Opacity and executive compensation*

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June 2010

Abstract

We develop and test the hypothesis that firms' opacity induces increased risk sharing by managers, in particular by taking more risk in executive compensation contracts. We test this hypothesis in a manner robust to errors-in-variables bias and reverse-causality by using institutional trading as an instrument for firms' opacity. Consistent with the hypothesis, we find a positive relation between pay-performance sensitivity and measures of the opacity of financial reporting and stock prices. Our findings suggest that institutional trading can act as a substitute for risky executive compensation by limiting opacity.

JEL classification:G30, G32, J33, L22

Keywords: Pay-for-performance, Incentives, Institutional trading, Accounting quality, Stock price informativeness

*For helpful comments, we thank Maxim Mironov, José Marin, Andrea Menini, Antonio Parbonetti, João Pereira, Clara Raposo and seminar participants at the 2009 Meetings of the American Accounting Association and the European Accounting Association, Instituto Empresa, ISCTE - Lisbon University Institute, and the University of Padova. We thank Cong Gao for diligent research assistance.

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1 Introduction

A long-standing debate contests the underlying drivers of equity-based incentives in executive pay. Proposed explanations range from managerial self-interest (Bertrand and Mullainathan (2001) and Bebchuk and Fried (2004)) to an effective replacement for direct monitoring (Holmstrom and Milgrom (1987) and Prendergast (2002)). In this paper, we develop and test a novel explanation rooted in opacity and risk-sharing. We do not rule out other contributing explanations, but rather show that a firm's characteristic level of opacity and information flow is an important part of the picture. We additionally establish that a firm's characteristic level of institutional trading, which alleviates opacity, helps sort out economic causality between opacity and equity-based compensation incentives.

We draw intuition from recent theory showing how managers of opaque firms naturally become fuller participants in the firm's risky outcomes (Jin and Myers (2006)). While managers of such firms can take private benefits in good times, they must contribute (or take less) in bad times, or else the pattern of earnings would reveal the chicanery. One implication of opacity in the Jin and Myers model is that the variability of observable stock returns is reduced. Because lower variability means that maintaining any given level of incentivization in executive pay requires a greater sensitivity to stock market outcomes, this in turn suggests that managers' increased risks may include more incentive compensation.

The Jin and Myers model does not include an explicit shareholder-chosen pay policy, nor does it incorporate managerial risk aversion, which has been one work-horse of executive compensation theory. We therefore illustrate specific implications of opacity for equity incentives in executive pay using a simple principal-agent model. A core result is that, when information flow is restricted, equity incentives are optimally determined in consideration of both private benefits and managerial risk participation. Equity incentives are predicted to be stronger for more opaque firms.[1]

Guided by the predictions of this simple model, we investigate the relationship of opacity and information flow characteristics of U.S. public companies to equity incentives in executive pay contracts. To so, we use stocks' characteristic levels of institutional trading as an instrumental variable. The reason for doing so is that stock price informativeness measures are additionally correlated with liquidity and other firm characteristics (Boehmer et al. (2005), Mohanram and Rajgopal (2009), Duarte and Young (2009)) and that compensation incentives also feedback into opacity, to the extent managers can influence it (Holthausen and Watts (2001), Cheng and Warfield (2005), Bergstresser and Philippon (2006), Cornett et al. (2008))[2]. Building on prior research showing that institutional trading brings information to the market (Keim and Madhavan (1996), Keim and Madhavan (2007), Piotroski and Roulstone (2004), and Sias et al. (2006), Chemmanur et al. (2010)), we show that a stock's characteristic level of institutional trading is a useful instrument for the extent of information environment influences on executive incentives. We find empirically that pay-for-performance incentives are stronger with more accounting opacity and with less stock-price informativeness. The results suggest that institutional trading is an underlying economic cause, substituting for incentives by limiting opacity and increasing stock price informativeness.[3]

[1] A positive relationship between opacity and incentives is also noted by Prendergast (2000). Prendergast (2002) presents models that predict such a relationship based on the idea that incentivizing expert decision-making agents is necessary for opaque and otherwise difficult risky situations where principals would not know what to do if they had direct control. We take Prendergast's independent (and more theoretically extensive) line of work as additional motivation for our empirical investigation.

[2] Relatedly, Vega and Wu (2006) show that measures of liquidity are partly driven by information flow. When implemented, measures of these two concepts appear to overlap.

[3] The role of institutional investors in determining executive compensation has been largely understood in terms of either activism or monitoring (Hartzell and Starks (2003)). Consistent with

Our work helps reconcile some of the tensions in the compensation literature. First, Prendergast (2000) emphasizes that, while a negative relation of risk and incentives is a standard implication of principal-agent models, existing empirical results tend to indicate the opposite.[4] We identify the separate influence of opacity, which would otherwise tend to be conflated with the influence of uncertainty. Second, Holmstrom and Tirole (1993) show theoretically that more informative and more liquid stock prices (i.e., less uncertainty, such as would result from intense trading by well-informed speculators like institutions) make pay-for-performance schemes more effective and, consequently, they should be used more. However, empirical work has generally found that incentives do not increase with firm size (which is broadly correlated with liquidity). Our work helps reconcile the reasoning and the result by showing that there is another important influence on incentives—opacity, which would tend to be greatest in smaller firms, is a positive influence. As such, our empirical analysis complements the recent work of Axelson and Baliga (2009), who argue that increasing transparency has negative effects on long term incentives.

