay through the channel other than the common component of SPI in a wider industry.

The second IV is a geographic indicator variable HQ, which equals to one if a firm headquarter in the previous year locates in a state with financial centers, and zero otherwise. The list of financial centers includes New York and Chicago. Accordingly, if a firm's headquarter in the previous year is in the state of New York or the state of Illinois, the HQ dummy equals to one. Otherwise the HQ dummy equals to zero. Compustat reports the address of a firm's current principal executive office, not its historic headquarter location. Ignoring this will lead to bias. To correct for this, we extract historic headquarter states from regulatory filings. Specifically, for each fiscal year, we look up each sample firm's headquarter state as listed in the firm's most recent 10-Q prior to the fiscal year-end. Our HQ dummy is defined based on this corrected HQ location. As more professional traders work in states with financial centers, it is less costly to collect information on firms in the same states. So the HQ dummy is expected to have a positive

[15] As an example, consider a dental equipment firm (3 digit SIC = 384). Its instrument would be constructed as the average of the SPI in the following 3 digit SIC industries: 380, 381, 382, 383, 385, 386, 387, 388, 389.

effect on SPI. In the meanwhile, it is unlikely for this geographic IV to affect the use of equity based pay in the executive compensation package. We run 2SLS regressions for the IV tests. The results are shown in Table 13.

Columns 1, 3, and 5 show the first stage regressions for PIN, PSI, and APIN. The results are consistent with our prediction that our both IVs are positively correlated with the SPI. In the first stage, the *F*-statistics are 70.67, 161.47, and 57.59 for PIN, PSI, and APIN as shown in Columns 1, 3, and 5 accordingly. It indicates that our IVs strongly relate with the SPI measures.

The second stage results are reported in Columns 2, 4, and 6 of Table 13. The dependent variable is the logarithm of equity-based pay. The coefficients of the instrumentalized SPI (fitted value from the first stage) are negative and statistically significant. The p-values of the Hansen J tests indicate that our IVs satisfy the requirement of exclusion condition, as shown in the Columns 2, 4, and 6 accordingly. Together with the *F*-tests in the first stage, this is evidence that our IVs are valid. The results in the second stage confirm that the negative effect of SPI on equity-based pay remains after considering the possibility that the SPI is endogenous. Omitted variables are unlikely to explain the link between SPI and compensation.

9.3 Event study: SPI and compensation of managers switching firms

In this section we focus on the managers who switch jobs to a new company. If a manager switches to a firm with more informative stock price, would she like to take a pay cut (or less of a rise than the average changer)? Focusing on these events helps us capture more variation of stock price informativeness. This variation of SPI is mainly due to the change of firms where the managers work in, rather than the internal change within firms. A potential concern is that the managerial decision of changing jobs is not completely exogenous. But it is less likely for managers to change jobs due to the direct consideration of stock price

informativeness. We control for manager fixed effect by using the first difference of all variables in our regressions. Manager fixed effect eliminates the contamination of all time-invariant manager-specific omitted variables. The first differences of the control variables, such as the differences of ROA, Tobin's Q, and Sales growth, capture the changes of firm characteristics between the old and new firms.

When we focus only on CEOs switching firms, the sample size is dramatically decreased. We can only identify eleven CEOs who switched to new firms in the following year in our original sample. To carry out regression analysis, we enlarge our scope to all named executive officers (NEOs) in Execucomp. We investigate how the change in SPI affects these executives' compensation. The SPI of firms is measured by the average SPI across the previous three years (t-3 to t-1). The first difference of SPI (new minus old) measures the SPI changes from the old firms to new firms. We expect executives would like to accept lower equity based pay and total pay due to less risk sharing. The results are reported in Table 14.

Columns 1 and 2 show the results for the change of equity based pay. The changes of PIN and PSI both have significantly negative effect on the equity based pay. It indicates that when a manager moves to a new firm with more informative stock price, she accepts less equity pay and shares less risk of loss with shareholders. The less risk-sharing leads to lower total pay, as shown in Columns 3 and 4. The cash pay is relatively sticky, and we observe the negative effect of PIN but not of PSI, as shown in Columns 5 and 6. The evidence of this event study echoes our main findings in Table 2. More informative stock prices lead to lower equity based pay and lower total pay.

9.4 Other robustness tests

We further carry out robustness tests for the relevant concerns and report the results in the online appendix. Our results are robust in these additional tests. For example, in the years of CEO turnover, insider trading may be more active and make the stock price more informative. Meanwhile, CEO compensation may be low due to the bad performance. It could drive the negative effect of SPI on compensation. As such, we use a dummy variable to control for CEO turnover as a robustness check. The results are shown in the online appendix Table IA 1, which indicates the SPI effect on compensation is quite robust[16].

We consider more factors in the stock market, such as the short interest and the share turnover. The short interest reflects the market pressure from investors with negative opinions on the firm. It could be the case that short interest is the omitted variable driving both high SPI and low CEO compensation. To address this concern, we control for short interest. Jayaraman and Milbourn (2012) find that stock liquidity can affect executive compensation. Holmstrom and Tirole (1993) find the amount of information in the stock price is affected by stock liquidity, which facilitates the market monitoring. Stock liquidity could be a candidate of omitted variable in our original setting. We thus include share turnover to address this concern. It turns out that the SPI effect of compensation is robust to the inclusion of the short interest and share turnover. The results are shown in the online appendix Table IA 2.

We consider some general changes of the firm characteristics, such as the risk and the market capitalization. When a firm becomes less risky, managers may deserve a lower compensation, and insiders may be more confident on their private information used for trading. When a firm becomes larger, managerial compensation may increase. At the same time, SPI may decrease because firm size has a negative effect on SPI (Ferreira and Laux, 2007). This might

[16] In another unreported test, we separate our sample into firm-years with CEO turnover and firm-years without CEO turnover. Our results are robust in both subsamples.

lead to the negative association between SPI and managerial compensation. Besides controlling for firm size, we further control for the change of the log of market capitalization and the change of systematic risk (measured by the change of the market beta in a CAPM model). Our results remain robust and are shown in the online appendix Table IA 5.

10. Conclusions

In this paper, we study the effect of stock price informativeness (SPI) on the managerial compensation. We find that SPI has comprehensive effects on the level, complexity, and efficiency of compensation. SPI makes managerial actions more transparent to principals. It decreases both total and equity-based pay. Corporate governance is crucial to the effect of SPI on the level of total compensation. We find the effect of SPI is concentrated in firms with better governance.

As SPI is related to stocks, we investigate its effects on equity-based pay. We find financial constraints, product market competition, and corporate diversification can affect the relationship between SPI and equity-based pay. SPI decreases compensation complexity. Specifically, we find that SPI increases the percent of cash pay, decreases compensation duration and dispersion, and makes firms less likely to hire compensation consultants. SPI also decreases the use of performance-based pay, especially the long-term and accounting performance-based pay.

SPI improves the efficiency of compensation. It has a positive effect on pay-performance sensitivity. SPI encourages firms to rely on the stock prices more aggressively in their compensation design, such as more option pay relative to stock pay, and more stock price performance-based pay. SPI decreases managerial perquisites and discourages managers from misusing corporate resources. SPI also affects pay for luck/skill. We find evidence of pay for

luck in low SPI firms and pay for skill in high SPI firms. The evidence that SPI affects executive compensation verifies one channel through which the financial market has real effects on corporate behaviors and the economy.

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Appendix: definition of variables

PIN	Probability of informed trading following Easley, Hvidkjaer, and O'Hara (2002). We use the average of the previous three years in our analysis. More details are in Section 2.1 of this paper
PSI	Stock price non-synchronicity following Durnev, Morck, and Yeung (2004). We use the average of the previous three years in our analysis. More details are available in Section 2.2 of this paper
Log(Total Compensation)	the natural log of total compensation
Log(Cash Compensation)	the natural log of the sum of salary and bonus
Log(Equity Compensation)	the natural log of total compensation less salary and bonus
Log(Perquisite Compensation)	the natural log of perquisite compensation
Cash Comp/Total Comp	the ratio of salary and bonus to total compensation
Pay Duration	the weighted average of the vesting periods of the different components of executive pay (including salary, bonus, restricted stocks, and stock options), with the weight for each component being the fraction of that component in the executive's total compensation package as calculated in Gopalan, Milbourn, Song, and Thakor (2014)
Comp Consultant	a dummy variable equal to one if the firm uses a compensation consultant and zero otherwise
Log(Assets)	the natural log of (total) book assets
Blockholder	a dummy variable equal to one if the firm has at least one institutional owner of more than 5% and zero otherwise
E-Index	the entrenchment index as calculated in Bebchuk, Cohen and Ferrell (2009)
R&D/Assets	the ratio of Research and Development (R&D) expenditures to the book value of total assets
ROA	the ratio of net income to (total) book assets
Tobin's Q	the sum of total assets plus market value of equity minus book value of equity divided by total assets
Cash/Assets	the ratio of cash and short term assets to the book value of total assets

Debt/Assets	the ratio of the sum of long-term and short-term debt to the book value of total assets
Sales Growth	the percentage change in revenue with respect to the previous fiscal year
Institutional Ownership	the total shares held by institutions (Thomson Reuters) divided by the total shares outstanding.
Stock Return	the one-year percentage return for the firm's stock over the previous fiscal year
Stock Volatility	the stock return volatility calculated as the annualized volatility of daily stock returns during the previous year
Firm Age	the number of years since a stock first appears in CRSP
Number Segments	the number of different/unique business segments
FC-Bond (Table 4)	a financial constraint dummy variable equal to one if a firm has outstanding debt but no S&P bond rating or has a bond rating of D or SD and zero otherwise
FC-CP (Table 4)	a financial constraint dummy variable equal to one if a firm has outstanding debt but no S&P commercial paper rating or has a commercial paper rating of D or SD and zero otherwise
Whited Wu Index (Table 4)	the financial constraint measure as calculated in Whited and Wu (2006)
Fluidity (Table 5)	the text-based measure of product market competition variable as calculated in Hoberg, Phillips, and Prabhala (2014)
Similarity (Table 5)	the text-based firm-level similarity measure as calculated in Hoberg and Phillips (2016)
TNIC HHI (Table 5)	the text-based firm-level herfindahl/concentration measure as calculated in Hoberg and Phillips (2016)
TDC1 Complexity of CEO Pay (Table 7)	equal to 1 minus the TDC1 Herfindahl Index of the proportions of all components in the total compensation (Albuquerque, Carter and Lynch 2015). The Herfindahl index is $\sum_{x \in C} \left(\frac{x}{TDC1}\right)^2$, where TDC1 is the total compensation for CEO, and C={Salary, Bonus, Non-equity incentives, fair value of option awards, fair value of stock awards, other compensation, aggregate amount of deferred compensation}.
Performance-Vesting (PV) Pay (Table 8)	the portion of the CEOs compensation that is tied to specific performance measures

Long-Term PV (LT PV) Pay (Table 8)	the portion of the CEOs compensation that is tied to specific performance measures which vests in more than 12 months
Accounting PV (Acctg PV) Pay (Table 8)	the portion of the CEOs compensation that is tied to specific accounting performance measures (such as EPS, ROA, etc)
LT Accounting PV Pay (Acctg LT PV) (Table 8)	the portion of the CEOs compensation that is tied to specific accounting performance measures which vests in more than 12 months
Delta (Table 9)	the dollar change in the CEO's firm related wealth associated with a 1% change in the firm's stock price as calculated in Core and Guay (2002)
Option Comp/Stock Comp (Table 9)	the ratio of option compensation to stock compensation
Stock PV (Stock PV Pay) (Table 9)	the portion of the CEOs compensation that is tied to specific accounting performance measures (such as EPS, ROA, etc)
Ind Return (Table 11)	the predicted (luck) return as calculated in Garvey and Milbourn (2006)
Ind-Adj Return (Table 11)	the residual (skill) return as calculated in Garvey and Milbourn (2006)

Table 1: Summary Statistics

This table presents summary statistics for CEO compensation, stock price informativeness (SPI) and firm characteristics. The sample consists of all firms in Execucomp and Compustat for which SPI and compensation data is available for the years 1994 – 2015 inclusive. All variables are winsorized at the 1st and 99th percentile values. Variable definitions are as defined in the Appendix.

Variable	**Mean**	**p25**	**p50**	**p75**	**SD**	**N**
PIN	0.176	0.120	0.159	0.208	0.087	35,005
PSI	1.286	0.331	1.143	2.141	1.321	33,652
Log(Total Compensation)	7.884	7.151	7.908	8.644	1.048	35,005
Log(Cash Compensation)	6.760	6.349	6.753	7.156	0.718	35,005
Log(Equity Compensation)	6.948	6.151	7.406	8.374	2.066	35,005
Log(Perquisite Compensation)	3.812	2.555	3.932	5.101	1.824	35,005
Log(Assets)	7.552	6.329	7.454	8.692	1.691	34,993
Cash Comp/Total Comp	0.427	0.189	0.357	0.618	0.284	34,945
Pay Duration	0.971	0.014	0.900	1.431	0.910	11,432
Comp Consultant	0.583	0	1	1	0.493	7,220
Blockholder	0.899	1	1	1	0.302	35,005
E-Index	2.987	2	3	4	1.507	26,169
R&D/Assets	0.028	0	0	0.027	0.068	35,005
ROA	0.027	0.012	0.044	0.083	0.214	32,483
Tobins Q	1.956	1.159	1.504	2.173	1.511	32,387
Cash/Assets	0.133	0.016	0.063	0.189	0.168	34,993
Debt/Assets	0.234	0.062	0.210	0.348	0.213	34,885
Sales Growth	0.120	-0.008	0.075	0.183	0.375	34,931

Table 2: Compensation and Stock Price Informativeness

This table presents panel regressions of the log of total, cash, and equity compensation on stock price informativeness and other firm-level controls. The sample includes CEOs from 1994-2015. Stock price informativeness is measured by the probability of information-based trading (PIN) and stock price nonsynchronicity (PSI). In our regression we use the average PIN or PSI across the previous three years. All specifications include industry and year fixed effects. Robust standard errors are clustered at the firm level. Variable definitions are as defined in the Appendix.

	(1) Log(Equity Comp)	(2) Log(Equity Comp)	(3) Log(Total Comp)	(4) Log(Total Comp)	(5) Log(Cash Comp)	(6) Log(Cash Comp)
PIN	-0.654***		-0.223***		-0.285***	
	[-3.49]		[-2.69]		[-4.35]	
PSI		-0.150***		-0.037***		-0.004
		[-7.11]		[-3.87]		[-0.47]
Log(Assets)	0.669***	0.617***	0.466***	0.456***	0.254***	0.259***
	[41.22]	[32.89]	[56.77]	[46.47]	[37.97]	[32.11]
R&D/Assets	2.168***	1.973***	0.788***	0.741***	0.189	0.199
	[6.15]	[5.84]	[4.80]	[4.61]	[1.36]	[1.45]
ROA	0.390***	0.383***	0.132***	0.127***	0.153***	0.150***
	[4.13]	[4.11]	[2.68]	[2.61]	[2.78]	[2.73]
Tobin's Q	0.103***	0.095***	0.085***	0.083***	0.018***	0.019***
	[6.04]	[5.69]	[10.99]	[10.92]	[3.41]	[3.62]
Cash/Assets	0.325*	0.333**	0.341***	0.339***	-0.169***	-0.183***
	[1.95]	[2.02]	[4.53]	[4.45]	[-2.97]	[-3.17]
Debt/Assets	0.006	0.094	-0.019	-0.001	-0.04	-0.046
	[0.06]	[0.89]	[-0.38]	[-0.03]	[-0.97]	[-1.10]
Sales Growth	0.066*	0.068*	0.059***	0.060***	-0.003	0.001
	[1.84]	[1.87]	[3.25]	[3.25]	[-0.17]	[0.05]
Ind FE	Y	Y	Y	Y	Y	Y
Yr FE	Y	Y	Y	Y	Y	Y
Observations	32,233	30,909	32,233	30,909	32,233	30,909
R-squared	0.324	0.326	0.508	0.508	0.383	0.385