The remainder of the paper is organized as follows. Section 2 discusses the implications of opacity for private benefits and incentive pay, lays out an illustrative model and specifies empirical predictions. Section 3 describes the sample. Section 4 presents our methods and main evidence on the relation between incentives, opacity, and institutional trading. Section 5 reports robustness checks. Section 6 concludes.

monitoring reasoning, Kim (2007) argues that frequent trading is indicative of lax monitoring, and shows that trading by blockholders is associated with more incentives in a company's compensation structure. We control for such influences, and show that, in addition, institutional trading, via its influence on opacity and information flow, represents another route by which institutions are important for compensation contracts.

[4]The findings are certainly not unanimous; for example, Aggarwal and Samwick (1999) find a negative relation.

2 Opacity, private benefits and incentive pay

In this section, we describe the broad intuitions we draw from Jin and Myers (2006) for the case of pay-for-performance in executive compensation, and we incorporate them into an illustrative principal-agent model so that we can draw testable implications. The bottom line in our reasoning is that the equity pay component of optimal executive compensation contracts is positively related to opacity.

2.1 The Jin and Myers model of returns under opacity

Jin and Myers (2006) begin with the idea that a portion of firms' wealth creation is hidden from shareholders, and that managers can expropriate that portion with impunity.[5] They show how opacity-enabled private benefits in turn lead to managers sharing in the firm's risk. If managers do not cover the firm's losses in bad times (e.g., by scrimping on their compensation or drawing down hidden reserves), then the game will be revealed and they will be fired. The ups and downs would cancel out in expected value, except that managers retain the option to abandon the firm in case of an overwhelming hidden loss. Overall, then, the extent to which managers

[5] Jin and Myers focus on the way that opacity allows for the expropriation of wealth created by the firm. Their idea is most closely related to those of perquisite consumption (Yermack (2006) and private benefits being captured by controllers (Shleifer and Vishny (1997), Section 5). As Jin and Myers discuss, managers might be able to expropriate value even if investors can see what is happening, depending on the strength of investors' legal protections and investors costs of monitoring (Jensen and Meckling (1976)). Note that this is also a distinct idea from the notion that managers with equity-based pay or career concerns will have an incentive to report higher earnings and other good news if stock prices respond positively to earnings (Bergstresser and Philippon (2006), Kothari et al. (2009)). It is also distinct from the idea in Kerschenheiter and Melumad (2002) that equity compensation might induce managers to smooth the income stream in order to encourage investors to treat them as a more reliable indicator of permanent changes in value. Because such effects might be operating in the data, we allow for the possibility that incentives can influence reporting in our empirical methods, as discussed later.

naturally share in the firm's risky wealth creation is greater when opacity is greater.[6]

Jin and Myers' firm has real earnings that vary according to visible and opaque firm-specific components, and also a macro component. Each component is an independent autoregressive process with its own variance and with a common autocorrelation coefficient φ, reflecting the tendency for earnings to mean-revert. In this setting, we can define the firm's opacity as $\pi = \frac{\sigma_o^2}{\sigma_v^2}$, where σ_v^2 (σ_o^2) is the innovation variance for the visible (opaque) firm-specific component.[7] Opacity so defined has a minimum of zero and is unbounded on the upside. To focus on opacity rather than variations in overall firm risk, we explicitly assume that $\sigma_v^2 + \sigma_o^2 = \sigma_f^2$, where σ_f^2 is a fixed number; thus, a more opaque firm has real earnings weight shifted from one category to the other, not more earnings possibilities overall.[8] Then, from Jin and Myers' Eq. (18) the variance of shareholder returns at a particular time is given by

$$\mathrm{Var}(r_t) = \frac{1+\mu}{K_\mu + \varphi C_{t-1}} \left(\sigma_{mkt}^2 + \frac{\sigma_f^2}{1+\pi} \right), \tag{1}$$

where μ is the unconditional expected return (a fixed number), K_μ is a fixed number whose value depends on μ, C_t is the part of realized real earnings in the most recent period that are visible to investors (i.e., the sum of the market and the visible firm-specific component), and σ_{mkt}^2 is the variance of the macro component.

From Eq. (1), it is apparent that the conditional variance of returns to share-

[6] Jin and Myers' main concern is the link of opacity to R^2 and crashes. They emphasize that opacity-enabled private benefits affect these outcomes differently than private benefits enabled by weak governance. We will similarly show distinct effects on executive compensation incentives. Like Jin and Myers, we will emphasize opacity effects because that is the focus of our empirical work. We have checked for robustness to controls for governance effects, which turn out to be less prominent in our data.

[7] This definition of opacity is the reciprocal (minus one) of transparency as defined by Jin and Myers. We use our own notation to allow us to reflect only enough detail to make our points.