Table 3: Governance and Stock Price Informativeness: Complementary Effect

This table presents panel regressions of different components of pay on stock price informativeness and other firm-level controls. The sample includes all CEOs from 2006-2015. Yes/No Blockholder is for the subsample with/without blockholder, where blockholder is defined as the institutional investors holding more than 5% of shares outstanding. High/Low E-Index is above/below median E-Index in a given year. Stock price informativeness is measured by the probability of information-based trading (PIN) and stock price nonsynchronicity (PSI). In our regression we use the average PIN or PSI across the previous three years. All specifications include industry and year fixed effects. Robust standard errors are clustered at the firm level. Variable definitions are as defined in the Appendix.

	(1)	(2)	(3)	(4)
VARIABLES	Log(Total Comp)	Log(Total Comp)	Log(Total Comp)	Log(Total Comp)
E-Index	Low	High	Low	High
PIN	-0.292**	-0.052		
	[-2.12]	[-0.45]		
PSI			-0.029*	-0.018
			[-1.88]	[-1.27]
Other Controls	Y	Y	Y	Y
Ind FE	Y	Y	Y	Y
Yr FE	Y	Y	Y	Y
Observations	14,344	9,822	13,761	9,407
R-squared	0.515	0.548	0.514	0.549

	(1)	(2)	(3)	(4)
VARIABLES	Log(Total Comp)	Log(Total Comp)	Log(Total Comp)	Log(Total Comp)
Blockholder	Yes	No	Yes	No
PIN	-0.212**	-0.271		
	[-2.55]	[-1.01]		
PSI			-0.038***	-0.01
			[-3.77]	[-0.40]
Other Controls	Y	Y	Y	Y
Ind FE	Y	Y	Y	Y
Yr FE	Y	Y	Y	Y
Observations	29,083	3,150	27,854	3,056
R-squared	0.496	0.624	0.496	0.622

Table 4: SPI, Equity Pay & Financial Constraints

This table presents panel regressions of the log of equity compensation on stock price informativeness interacted with measures of financial constraints and other firm-level controls. The sample includes CEOs from 1994-2015 in nonfinancial and non-utility firms. Stock price informativeness is measured by the probability of information-based trading (PIN) and stock price nonsynchronicity (PSI). In our regression we use the average PIN or PSI across the previous three years. All specifications include all controls used in Table 3, but for brevity we suppress their coefficients. All specifications include industry and year fixed effects. Robust standard errors are clustered at the firm level. Variable definitions are as defined in the Appendix.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VARIABLES	Log(Equity)	Log(Equity)	Log(Equity)	Log(Equity)	Log(Equity)	Log(Equity)	Log(Equity)	Log(Equity)
Log(Assets) x PIN	0.280*							
	[1.77]							
Log(Assets) x PSI		0.036***						
		[4.05]						
FC-Bond x PIN			-0.225					
			[-0.57]					
FC-Bond x PSI				-0.069**				
				[-2.38]				
FC-CP x PIN					-1.468***			
					[-3.75]			
FC-CP x PSI						-0.112***		
						[-3.91]		
WW-Index x PIN							-2.127	
							[-0.87]	
WW-Index x PSI								-0.402***
								[-2.67]
PIN	-2.630**		-0.630**		0.52		-1.410*	
	[-2.42]		[-2.20]		[1.57]		[-1.73]	
PSI		-0.432***		-0.166***		-0.105***		-0.326***
		[-6.66]		[-5.81]		[-3.31]		[-5.90]
FC-Bond			-0.204**	-0.125*				
			[-2.39]	[-1.86]				
FC-CP					0.015	-0.094*		
					[0.19]	[-1.72]		
WW-Index							2.688***	2.772***
							[3.18]	[3.69]
Other Controls	Y	Y	Y	Y	Y	Y	Y	Y
Ind FE	Y	Y	Y	Y	Y	Y	Y	Y
Yr FE	Y	Y	Y	Y	Y	Y	Y	Y
Observations	23,341	22,581	20,658	19,995	20,326	19,684	23,318	22,558
R-squared	0.325	0.329	0.343	0.347	0.349	0.353	0.327	0.331

Table 5: SPI, Compensation and Competition

This table presents panel regressions of the log of equity compensation on stock price informativeness interacted with measures of competitiveness and other firm-level controls. The sample includes CEOs from 1994-2015 in nonfinancial and non-utility firms. Stock price informativeness is measured by the probability of information-based trading (PIN) and stock price nonsynchronicity (PSI). In our regression we use the average PIN or PSI across the previous three years. Low Fluidity (Low similarity) is an indicator variable which equals 1 if the fluidity (product similarity) is below the median in a year, and 0 otherwise. High HHI is an indicator dummy which equals 1 if the HHI is above the median in a year, and 0 otherwise. The value 1 for each of these three dummies indicates that a firm has relatively low product market competition. All specifications include all controls used in Table 3, but for brevity we suppress their coefficients. All specifications include industry and year fixed effects. Robust standard errors are clustered at the firm level. Variable definitions are as defined in the Appendix.

VARIABLES	(1) Log(Equity)	(2) Log(Equity)	(3) Log(Equity)	(4) Log(Equity)	(5) Log(Equity)	(6) Log(Equity)
Low Fluidity x PIN	-1.222***					
	[-3.23]					
Low Fluidity x PSI		-0.120***				
		[-4.65]				
Low Similarity x PIN			-0.739**			
			[-2.11]			
Low Similarity x PSI				-0.093***		
				[-3.71]		
High HHI x PIN					-0.692**	
					[-2.19]	
High HHI x PSI						-0.054**
						[-2.37]
PIN	-0.191		-0.430		-0.480*	
	[-0.57]		[-1.49]		[-1.84]	
PSI		-0.079***		-0.093***		-0.123***
		[-2.75]		[-3.48]		[-4.98]
Low Fluidity	0.211***	0.145***				
	[3.06]	[3.38]				
Low Similarity			0.028	0.032		
			[0.43]	[0.66]		
High HHI					0.057	0.025
					[1.00]	[0.64]
Other Controls	Y	Y	Y	Y	Y	Y
Ind FE	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y
Observations	25,968	24,884	27,807	26,660	27,807	26,660
R-squared	0.302	0.305	0.307	0.31	0.307	0.309

Table 6: SPI & Number of Segments

This table presents panel regressions of the percentage of equity compensation on the number of segments, stock price informativeness and other firm-level controls. We use the number of segments to proxy for how severe the inefficiency of equity compensation as shown in Paul (1992). The sample includes firms from 1994-2015. Stock price informativeness is measured by the probability of information-based trading (PIN) and stock price nonsynchronicity (PSI). In our regression we use the average PIN or PSI across the previous three years. All specifications include industry and year fixed effects. Robust standard errors are clustered at the firm level. Variable definitions are as defined in the Appendix.

	(1)	(2)	(3)	(4)
VARIABLES	Percent Equity Pay	Percent Equity Pay	Percent Equity Pay	Percent Equity Pay
Num Segments x PIN			-0.069***	
			[-2.59]	
Num Segments x PSI				-0.004**
				[-2.43]
Num Segments			0.009*	0.002
			[1.96]	[0.51]
PIN	-0.069**		0.090*	
	[-2.53]		[1.68]	
PSI		-0.025***		-0.018***
		[-7.91]		[-3.76]
Log(Assets)	0.069***	0.060***	0.071***	0.059***
	[28.82]	[21.73]	[24.51]	[17.74]
R&D/Assets	0.272***	0.247***	0.255***	0.223***
	[4.98]	[4.67]	[4.46]	[4.06]
ROA	0.025	0.025	0.021	0.023
	[1.56]	[1.57]	[1.28]	[1.44]
Tobin's Q	0.016***	0.014***	0.015***	0.013***
	[6.99]	[6.23]	[6.25]	[5.55]
Cash/Assets	0.100***	0.101***	0.096***	0.092***
	[4.33]	[4.39]	[3.73]	[3.62]
Debt/Assets	0.002	0.018	-0.006	0.015
	[0.12]	[1.09]	[-0.33]	[0.81]
Sales Growth	0.007	0.007	0.015***	0.016***
	[1.21]	[1.26]	[2.59]	[2.86]
Firm Age	-0.001***	-0.001***	-0.001***	-0.001***
	[-5.61]	[-5.19]	[-4.24]	[-3.80]
Ind FE	Y	Y	Y	Y
Year FE	Y	Y	Y	Y
Observations	27,638	26,473	20,068	19,315
R-squared	0.289	0.290	0.273	0.275

Table 7: Compensation Complexity and Stock Price Informativeness

This table presents panel regressions of percent cash compensation and pay duration on stock price informativeness and other firm-level controls. Specifications 5 and 6 are logistic regressions using a compensation consultant dummy as the dependent variable. The sample includes CEOs from 2006-2015. Pay duration is calculated following Gopalan, Milbourn, Song, and Thakor (2014). Stock price informativeness is measured by the probability of information-based trading (PIN) and stock price nonsynchronicity (PSI). In our regression we use the average PIN or PSI across the previous three years. All specifications include industry and year fixed effects. Robust standard errors are clustered at the firm level. Variable definitions are as defined in the Appendix.

VARIABLES	(1) Percent Cash Pay	(2) Percent Cash Pay	(3) Pay Duration	(4) Pay Duration	(5) TDC1 Complexity	(6) TDC1 Complexity	(7) C Consultant	(8) C Consultant
PIN	0.062**		-0.434***		-0.062***		-0.863*	
	[2.39]		[-2.72]		[-2.73]		[-1.88]	
PSI		0.024***		-0.036*		-0.027***		-0.088**
		[8.59]		[-1.91]		[-11.41]		[-1.99]
Log(Assets)	-0.067***	-0.057***	0.085***	0.075***	0.033***	0.022***	-0.001	-0.012
	[-32.78]	[-24.17]	[6.15]	[5.12]	[18.19]	[10.80]	[-0.04]	[-0.38]
R&D/Assets	-0.284***	-0.257***	-0.01	0.036	0.175***	0.150***	0.349	0.33
	[-5.47]	[-5.10]	[-0.04]	[0.13]	[4.01]	[3.50]	[0.50]	[0.47]
ROA	-0.026**	-0.025**	0.047	0.062	0.064***	0.063***	-0.539**	-0.536*
	[-2.11]	[-2.13]	[0.55]	[0.71]	[5.52]	[5.49]	[-2.00]	[-1.94]
Tobin's Q	-0.017***	-0.015***	0.022**	0.024**	0.008***	0.007***	-0.084***	-0.084***
	[-7.80]	[-6.99]	[2.17]	[2.29]	[4.91]	[4.23]	[-3.12]	[-3.01]
Cash/Assets	-0.106***	-0.107***	-0.199*	-0.246**	-0.021	-0.025		
	[-5.01]	[-5.14]	[-1.90]	[-2.33]	[-1.18]	[-1.38]		
Debt/Assets	-0.006	-0.02	0.089	0.124	-0.014	0.000		
	[-0.43]	[-1.47]	[1.17]	[1.60]	[-1.19]	[0.02]		
Sales Growth	-0.012**	-0.012**	-0.03	-0.026	0.016***	0.018***		
	[-2.22]	[-2.34]	[-0.72]	[-0.62]	[3.73]	[4.11]		
Stock Return							-0.028	-0.048
							[-0.81]	[-1.35]
Stock Volatility							6.630**	7.333**
							[2.29]	[2.50]
Ind FE	Y	Y	Y	Y	Y	Y	Y	Y
Yr FE	Y	Y	Y	Y	Y	Y	Y	Y
Observations	32,178	30,863	10,385	9,940	32,747	31,417	6,545	6,215
R-squared	0.286	0.287	0.164	0.162	0.213	0.223	0.1	0.1

Table 8: Performance-Based Pay and Stock Price Informativeness

This table presents panel regressions of different types of performance-based compensation on stock price informativeness and other firm-level controls. The sample includes CEOs from 2006-2015. Performance vesting (PV) pay is the portion of the CEOs compensation that is tied to performance metrics. Long term (LT) pay is performance-based pay that vests in more than 1 year. Accounting performance compensation is the portion of the CEOs total compensation that is tied to accounting measures (EPS, ROA, etc). Stock price informativeness is measured by the probability of information-based trading (PIN) and stock price nonsynchronicity (PSI). We first calculate the average PIN or PSI across the previous three years. High PIN (PSI) is an indicator variable which equals to 1 if the average is above the median in a year, and 0 otherwise. All specifications include industry and year fixed effects. Robust standard errors are clustered at the firm level. Variable definitions are as defined in the Appendix.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
VARIABLES	PV Pay	PV Pay	PV Pay (LT)	PV Pay (LT)	PV(Acctg)	PV(Acctg)	PV(Acctg-LT)	PV(Acctg-LT)
High PIN	-0.021*		-0.020**		-0.020**		-0.018**	
	[-1.85]		[-2.09]		[-2.03]		[-2.19]	
High PSI		-0.028**		-0.024**		-0.027**		-0.019*
		[-2.05]		[-2.08]		[-2.16]		[-1.80]
Log(Assets)	0.020***	0.021***	0.025***	0.025***	0.008*	0.008*	0.014***	0.014***
	[3.83]	[3.77]	[5.69]	[5.44]	[1.75]	[1.67]	[3.62]	[3.45]
R&D/Assets	-0.084	-0.100	-0.032	-0.049	-0.266***	-0.279***	-0.179**	-0.192***
	[-0.80]	[-0.94]	[-0.35]	[-0.53]	[-3.23]	[-3.36]	[-2.48]	[-2.64]
ROA	0.030	0.021	0.023	0.016	0.025	0.021	0.020	0.016
	[0.82]	[0.59]	[0.76]	[0.52]	[0.79]	[0.67]	[0.79]	[0.64]
Tobin's Q	-0.008*	-0.008*	-0.001	-0.001	-0.003	-0.003	0.003	0.004
	[-1.92]	[-1.86]	[-0.24]	[-0.13]	[-0.68]	[-0.68]	[0.94]	[1.00]
Cash/Assets	-0.073*	-0.059	-0.060*	-0.049	-0.025	-0.014	-0.013	-0.004
	[-1.78]	[-1.42]	[-1.81]	[-1.45]	[-0.69]	[-0.37]	[-0.42]	[-0.14]
Debt/Assets	0.016	0.014	0.002	0.002	0.006	0.009	-0.000	0.004
	[0.49]	[0.42]	[0.07]	[0.06]	[0.16]	[0.24]	[-0.01]	[0.12]
Sales Growth	-0.012	-0.011	-0.006	-0.005	0.003	0.002	0.005	0.004
	[-1.64]	[-1.48]	[-0.88]	[-0.75]	[0.40]	[0.35]	[0.83]	[0.67]
Number Segments	0.008*	0.009**	0.004	0.005	0.008**	0.008**	0.003	0.004
	[1.90]	[2.06]	[1.13]	[1.28]	[1.99]	[2.19]	[0.90]	[1.12]
Ind FE	Y	Y	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y	Y	Y
Observations	4,475	4,293	4,475	4,293	4,475	4,293	4,475	4,293
R-squared	0.086	0.089	0.079	0.080	0.072	0.075	0.061	0.062