[8] Though not discussed, this assumption is actually implicit in Jin and Myers' setup.

holders is decreasing in opacity.[9] Thus, if shareholders wish to impose any particular level of risk-participation upon managers via exposure to the firm's stock market return, they will need to use stronger pay-for-performance incentives when opacity is greater.

The intuitions above are not in themselves a sufficient basis for sharp empirical predictions about incentive pay. The Jin and Myers model does not include a shareholder decision on an incentive compensation contract. Moreover, in contrast to a principal-agent situation, the management does not expend costly effort to create value. Also in contrast to the traditional principal-agent models, managers are risk-neutral, and therefore do not resist accepting risk from shareholders. In the next subsection, we present a simple model that adds these features while keeping the essence of the Jin and Myers idea that opacity both enables private benefits and induces managerial risk participation. As we will show, the notion that opacity drives a wedge between manager and shareholder risks in a way that both enables private benefits for managers and reduces the variance of shareholder returns, when incorporated into a simple principal-agent model, implies that shareholders will choose stronger equity incentives for managers. The model's purpose is not to break new theoretical ground, but to analytically illustrate these empirical predictions.

2.2 An illustrative model of opacity, private benefits and incentive compensation

Consider a simple one-period principal-agent problem in which a sharing rule for the observable value created by a firm is to be negotiated. The principal (i.e., the share-

[9] Considered along, Eq. (1) would overstate the effect of opacity on shareholder risks. Because managers retain the abandonment option, shareholders also bear a crash risk.

holders) maximizes expected value conditional on the knowledge that the risk-averse agent (i.e., the management) will maximize expected utility, including consideration of its unobservable effort.

The firm's total output is defined as

$$\widetilde{x}_f = \widetilde{x}_v + \widetilde{x}_o, \tag{2}$$

where $\widetilde{x}_f$ is a random variable representing the total value created by the firm, $\widetilde{x}_v$ is the portion visible to shareholders, and $\widetilde{x}_o$ is an opaque portion. Similar to the Jin and Myers' case, shareholders can only obtain the visible component at most; managers will keep the opaque component. As there are only two independent risk components here, we choose to think of managers decisions and work as fundamentally affecting both the full firm and the opaque portion as follows:

$$\widetilde{x}_f = w + \widetilde{\varepsilon}_f, \text{where } \widetilde{x}_f \sim N\left(0, \sigma_f^2\right), \text{ and} \tag{3}$$

$$\widetilde{x}_o = kw + h\widetilde{\varepsilon}_f + \widetilde{\varepsilon}_m, \text{ where } \widetilde{\varepsilon}_m \sim N\left(0, \sigma_m^2\right), \tag{4}$$

where $0 < k < 1$ and $0 < h < 1$ are fixed parameters. With this setup, work creates value; the issue is only how much work and who benefits. The random outcome $\widetilde{\varepsilon}_f$ represents the risky part of the outcome of the firm's value creation process, which affects both shareholders and management. The random outcome $\widetilde{\varepsilon}_m$ represents risks that are unique to the management, such as career concerns. Then the visible portion of value creation available to shareholders is then characterized by

$$\widetilde{x}_v = \widetilde{x}_f - \widetilde{x}_o = (1-k)\,w + (1-h)\widetilde{\varepsilon}_f - \widetilde{\varepsilon}_m. \tag{5}$$

Shareholders can calculate the expectation of opaque value creation using k. With stronger corporate governance, k would be smaller, implying that the visible part of value created by the firm would be larger. Opacity is characterized by the parameters h, which governs the opacity of the firm's production process, and σ_m^2. Note that $Var(\widetilde{x}_v) = (1-h)^2\sigma_f^2 + \sigma_m^2$. The risk to shareholders decreases in opacity about the production process and increases in uncertainty about the management's special risks.[10]

The shareholders' problem is to set up a sharing rule (the compensation plan) that has a fixed component β and a variable component α, where $0 < \alpha < 1$, so that managerial compensation is $\alpha x_v + \beta$, with the parameters to be chosen by the shareholders in Stackelberg-leader fashion, so the management can take them into account in solving its problem. We assume a linear sharing rule, following Holmstrom and Milgrom (1987), who show conditions under which such a rule is optimal.[11] Managers perceive a cost of effort $c(w)$, where $c' > 0$ and $c'' > 0$. Consistent with the literature, managers are risk averse, as characterized by a coefficient of risk aversion r. We think of all outcomes as being already adjusted for market risks, and so treat shareholders as risk neutral.[12]

This setup incorporates a tension between visible and opaque outcomes analogous to the Jin and Myers (2006) model, and allows for opacity to influence the allocation of risks. As we now show, it also allows for opacity to influence shareholders' choice of compensation contracts.

[10] Career-based risks seem consistent with Jin and Myers' thinking (and with Myers (2000) on which it is based), for they suppose that a management that abandons the firm in the face of losses must sit-out one or more periods before benefiting from another firm. We therefore do not suppose that managerial effort in itself increases the management's risks from the opaque portion of the firm.

[11] Normality and negative exponential utility, for example, are sufficient.

[12] This is one reason that we do not explicitly incorporate the macro risks of the Jin and Myers framework (i.e., we set σ_{mkt} to zero).