Table 9: Incentives and Stock Price Informativeness

This table presents panel regressions of delta (pay-performance sensitivity), option compensation scaled by stock compensation and stock performance compensation on stock price informativeness and other firm-level controls. The sample includes CEOs from 2006-2015. Delta is calculated following Core and Guay (2002). Stock performance compensation is the portion of the CEOs total compensation that is tied to the firm's stock price performance. Stock price informativeness is measured by the probability of information-based trading (PIN) and stock price nonsynchronicity (PSI). In our regression we use the average PIN or PSI across the previous three years. All specifications include industry and year fixed effects. Robust standard errors are clustered at the firm level. Variable definitions are as defined in the Appendix.

VARIABLES	(1) Delta	(2) Delta	(3) Vega	(4) Vega	(5) Option/Stock	(6) Option/Stock	(7) Stock Perf Comp	(8) Stock Perf Comp
PIN	207.629***		-8.692		2.265**		0.059**	
	[2.58]		[-0.66]		[2.45]		[2.41]	
PSI		15.146*		3.721**		0.247***		0.005**
		[1.72]		[2.39]		[2.87]		[2.13]
Log(Assets)	219.588***	220.501***	59.367***	61.135***	0.071	0.118*	0.001	0.001
	[25.10]	[22.71]	[40.41]	[36.25]	[1.29]	[1.89]	[0.58]	[0.90]
R&D/Assets	-394.624***	-371.475***	163.057***	166.917***	3.250**	3.084**	0.082*	0.061
	[-2.75]	[-2.61]	[7.47]	[7.58]	[2.21]	[2.12]	[1.90]	[1.55]
ROA	99.984**	107.107***	30.082***	29.080***	0.107	0.121	0.000	0.000
	[2.48]	[2.63]	[4.47]	[4.30]	[0.39]	[0.47]	[-0.03]	[0.01]
Tobin's Q	160.407***	159.134***	12.128***	12.049***	0.298***	0.292***	-0.002	-0.001
	[16.90]	[16.43]	[11.19]	[11.16]	[4.42]	[4.22]	[-1.15]	[-0.77]
Cash/Assets	247.865***	246.557***	40.969***	43.862***	0.813	0.73	-0.006	-0.008
	[3.74]	[3.73]	[4.43]	[4.67]	[1.54]	[1.35]	[-0.48]	[-0.68]
Debt/Assets	-406.659***	-405.460***	-35.512***	-36.190***	-0.785**	-0.781**	0.009	0.006
	[-7.77]	[-7.46]	[-4.77]	[-4.70]	[-2.34]	[-2.27]	[1.18]	[0.78]
Sales Growth	97.756***	92.566***	-2.890	-3.575*	0.025	0.013	-0.006	-0.006
	[5.65]	[5.59]	[-1.46]	[-1.88]	[0.24]	[0.12]	[-1.49]	[-1.44]
Ind FE	Y	Y	Y	Y	Y	Y	Y	Y
Yr FE	Y	Y	Y	Y	Y	Y	Y	Y
Observations	30,000	28,804	30,173	28,970	14,591	13,815	3,859	3,685
R-squared	0.288	0.287	0.418	0.419	0.111	0.113	0.047	0.043

Table 10: Perquisite Compensation and Stock Price Informativeness

This table presents panel regressions of the natural log of perquisite compensation on stock price informativeness and other firm-level controls. The sample includes CEOs from 1994-2015. Stock price informativeness is measured by the probability of information-based trading (PIN) and stock price nonsynchronicity (PSI). In our regression we use the average PIN or PSI across the previous three years. Perquisite compensation is compustat variable "othcomp". All specifications include industry and year fixed effects. Robust standard errors are clustered at the firm level. Variable definitions are as defined in the Appendix.

	(1)	(2)
	Log(Perq)	Log(Perq)
PIN	-0.920**	
	[-2.02]	
PSI		-0.107**
		[-2.02]
Log(Assets)	0.491***	0.455***
	[10.25]	[8.90]
R&D/Assets	-1.522	-1.427
	[-1.56]	[-1.47]
ROA	-0.185	-0.163
	[-0.69]	[-0.60]
Tobin's Q	-0.012	-0.038
	[-0.34]	[-1.09]
Cash/Assets	-0.933***	-0.881**
	[-2.70]	[-2.50]
Debt/Assets	0.132	0.233
	[0.44]	[0.79]
Sales Growth	-0.183*	-0.149
	[-1.78]	[-1.45]
E-Index	0.097**	0.104**
	[2.34]	[2.46]
Inst Ownership	-0.544*	-0.381
	[-1.75]	[-1.38]
Ind FE	Y	Y
Yr FE	Y	Y
Observations	4,850	4,653
R-squared	0.251	0.255

Table 11: Pay for Luck and Stock Price Informativeness

This table presents panel regressions of total compensation industry return (Luck), industry-adjusted return (Skill) and other firm-level controls. The sample includes CEOs from 2006-2015. Stock price informativeness is measured by the probability of information-based trading (PIN) and stock price nonsynchronicity (PSI). In our regression we use the average PIN or PSI across the previous three years. Large/Small PIN (PSI) is top/bottom quartile in a given year. Industry (Luck) and Industry-Adjusted Return (Skill) are estimated as in Garvey and Milbourn (2006). All specifications include industry and year fixed effects. Robust standard errors are clustered at the firm level. Variable definitions are as defined in the Appendix.

VARIABLES	(1) Log(Total Comp)	(3) Log(Total Comp)	(2) Log(Total Comp)	(4) Log(Total Comp)
Setting	Large PIN	Small PIN	Large PSI	Small PSI
Ind Return (Luck)	0.028	0.159**	0.052	0.120*
	[0.38]	[2.10]	[0.87]	[1.77]
Ind-Adj Return (Skill)	0.041**	-0.015	0.033*	-0.018
	[2.28]	[-0.84]	[1.94]	[-0.96]
Log(Assets)	0.480***	0.460***	0.482***	0.504***
	[30.05]	[20.77]	[31.40]	[28.54]
R&D/Assets	0.659***	0.548*	0.454***	1.190***
	[4.12]	[1.77]	[3.61]	[2.96]
Tobin's Q	0.076***	0.068***	0.073***	0.079***
	[6.59]	[3.84]	[5.56]	[4.06]
Cash/Assets	0.390***	0.155	0.478***	0.291**
	[3.58]	[1.07]	[4.42]	[2.29]
Debt/Assets	-0.060	-0.042	-0.033	-0.018
	[-0.86]	[-0.55]	[-0.51]	[-0.19]
Sales Growth	0.033	0.055	0.052**	0.098**
	[1.53]	[1.47]	[2.21]	[2.06]
Return (t-1)	0.008**	0.002	0.008***	0.000
	[2.24]	[0.57]	[3.23]	[0.03]
ROA (t-1)	0.028	0.071	-0.025	-0.008
	[0.41]	[0.84]	[-0.68]	[-0.07]
Ind FE	Y	Y	Y	Y
Year FE	Y	Y	Y	Y
Observations	6,117	6,337	7,306	6,169
R-squared	0.466	0.458	0.451	0.471

Table 12: Compensation and Stock Price Informativeness – Alternative SPI Measure

This table presents panel regressions of the log of total, cash, and equity compensation on stock price informativeness and other firm-level controls. The sample includes CEOs from 1994-2015. Stock price informativeness is measured by Adjusted-PIN (APIN) from Duarte and Young (2009). In our regression we use the average APIN across the previous three years. All specifications include industry and year fixed effects. Robust standard errors are clustered at the firm level. Variable definitions are as defined in the Appendix.

	(1)	(2)	(3)
VARIABLES	Log(Equity Comp)	Log(Total Comp)	Log(Cash Comp)
APIN	-1.567***	-0.621***	-0.401***
	[-4.97]	[-4.32]	[-3.63]
Log(Assets)	0.659***	0.466***	0.250***
	[39.85]	[51.32]	[33.36]
R&D/Assets	2.093***	0.835***	0.314***
	[5.50]	[4.83]	[2.61]
ROA	0.405***	0.157***	0.217***
	[3.54]	[2.94]	[3.67]
Tobin's Q	0.109***	0.086***	0.014**
	[6.91]	[11.51]	[2.54]
Cash/Assets	0.389**	0.383***	-0.144***
	[2.41]	[5.15]	[-2.58]
Debt/Assets	0.113	0.018	-0.021
	[1.05]	[0.34]	[-0.50]
Sales Growth	0.067*	0.072***	0.012
	[1.67]	[3.91]	[0.76]
Ind FE	Y	Y	Y
Year FE	Y	Y	Y
Observations	27,256	27,256	27,256
R-squared	0.312	0.498	0.380

Table 13: Compensation and Stock Price Informativeness – IV Setting

This table presents 2SLS regressions for the IV method. We use two IVs. The first IV is the average SPI in 2-digit SIC industry (excluding a firm's own 3-digit SIC industry average SPI). This IV follows Bennett, Stulz, and Wang (2017), and is constructed as follows. We first calculate the average SPI within industry (3-digit SIC). Then take the average of the 3-digit SIC industry-level SPI within the corresponding 2-digit SIC industry. When taking the average, we exclude the 3-digit SIC industry-level SPI for a firm, if the firm is in this 3-digit SIC industry. Then we use the average of this 2-digit SIC industry-level SPI across the previous three years (t-3 to t-1) as our IV. The second IV is a geographic indicator variable, which equals to one if a firm headquarter in the previous year locates in a state with financial centers, and zero otherwise. Financial centers include New York and Chicago, and the states are New York and Illinois accordingly. Odd (even) columns show the results in the first (second) stage regressions. All specifications include industry and year fixed effects. Robust standard errors are clustered at the firm level. ***, **, * Denote significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	PIN	Log(Equity)	PSI	Log(Equity)	APIN	Log(Equity)
Stage	1st	2nd	1st	2nd	1st	2nd
PIN		-3.562*				
		[-1.69]				
PSI				-0.232**		
				[-2.40]		
APIN						-7.741***
						[-2.65]
SIC2 Mean PIN (Excl SIC3)	0.366***					
	[11.77]					
SIC2 Mean PSI (Excl SIC3)			0.417***			
			[17.83]			
SIC2 Mean APIN (Excl SIC3)					0.339***	
					[10.70]	
HQ(NY or IL)	0.003		0.064*		0.003*	
	[1.23]		[1.92]		[1.75]	
Log(Assets)	-0.018***	0.598***	-0.398***	0.568***	-0.016***	0.539***
	[-31.79]	[14.48]	[-44.54]	[13.40]	[-37.44]	[10.89]
R&D/Assets	-0.053***	2.096***	-0.987***	1.970***	-0.050***	1.961***
	[-4.32]	[5.68]	[-5.55]	[5.65]	[-6.27]	[4.97]
ROA	-0.010**	0.395***	-0.107***	0.395***	-0.007***	0.433***
	[-2.36]	[3.82]	[-2.71]	[4.26]	[-2.88]	[3.60]
Tobin's Q	-0.001***	0.117***	-0.071***	0.110***	-0.002***	0.102***
	[-2.66]	[6.27]	[-10.29]	[5.85]	[-7.59]	[5.69]
Cash/Assets	-0.010**	0.438***	-0.172**	0.462***	-0.009***	0.491***
	[-2.05]	[2.60]	[-2.21]	[2.85]	[-2.88]	[2.99]
Debt/Assets	-0.000	0.072	0.345***	0.176	-0.000	0.187*
	[-0.03]	[0.68]	[6.11]	[1.61]	[-0.19]	[1.80]
Sales Growth	0.012***	0.083*	0.159***	0.073*	0.009***	0.114**
	[8.38]	[1.73]	[8.67]	[1.70]	[7.83]	[2.26]
Ind FE	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y
F-test	70.67		161.47		57.59	
Hansen J (p-value)		0.16		0.18		0.12
Observations	29,137	29,137	27,929	27,929	25,497	26,119

Table 14 Compensation and SPI: evidence from executives switching firms

This table presents the regression results for the SPI effect on the compensation of executives who switch firms. We use the first differences of all variables (new minus old) to capture the changes of compensation, SPI, and firms characteristics when the executives switch to new firms. By doing this we control the executive fixed effect. All specifications further include industry and year fixed effects. The PIN are PSI are the average across the previous three years. Robust standard errors are clustered at the firm level. ***, **, * Denote significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Ch(Equity Comp)	Ch(Equity Comp)	Ch(Total Comp)	Ch(Total Comp)	Ch(Cash Comp)	Ch(Cash Comp)
Change(PIN)	-2.000*		-1.354**		-1.094**	
	[-1.70]		[-2.50]		[-2.30]	
Change(PSI)		-0.276**		-0.152**		0.065
		[-2.00]		[-2.05]		[1.03]
Ch(Log(Assets))	0.356***	0.305***	0.183***	0.195***	0.094**	0.101***
	[4.03]	[3.73]	[4.25]	[4.43]	[2.46]	[2.59]
Ch(R&D/Assets)	2.314	2.382	-0.974	-0.969	-0.424	-0.358
	[1.11]	[1.20]	[-0.92]	[-0.91]	[-0.46]	[-0.38]
Ch(ROA)	0.048	-0.074	-0.067	-0.106	0.111	0.121
	[0.14]	[-0.23]	[-0.39]	[-0.62]	[0.71]	[0.76]
Ch(Tobin's Q)	0.062	0.081	0.084**	0.083**	0.056*	0.056*
	[0.79]	[1.13]	[2.23]	[2.16]	[1.82]	[1.80]
Ch(Cash/Assets)	0.899	0.670	0.476	0.361	0.090	0.136
	[1.25]	[1.00]	[1.33]	[1.00]	[0.28]	[0.42]
Ch(Debt/Assets)	1.209**	1.070**	0.439*	0.417	0.376	0.409*
	[2.30]	[2.19]	[1.70]	[1.59]	[1.60]	[1.71]
Ch(Sales Growth)	-0.135	-0.113	-0.057	-0.037	-0.032	-0.030
	[-0.71]	[-0.64]	[-0.60]	[-0.39]	[-0.36]	[-0.34]
Ind FE	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y
Observations	573	550	573	550	701	677
R-squared	0.338	0.227	0.216	0.222	0.284	0.267

Internet Appendix

for

Managerial Compensation and Stock Price Informativeness

Table IA 1: Compensation, Stock Price Informativeness and CEO Turnover

This table presents panel regressions of the log of total, cash, and equity compensation on stock price informativeness and other firm-level controls. All tests include a CEO Turnover dummy. The sample includes CEOs from 1994-2015. Stock price informativeness is measured by the probability of information-based trading (PIN) and stock price nonsynchronicity (PSI). In our regression we use the average PIN or PSI across the previous three years. All specifications include industry and year fixed effects. Robust standard errors are clustered at the firm level. Variable definitions are as defined in the Appendix.