2.2.1 Management's and shareholders' objectives

Management maximizes its expected utility by choosing its effort level w conditional on the incentive α that has been set by the shareholders. The standard transform of the problem under the assumption of exponential utility lets us work with the certainty-equivalent expected value:

$$\max_w \Pi_M = \alpha w(1-k)+\beta+kw-c(w)-\frac{r}{2}\left\{\alpha^2\left[(1-h)^2\sigma_f^2+\sigma_m^2\right]+h^2\sigma_f^2+\sigma_m^2\right\}. \quad (6)$$

The first order condition for the w choice implies that the agent's marginal cost of effort at the optimal effort level is

$$c'(w) = \alpha + (1-\alpha)k. \quad (7)$$

Management in effect sets its marginal cost equal to the weighted average of its benefit from a marginal shareholder dollar and its marginal private benefit, putting more weight on the shareholder benefit when incentives are stronger. For any given incentive contract, α, the management is willing to bear a larger marginal cost of effort (and therefore to expend more effort) when corporate governance, as characterized by k, is weaker. The reason is that, with larger k, work leads to more private benefits as well as visible value that is split with the shareholders according to the compensation plan. The shareholders have taken the management's work responses into account when setting the incentive, α. Taking the total derivative of Eq. (7) with respect to α and rearranging makes that response explicit:

$$\frac{dw}{d\alpha} = \frac{1-k}{c''(w)}. \quad (8)$$

Focusing next on shareholder choices, we show how this response figures into the way shareholders set the incentive contract.

Absent corner solutions where the fixed pay component, β, is driven to zero, it will be set by reservation level considerations. Then α, the incentive choice, is shareholders' key decision. Because the management will adjust effort to cover all its costs, including risk costs, the shareholders, in effect, bear all costs.[13] The shareholders' problem is therefore to maximize the total expected certainty-equivalent surplus $\Pi_S + \Pi_M$ where $\Pi_S = (1-\alpha)(1-k)w - \beta$ and Π_M is as given in Eq. (6). The maximand in detail is

$$\max_{\alpha} \left(\Pi_S + \Pi_M\right) = w - c(w) - \left\{\alpha^2\left[(1-h)^2\sigma_f^2 + \sigma_m^2\right] + h^2\sigma_f^2 + \sigma_m^2\right\}. \tag{9}$$

Solving for α from the first-order condition yields:

$$\alpha = \frac{(1-k)^2}{(1-k)^2 + rc''(w)\left[(1-h)^2\sigma_f^2 + \sigma_m^2\right]}, \tag{10}$$

where we have used Eq. (7) and Eq. (8) to incorporate the management's marginal costs and responsiveness to the principal's choices.

2.2.2 Equity incentives and opacity

Eq. (10) sets α, the equity incentive parameter. Several points are evident by inspection. Optimal equity incentives are decreasing in the corporate governance weakness parameter k, decreasing in the uncertainty of managerial career concerns σ_m^2, and increasing in the opacity parameter h. Stronger shareholder rights lead

[13] In Jin and Myers, the management is the residual claimant except in abandonment. Our model retains their feature of opacity-enabled private benefits while leaving shareholders in the residual claimant position.

to more incentive pay because the shareholders capture more of the benefit. More uncertainty in management's career concerns leads to less incentive pay because the risk costs become part of the risk of the visible portion of the firm, and more incentives make management doubly exposed. Opacity is our central interest. More opacity leads to more incentive pay because, similar to the Jin and Myers result in Eq. (1), opacity reduces the variance risks that shareholders see, and that are partly imposed on management via incentive pay.[14] By increasing the level of incentive pay, opacity creates an additional private benefit in the sense of more expected pay for a given shareholder outcome. Since the same holds true in expectations, this private benefit amounts to more expected pay for a given level of work.

We next ask what managers would choose as their desired level of opacity parameter h, if they could control given an arbitrary incentive α set by shareholders. The first order condition of the management's problem Eq. (6) implies

$$h = \frac{\alpha^2}{1+\alpha^2}, \tag{11}$$

which is increasing in α. This implication matches with empirical findings in, for example, Bergstresser and Philippon (2006) and Kothari et al. (2009) that managers respond to incentive pay by increasing the level of earnings management. For empirical work, the implication is that it is important to allow for feedback effects of incentives into opacity, to the extent it is under management control. We therefore devise methods that are robust to this sort of endogeneity, as discussed below.

[14] Our illustrative model does not incorporate the extra "crash risk" faced by shareholders in the Jin and Myers framework due to the shareholders being short the abandonment option—but this risk does not feed through to a management risk in any case, because management holds the abandonment option

3 Measuring incentives and opacity

We turn next to empirical tests for the relationship of equity incentives to stocks' degree of opacity and its opposite, information flow. In this section, we begin by motivating empirical measures of key theoretical constructs and by describing our sample.