VARIABLES	(1) Log(Equity)	(2) Log(Equity)	(3) Log(Total)	(4) Log(Total)	(5) Log(Cash)	(6) Log(Cash)
PIN	-0.569***		-0.206***		-0.272***	
	[-3.07]		[-2.58]		[-4.72]	
PSI		-0.143***		-0.033***		0.004
		[-6.76]		[-3.45]		[0.58]
CEO Turnover	0.081**	0.087**	-0.024	-0.022	-0.156***	-0.154***
	[2.39]	[2.54]	[-1.64]	[-1.47]	[-14.27]	[-13.92]
Log(Assets)	0.683***	0.632***	0.473***	0.464***	0.269***	0.278***
	[44.01]	[35.55]	[62.16]	[50.23]	[46.96]	[39.48]
R&D/Assets	2.004***	1.811***	0.688***	0.646***	0.106	0.131
	[5.78]	[5.44]	[4.45]	[4.25]	[0.90]	[1.12]
ROA	0.346***	0.340***	0.103**	0.098**	0.095**	0.093**
	[3.73]	[3.71]	[2.22]	[2.14]	[2.07]	[2.05]
Tobin's Q	0.103***	0.096***	0.085***	0.083***	0.019***	0.021***
	[5.92]	[5.58]	[10.93]	[10.89]	[4.00]	[4.51]
Cash/Assets	0.426**	0.439***	0.421***	0.422***	-0.057	-0.067
	[2.54]	[2.67]	[5.86]	[5.86]	[-1.16]	[-1.35]
Debt/Assets	0.045	0.137	-0.005	0.012	-0.014	-0.025
	[0.45]	[1.35]	[-0.10]	[0.26]	[-0.41]	[-0.70]
Sales Growth	0.118***	0.121***	0.083***	0.084***	0.012	0.010
	[3.27]	[3.35]	[4.82]	[4.85]	[1.02]	[0.82]
Ind FE	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y
Observations	29,002	27,848	29,002	27,848	29,002	27,848
R-squared	0.326	0.328	0.528	0.529	0.459	0.462

Table IA 2: Compensation, Stock Price Informativeness, Share Turnover and Short Interest

This table presents panel regressions of the log of total, cash, and equity compensation on stock price informativeness and other firm-level controls. All tests control for share turnover and short interest in addition to the other controls used throughout the paper. The sample includes CEOs from 1994-2015. Stock price informativeness is measured by the probability of information-based trading (PIN) and stock price nonsynchronicity (PSI). In our regression we use the average PIN or PSI across the previous three years. All specifications include industry and year fixed effects. Robust standard errors are clustered at the firm level. Variable definitions are as defined in the Appendix.

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Log(Equity)	Log(Equity)	Log(Total)	Log(Total)	Log(Cash)	Log(Cash)
PIN	-0.475**		-0.177**		-0.227***	
	[-2.43]		[-2.06]		[-3.24]	
PSI		-0.113***		-0.026***		-0.001
		[-5.28]		[-2.60]		[-0.12]
APIN						
Share Turnover	0.132***	0.115***	0.084***	0.081***	-0.049***	-0.050***
	[4.68]	[3.99]	[6.31]	[5.97]	[-5.06]	[-5.10]
Short Interest	0.746*	0.684*	0.269	0.272	0.771***	0.792***
	[1.85]	[1.66]	[1.35]	[1.32]	[4.74]	[4.69]
Log(Assets)	0.678***	0.638***	0.469***	0.464***	0.266***	0.272***
	[42.23]	[33.98]	[55.66]	[45.56]	[37.71]	[31.89]
R&D/Assets	2.208***	2.031***	0.829***	0.791***	0.411***	0.425***
	[5.88]	[5.54]	[5.00]	[4.82]	[3.38]	[3.55]
ROA	0.431***	0.411***	0.187***	0.178***	0.221***	0.217***
	[3.76]	[3.59]	[3.34]	[3.17]	[3.66]	[3.61]
Tobin's Q	0.095***	0.092***	0.081***	0.081***	0.017***	0.018***
	[5.49]	[5.30]	[10.62]	[10.70]	[3.25]	[3.52]
Cash/Assets	0.208	0.242	0.275***	0.278***	-0.092*	-0.106*
	[1.20]	[1.40]	[3.65]	[3.66]	[-1.66]	[-1.90]
Debt/Assets	0.022	0.096	-0.025	-0.015	-0.047	-0.058
	[0.20]	[0.84]	[-0.47]	[-0.27]	[-1.10]	[-1.32]
Sales Growth	0.069*	0.071*	0.063***	0.064***	0.009	0.014
	[1.84]	[1.87]	[3.74]	[3.69]	[0.60]	[1.05]
Ind FE	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y
Observations	28,044	26,906	28,044	26,906	28,044	26,906
R-squared	0.316	0.317	0.504	0.505	0.393	0.397

Table IA 3: Salary, Bonus and Stock Price Informativeness

This table presents panel regressions of the log of salary and bonus compensation on stock price informativeness and other firm-level controls. The sample includes CEOs from 1994-2015. Stock price informativeness is measured by the probability of information-based trading (PIN) and stock price nonsynchronicity (PSI). In our regression we use the average PIN or PSI across the previous three years. All specifications include industry and year fixed effects. Robust standard errors are clustered at the firm level. Variable definitions are as defined in the Appendix.

VARIABLES	(1) Log(Salary)	(2) Log(Salary)	(3) Log(Bonus)	(4) Log(Bonus)
PIN	-0.107		0.348	
	[-0.95]		[1.12]	
PSI		-0.020*		0.110***
		[-1.68]		[3.34]
Log(Assets)	0.170***	0.166***	0.189***	0.235***
	[14.89]	[11.97]	[7.70]	[8.32]
R&D/Assets	0.390**	0.351**	-0.179	-0.125
	[2.25]	[2.12]	[-0.36]	[-0.26]
ROA	0.104**	0.103**	0.471***	0.461***
	[2.14]	[2.06]	[2.73]	[2.69]
Tobin's Q	-0.006	-0.006	0.070***	0.087***
	[-0.77]	[-0.81]	[3.47]	[4.37]
Cash/Assets	-0.104	-0.111	0.030	-0.003
	[-1.26]	[-1.31]	[0.15]	[-0.01]
Debt/Assets	0.048	0.052	-0.534***	-0.580***
	[0.70]	[0.74]	[-3.72]	[-4.00]
Sales Growth	-0.050***	-0.046**	0.333***	0.330***
	[-2.78]	[-2.57]	[5.06]	[5.06]
Ind FE	Y	Y	Y	Y
Year FE	Y	Y	Y	Y
Observations	22,858	21,850	22,858	21,850
R-squared	0.202	0.205	0.366	0.367

Table IA 4: Compensation, Stock Price Informativeness and Competition – TNIC Industries

This table presents panel regressions of the log of equity compensation on stock price informativeness interacted with measures of competitiveness and other firm-level controls. The sample includes CEOs from 1994-2015 in nonfinancial and non-utility firms. Stock price informativeness is measured by the probability of information-based trading (PIN) and stock price nonsynchronicity (PSI). In our regression we use the average PIN or PSI across the previous three years. Low Fluidity (Low similarity) is an indicator variable which equals 1 if the fluidity (product similarity) is below the median in a year, and 0 otherwise. High HHI is an indicator dummy which equals 1 if the HHI is above the median in a year, and 0 otherwise. The value 1 for each of these three dummies indicates that a firm has relatively low product market competition. All specifications include all controls used in Table 3, but for brevity we suppress their coefficients. All specifications include industry and year fixed effects. Industry fixed effects used are TNIC industries, not SIC 2-digit industries. Robust standard errors are clustered at the firm level. Variable definitions are as defined in the Appendix.