3.1 Incentives

Our main measure of equity incentives is the delta, or value-impact on the year's option grants per $1,000 change in shareholder value, calculated following the method of Yermack (1995). We generally refer to this as the contractual pay-for-performance incentive, or simply "PPS". We focus on incentives contractually set by the board of directors, as shareholders' representatives, because our predictions are about the incentives that shareholders would choose. We focus on current-year (new) option compensation because options have historically been the main source of incentive compensation for executives (Murphy (1999)), and because boards provide incentives to executives through new options grants. Boards cannot fully control the incentive structure provided by previously awarded compensation—but they can react in the current year, considering executives' choices to sell shares or to hedge options, to provide a compensation structure that they believe is appropriate. Thus, it is the current compensation that is the fullest measure of a compensation decision. Additionally, current values of past compensation grants are a noisy measure of boards' past intentions, having been affected by firm performance and market-wide factors, and so less important for our purposes.

3.2 Opacity and information flow

We employ several measures of opacity and information flow. Depending on the measure, we are careful to use empirical methods that are robust to contamination by liquidity, operating variance, or other characteristics. We also ensure that our treatment of measures that are under the influence of management is robust to feedback effects.

Among our measures are two market-based measures of stock-price informativeness (i.e., the opposite of opacity). One is the share of the firm's returns variance that is comprised of idiosyncratic variance, i.e., the idiosyncratic risk share. The underlying notion is that firm-specific information flow drives a firm's return away from that of the market overall. The extent to the two deviate in general, indexed by the risk share, is taken as a measure of the firm's characteristic extent of firm-specific information. This variable has been used as an index of information flow in other studies, including Roll (1988), Morck et al. (2000), and Durnev et al. (2004). Our second measure of price informativeness is the probability of informed trading (PIN) of Easley et al. (2002) as a measure of the informativeness of stock prices. Like idiosyncratic risk, PIN has been used to index informativeness in many studies, including, for example, Chen et al. (2007) and Vega (2006).[15]

Unfortunately, neither idiosyncratic risk share nor PIN are clean measures of stock price informativeness. Idiosyncratic risk also incorporates noise and uncertainty (Lee and Liu (2006)). PIN is additionally influenced by the stock's liquidity overall,

[15] As PIN represents the probability of trading against a better-informed trader, it could be argued that it is a measure of the degree to which stock prices do not yet incorporate information. However, Vega and Wu (2006) show that PIN is positively correlated with information. Taken as a practical index of the prevailing market conditions for a stock, PIN does then index informativeness. In this context, the commonly-used term "stock price informativeness" actually returns to the informativeness of the time series of returns.

i.e., not only the part that pertains to information conditions (Duarte and Young (2009)). Thus, these variables bring the potential for errors-in-variables biases when used as regressors. We can hope to sort out the influences if we can observe a stock characteristic that is correlated with information flow. Based on research noted in the introduction, we turn to the stock's characteristic level of institutional trading, and additionally to those components of institutional trading that might be especially information-laden. We employ the idea of a two-stage procedure suggested by Core et al. (1999) and Bowen et al. (2008), in which we break these noisy information flow measures into predicted and residual components using a first-stage regression on institutional trading. We discuss the procedure in more detail in the empirical section.

We also provide an second full set of tests using two accounting-based indicators of poor accruals quality that have been widely used in the literature to index accounting opacity. Accruals are the difference between earnings and cash flows, and thus embody the firm's accounting choices as well as the ways its business cycle naturally deviates from a cash basis. The modified Jones model (Dechow et al. (1995)) and the Dechow and Dichev (2002) model provide alternative benchmarks for a firm's normal accruals level. In the case of the Jones model, the benchmark is based on the firm's sales, assets and other activity and size measures. In the case of the Dechow Dichev model, the benchmark is based on cash flows in adjacent years, on the reasoning that the deviations of earnings from cash flows over the firm's business cycle is inherently temporary. Following standard procedures, we then measure accruals quality using the modified Jones model as a deviation from normal accruals in a specific year, and using the Dechow Dichev model as the standard deviation of residuals over a five year span.

These accounting opacity measures are potentially subject to reverse-causality, in that equity incentives may induce opacity via earnings management if stock prices respond to earnings, and especially if investors overestimate the value-importance of accruals (Sloan (1996)). A variety of studies find evidence of this, including Cheng and Warfield (2005), Bergstresser and Philippon (2006), and Cornett et al. (2008). Econometrically, we can untangle the situation using an instrumental variable regression, provided we have a good instrument for opacity. Here again we turn to a stock's characteristic level of institutional trading, because institutional trading, and especially some subsets of it, have been shown to be informative.

As our key measure of institutional trading we employ the absolute value of the quarterly change in institutional holding, aggregated yearly over all institutions trading shares in the firm, divided by total shares traded during the year. For robustness and to extend the intuition, we also use two alternative and targeted measures of institutional trading: trading by "dedicated institutions" following Bushee (1998) (i.e., ones that tend to be long-term holders of stocks and who therefore have stronger incentives to gather information), and net institutional trading against retail investors (since the trading of one institution against another might be thought to contain contradictory indications about the value of the stock).

In our tests, we need to control for extraneous influences on the structure of executive compensation contracts. To incorporate the monitoring effects of institutional holdings and to avoid data mining concerns, we follow Hartzell and Starks (2003) to establish a core set of control variables. One set of controls are for differences in managerial compensation across firm size, investment opportunities, and performance (see also Smith and Watts (1992)). Controls for these differences include the market value of equity, the change in market value of equity of the firm over the past fiscal year, and Tobin's q. Hartzell and Starks discuss institutional holdings and institutional concentration as positively affecting executive incentive levels.

We incorporate two of their measures in our regressions: the percentage of shares held by institutional investors and the percentage of shares held by the five largest institutional investors.

3.3 Data

The initial data for our study are drawn from Standard and Poors' Compustat and Execucomp databases, and from Thomson's institutional ownership database compiled from SEC 13F filings. The sample period is from 1993 (when detailed Execucomp data begins) to 2002 (a year after data on PIN, an important lagged regressor, ends). The intersection of these data sets yields 71,805 executive-years, comprising roughly 2,691 unique firms. We calculate PPS alternatively for the top five executives of the firm, and, for robustness, also as an aggregate measure of PPS that sums across the firm's top five executives. Since the compensation of the CEO is generally substantially different in structure and magnitude from that of other executives, we employ a dummy variable that distinguishes CEO effects in regressions. Finally, as another robustness check, we provide CEO-only results. For additional robustness, we also employ several other measures of current compensation in our tests: total compensation defined as the sum of the executive's salary, bonus, equity grants, and all other annual compensation; cash compensation defined as salary and bonus only; and incentive compensation defined as the difference between total compensation and cash compensation.

We are able to measure the core variables for a panel of 29932 executive-years based on CRSP and Compustat Merged database records. For analyses involving measures of pay other than PPS and/or specialized measures of institutional trading, samples are slightly smaller. A list of all variables used, along with their specific definitions and calculation methods, is provided in the Appendix.

Table 1 presents descriptive statistics. Of particular note is the PPS of the executive compensation contract across the top five executives, with a mean of 0.706. This mean PPS indicates that top-five pay increases by about 70¢ for every $1,000 increase in shareholder wealth. The standard deviation is nearly twice as large, indicating wide variation in firms' practices.

From this point forward, we use log or logistic transforms for variables with limited range, to arrive at a form appropriate for the left-hand side of a regression. We mainly choose logistic transforms for variables with ranges limited between zero and one; otherwise we take the log. Even so, we use the log in the case of PIN to match with other literature.

4 Empirical methods and results

This section presents separate regression analyses of the two measures of stock price informativeness and the two measures of accounting opacity as determinants of executive compensation incentives.

4.1 Empirical design and preliminary analysis

Our approach will be to add stock price informativeness or accounting opacity as regressors to a benchmark model of PPS, and to apply estimation procedures that use institutional trading (which, as we will show below, is a variable that indexes information flow) to obtain valid inference given the econometrically-difficult properties of the informativeness and opacity measures.

For a benchmark model we largely follow Hartzell and Starks (2003). The dependent variable in their study and ours, PPS, is left censored in that many firms do not grant options in particular years, or do not utilize option compensation at all. Hartzell and Starks therefore argue that a Tobit model is appropriate. Their regressors are institutional holdings percentage, institutional holdings concentration, market capitalization, change in market capitalization, Tobin's q, and a CEO dummy variable. To alleviate concerns of reverse-causality in our findings, regressors are lagged by one year unless otherwise noted.

Like Hartzell and Starks, we treat the data as a panel, and we include industry and year fixed effects. Hall and Liebman (1998) document that executive compensation has increased dramatically over the last two decades, while Aggarwal and Samwick (1999) argue for industry-specific compensation contracts. Year effects not only control for changes in compensation patterns throughout the sample period, but also control for exogenous factors that affect the PPS (such as market upturns and downturns and changes in interest rates). Additionally, we judge significance using firm-level cluster-robust t-statistics.

Column (1) of Table 2 presents base-case estimates of the Hartzell and Starks (2003) Tobit for our sample. We find coefficient estimates similar to Hartzell and Starks', suggesting that our sample is broadly comparable to theirs. We next add squared terms for market value and Tobin's q to the Hartzell and Starks specification to better conform to the economic characteristics of the data.[16] We report the results,

[16]This choice is based on an empirical investigation, motivated by the fact that the Hartzell and Starks specification has been criticized in that the estimated coefficient on institutional holdings concentration is sensitive to whether market capitalization enters as its dollar value or its log (Smith and Swan (2009)). The Tobit specification restricts regressors' influence on the amount of PPS for firms that use it to be the same as their influence on the probability of using any PPS at all (Greene (2002), p. 762). We have investigated whether this restriction fits the data using a double hurdle model (Cragg (1971)). We have also examined probit regressions for the probability of using PPS, and separate truncated regressions for the level of PPS when it is positive. The Tobit restriction is not valid. For example, larger firms are more likely to use some PPS, but, given that they do, the extent of PPS is decreasing in firm size. For our full sample, the relations of firm size and Tobin's

which are consistent with those of Hartzell and Starks, in column (2) of Table 2. This specification becomes our base model for additional analyses.