VARIABLES	(1) Log(Equity)	(2) Log(Equity)	(3) Log(Equity)	(4) Log(Equity)	(5) Log(Equity)	(6) Log(Equity)
Low Fluidity x PIN	-1.042***					
	[-2.76]					
Low Fluidity x PSI		-0.099***				
		[-3.88]				
Low Similarity x PIN			-0.661*			
			[-1.93]			
Low Similarity x PSI				-0.094***		
				[-3.80]		
High TNIC HHI x PIN					-0.618*	
					[-1.95]	
High TNIC HHI x PSI						-0.046**
						[-2.01]
PIN	-0.323		-0.526*		-0.574**	
	[-0.96]		[-1.84]		[-2.18]	
PSI		-0.119***		-0.121***		-0.156***
		[-4.03]		[-4.53]		[-6.25]
Low Fluidity	0.246***	0.187***				
	[3.53]	[4.10]				
Low Similarity			0.079	0.122**		
			[1.16]	[2.47]		
High TNIC HHI					0.088	0.068*
					[1.52]	[1.77]
Log(Assets)	0.637***	0.580***	0.635***	0.580***	0.635***	0.578***
	[38.57]	[30.27]	[38.76]	[30.52]	[38.90]	[30.38]
ROA	0.199***	0.211***	0.184**	0.197***	0.178**	0.191**
	[2.63]	[2.74]	[2.44]	[2.58]	[2.37]	[2.49]
Tobin's Q	0.112***	0.100***	0.114***	0.103***	0.115***	0.103***
	[6.29]	[5.77]	[6.31]	[5.91]	[6.33]	[5.91]
Cash/Assets	0.469***	0.456***	0.434**	0.433***	0.453***	0.448***
	[2.80]	[2.75]	[2.56]	[2.59]	[2.70]	[2.72]
Debt/Assets	-0.022	0.080	-0.034	0.072	-0.037	0.069
	[-0.20]	[0.74]	[-0.32]	[0.68]	[-0.35]	[0.65]
Sales Growth	0.081**	0.087**	0.097**	0.096**	0.100***	0.103***
	[2.00]	[2.16]	[2.51]	[2.48]	[2.58]	[2.66]
TNIC Ind FE	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y
Observations	25,930	24,846	27,778	26,631	27,778	26,631
R-squared	0.287	0.291	0.291	0.295	0.291	0.295

Table IA 5: Compensation, Stock Price Informativeness, Change in Risk and Firm Value

This table presents panel regressions of the log of total, cash, and equity compensation on stock price informativeness and other firm-level controls. All tests control for year-over-year change in CAPM/market beta and MVE in addition to the other controls used throughout the paper. The sample includes CEOs from 1994-2015. Stock price informativeness is measured by the probability of information-based trading (PIN) and stock price nonsynchronicity (PSI). In our regression we use the average PIN or PSI across the previous three years. All specifications include industry and year fixed effects. Robust standard errors are clustered at the firm level. Variable definitions are as defined in the Appendix.

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Log(Equity)	Log(Equity)	Log(Total)	Log(Total)	Log(Cash)	Log(Cash)
PIN	-0.412*		-0.092		-0.286***	
	[-1.68]		[-0.84]		[-3.48]	
PSI		-0.138***		-0.038***		-0.025**
		[-4.76]		[-3.11]		[-2.32]
Change(Mkt Beta)	0.008	-0.002	-0.004	-0.003	-0.019	-0.022
	[0.18]	[-0.05]	[-0.21]	[-0.17]	[-1.41]	[-1.64]
Change(MVE)	0.153***	0.186***	0.097***	0.107***	0.145***	0.153***
	[3.73]	[4.37]	[5.27]	[5.65]	[11.49]	[11.92]
Log(Assets)	0.676***	0.621***	0.472***	0.457***	0.257***	0.252***
	[31.43]	[25.10]	[49.14]	[40.46]	[33.66]	[26.33]
R&D/Assets	2.803***	2.569***	1.128***	1.069***	0.316*	0.306*
	[5.22]	[4.93]	[5.04]	[4.81]	[1.81]	[1.74]
ROA	0.366*	0.306	0.239***	0.221***	0.287***	0.280***
	[1.92]	[1.59]	[3.28]	[3.00]	[4.28]	[4.15]
Tobin's Q	0.088***	0.078**	0.077***	0.075***	0.026***	0.025***
	[2.88]	[2.50]	[6.00]	[5.67]	[3.28]	[3.21]
Cash/Assets	0.007	0.046	0.314***	0.321***	-0.144*	-0.162*
	[0.03]	[0.18]	[2.79]	[2.81]	[-1.77]	[-1.92]
Debt/Assets	0.262*	0.361**	0.038	0.075	-0.075	-0.053
	[1.68]	[2.24]	[0.61]	[1.14]	[-1.56]	[-1.07]
Sales Growth	0.037	0.038	0.050	0.049	0.012	0.009
	[0.70]	[0.72]	[1.64]	[1.60]	[0.46]	[0.37]
Ind FE	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y
Observations	17,533	16,803	17,533	16,803	17,533	16,803
R-squared	0.372	0.371	0.572	0.571	0.445	0.446

Table IA6: Compensation Stability and Stock Price Informativeness

This table shows the effect of stock price informativeness on compensation stability. We use two measures of compensation stability: weights volatility and short-term pay volatility. Weights volatility is defined as $\mathrm{Std}_{t-5,t-1}(\sum_{i=1}^{7}|w_{i,t}-w_{i,t-1}|)$, where $\mathrm{Std}_{t-5,t-1}(\cdot)$ is the standard deviation function for values across previous five years, *i* is the index for seven pay components: salary, bonus, non-equity incentive, stock, options, perquisites, and deferred, *t* is the index for year *t*, *w* is the fraction of a component in total pay. Short-term (ST) pay volatility is the standard deviation of the fraction of short-term performance based pay in total pay across the previous five years. Stock price informativeness is measured by the probability of information-based trading (PIN) and stock price nonsynchronicity (PSI). In our regression we use the average PIN or PSI across the previous three years. We drop firm-year observations with CEO turnovers. All specifications include industry and year fixed effects. Robust standard errors are clustered at the firm level. Variable definitions are in Appendix.

	(1) Weights volatility	(2) Weights volatility	(3) ST pay volatility	(4) ST pay volatility
PIN	0.035*		0.036	
	[1.69]		[1.04]	
PSI		0.014***		0.007**
		[6.08]		[2.21]
Log(Assets)	-0.001	0.004**	-0.001	0.001
	[-0.69]	[2.45]	[-0.68]	[0.31]
R&D/Assets	-0.047	-0.045	-0.014	-0.008
	[-1.63]	[-1.57]	[-0.34]	[-0.19]
ROA	-0.021**	-0.022**	-0.024	-0.020
	[-2.44]	[-2.54]	[-1.38]	[-1.23]
Tobin's Q	-0.002*	-0.001	-0.008***	-0.008***
	[-1.85]	[-0.85]	[-3.83]	[-3.55]
Cash/Assets	0.050***	0.054***	0.011	0.008
	[3.55]	[3.84]	[0.68]	[0.47]
Debt/Assets	0.036***	0.027**	-0.009	-0.011
	[3.43]	[2.53]	[-0.85]	[-0.89]
Sales Growth	0.003	0.001	0.005	0.004
	[0.81]	[0.18]	[1.15]	[1.00]
Ind FE	Y	Y	Y	Y
Year FE	Y	Y	Y	Y
Observations	22,614	21,701	4,785	4,508
R-squared	0.284	0.289	0.078	0.079