Hartzell and Starks propose that institutional concentration (and, to a lesser extent, also institutional holdings) reflect a monitoring influence. They interpret their positive estimates of the coefficient on institutional concentration as supporting the notion that such institutional monitoring is a complement to PPS. Regarding institutional trading intensity, which we argue is an important additional index of institutions' influences, it is sometimes argued that this is an inverse indicator of monitoring. Extensive equity trading by institutions may be thought to represent short-term holders who therefore have little incentive to monitor the firm. Because we use institutional trading as an index of information flow below, we are motivated to check whether institutional trading might be related to more generous executive pay packages, suggesting a lack of monitoring. In columns (3) and (5), we therefore present regressions of total pay and cash pay, respectively, on our benchmark set of control variables. In columns (4) and (6), respectively, we add institutional trading to these regressions. The finding is that institutional trading is associated with a negative and statistically significant influence on both total pay and cash pay. Therefore, the evidence does not suggest that institutional trading represents a lack-of-monitoring influence for the firms in our sample.

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q to PPS are non-linear and non-monotonic. Edmans et al. (2009) note that the latter effect is also found by other studies.We therefore add squared terms to the Hartzell and Starks specification. As mentioned in the body of the paper, we report the results in column (2) of Table 2. Comparing with the Hartzell and Starks model in column (1), all the significant conclusions remain. Moreover, the estimated coefficient for the squared market value of equity is significantly positive, evidence that the non-linear specification better fits the data. We can be sure that we are not introducing any biases, as the Hartzell and Starks model nests within ours.

4.2 Stock price informativeness tests

In this section, we investigate the influence of measures of stock price informativeness, as inverse indexes of opacity, on PPS. With our modifications, we believe that the Hartzell and Starks Tobit regression model is properly specified for our investigation. It forms the basis for our regressions below. However, there is a substantial econometric difficulty in that idiosyncratic risk share and PIN are both contaminated measures of information flow. Idiosyncratic risk share is influenced by trading noise and pure uncertainty, as well as by stock specific information flow. PIN is influenced by liquidity as well as by the stock's information environment. In both cases, the contamination introduces the strong probability of an errors in variables bias in regression results. In both cases, there is reason to think that the contamination may be material for PPS. As to noise in idiosyncratic risk share, our model in this paper, other models in the principal-agent literature, and related reasoning, such as Prendergast (2002), all imply that uncertainty is a determinant of optimal equity incentives. As to PIN, Holmstrom and Tirole (1993) show how a principal-agent framework implies that liquidity is a determinant of equity incentive pay.

Our response is to look to institutional trading as a first-stage predictor for information flow, and to use a two stage procedure. In this case, we use institutional trading measures in first stage regressions to decompose the stock informativeness measure (either idiosyncratic risk share or PIN) into two parts. First, there is the fitted value of the regression, the part that is predicted based on institutional trading. Second, there is the residual part. We investigate the relationship between both parts of the informativeness measure and PPS by including them both in our regressions. We are not the first to use such a procedure. Bowen et al. (2008), for example, use this method to decompose earnings management measures into a fitted and residual portion based on corporate governance characteristics, and then investigate the valuation implications of the fitted portion. We include both the fitted value and the residual from our first stage procedure as regressors to be sure that OLS procedures are appropriate, i.e., there is no induced omitted variable bias. Almeida and Wolfenzon (2005) and Ferreira and Laux (2007) have used that same idea in other settings.

Before we use our various measures of institutional trading as a predictor variable in this way, we demonstrate that stock price informativeness is, in fact, strongly positively correlated with our institutional trading measures. In Table 3, we present the results of six OLS regressions. The models in the table are in three groups, based on the specific first-stage predictor of institutional trading that is used as a regressor to explain stock price informativeness. In columns (1) and (2), it is total institutional trading. In columns (3) and (4), it is dedicated institutional trading, i.e., trading by institutions classified as long-term and large holders of stocks according to the taxonomy in Bushee (1998). In columns (5) and (6), the instrumental variable is net institutional trading against retail investors. Then for the first column in each pair (columns (1), (3) and (5)) the dependent variable for the regression model is the idiosyncratic risk share. For the second column in each pair (columns (2), (4), and (6)), the dependent variable is PIN. In all cases, we include our full set of control variables to avoid any concerns that effects in this regression or the second-stage regression are influenced by omitted variables or back-door correlations, and we report coefficient estimates and firm-cluster robust t-statistics for each instrumental variable regression. In every one of the six regressions in Table 3, the specific measure of institutional trading is highly significantly positive as an influence on the stock price informativeness measure.

Building on these findings, we next proceed to second-stage regressions, and we report the results in Table 4. The layout of Table 4 follows the six-column arrangement of Table 3. Each pair of columns ((1) and (2), (3) and (4), and (5) and (6)) uses a particular measure of institutional trading as the instrumental variable for information flow. In the first column of each pair, the instrument is used to decompose the idiosyncratic risk share to arrive at two regressors. In the second column of each pair, the instrument is used to decompose PIN. In all cases, the dependent variable for the regression is PPS. We always include our full standard list of control variables, along with industry and year fixed effects.

Table 4 shows that the fitted value component of the idiosyncratic risk share and of PIN are uniformly negative and very strongly statistically significant in their association with PPS. The implication is that stronger stock-market information flow is associated with less PPS in executive compensation contracts. When the information flow via the stock market is stronger, there is less need for PPS to motivate managers, consistent with the reasoning of Axelson and Baliga (2009).

Reading across all the columns of Table 4, the relationship between PPS and the residual portions of the stock price informativeness measures—the parts not related to institutional trading—is uniformly positive. In the case of the idiosyncratic risk share residual, which should be a measure of noise in stock prices, this finding is consistent with many other empirical findings (see Prendergast (2000) for a survey and discussion) that volatility and incentives, including PPS incentives, are positively related. In the case of the PIN residual, which should be a measure of liquidity, the finding suggests that more liquidity results in more PPS, as suggested by the principal-agent literature and consistent with the time-series evidence of Jayaraman and Milbourn (2009). Our method breaks out these residual effects separately from the information flow effects, and shows both are economically important.

In total, our findings are direct support for the proposition developed earlier, that equity incentives set by shareholders should be stronger when stock price informativeness is less. Moreover, because measures of institutional trading are always the econometric instrument for endogenous opacity, the economic implication is that institutional trading is an indirect determinant of PPS. The evidence suggests that institutional trading can be a substitute for PPS by limiting the extent of opacity.

4.3 Accounting opacity tests

In this section, we investigate the influence of measures of accounting opacity on PPS. As discussed earlier in the paper, we need to allow for the fact that accounting opacity is known to be reverse-influenced by compensation incentives. One valid way to proceed is to use two-stage instrumental variable methods. Doing so requires an instrument that is correlated with accounting opacity. We use measures of institutional trading as instruments for our two measures of accounting opacity–the Jones accruals quality measure and the Dechow Dichev accruals quality measure. These indexes are inverse measures of accounting quality, and therefore direct measures of opacity.

To establish the appropriateness of our choice of instrumental variable, Table 5 provides regression results for several institutional trading regressions. The models in the table are in three groups, based on the specific instrumental-variable candidate measure of institutional trading that is used as a regressor to explain accounting opacity. In columns (1) and (2), the instrument is total institutional trading. In columns (3) and (4), it is dedicated institutional trading, i.e., trading by institutions classified as long-term and large holders of stocks according to the taxonomy in Bushee (1998). In columns (5) and (6), the instrumental variable is net institutional trading against retail investors. Then for the first column in each pair (columns (1),

(3) and (5)) the dependent variable for the regression model is the Jones accruals quality measure. For the second column in each pair (columns (2), (4), and (6)), the dependent variable is the Dechow Dichev accruals quality measure. In all cases, we include our full set of control variables, along with industry and year fixed effects, and we report coefficient estimates and firm-cluster robust t-statistics for each instrumental variable regression.

The key result is apparent in every variation of the model. The relationship of each institutional trading measure to every accounting opacity measure is negative. The t-statistics imply significance at high levels, with the weakest indication being for the relationship of dedicated institutional trading to the Jones measure of accounting quality. The t-statistic for that relationship is -1.899, still significant at the 10 percent level. We are therefore encouraged to use these measures of institutional trading as instruments for accounting opacity.

Table 6 presents the results of two stage least squares instrumental variables regressions to explain PPS with the accounting opacity measures, controlling for other influences such as firm size, investment opportunities and monitoring by institutional investors. The ordering of column pairs is the same as in the previous table. In all cases, the dependent variable is PPS, and we include our full set of control variables, along with firm and year fixed effects.

The key results are listed as the topmost entries in every column: the regression coefficient on every measure of opacity is positive, no matter what version of institutional trading we use as the instrument. The estimates are all significantly different from zero. The implication is that PPS is positively influenced by accounting opacity, and that the result is valid apart from any feedback effects of PPS into accounting opacity due to managerial incentives to manage earnings.

These findings complement our earlier findings using stock price informativeness measures. As before, because measures of institutional trading are always the econometric instrument for endogenous opacity, the economic implication is that institutional trading is an indirect determinant of PPS. The evidence suggests that institutional trading can be a substitute for PPS by limiting the extent of opacity.

To this point we have presented a full set of results in keeping with our illustrative model, working from the economic intuition of the Jin and Myers' framework that opacity encourages managerial participation in firms' risks. We next present a battery of robustness checks that confirm these findings.

5 Robustness checks

This section describes three sets of robustness checks of our findings, which are presented in Tables 7 - 9, respectively.

In Table 7, we check on the sensitivity of our findings to the measure of incentives used as the dependent variable. Table 7 contains four panels, each of which reports a set of four regression results using a specific dependent-variable measure of incentives. In columns (1)-(2) of each panel, we focus on the relation between incentives and our two measures of stock price informativeness, using total institutional trading as the instrumental variable to decompose each respective informativeness proxy into fitted and a residual component regressors. In columns (3)-(4), we focus on the relation between incentives and our two measures of accounting opacity, using institutional trading as the instrumental variable in two-stage least squares fashion. To save space and minimize visual complication, we report only the crucial coefficients and cluster-robust t-statistics, though we have used our usual full set of control variables and fixed effects in computing the results.

For Table 7, then, each of the four panels is set up the same, except that the measure of incentives used as the dependent variable of the regression differs across the panels. In Panel A, the incentive measure is drawn from Edmans et al. (2009), who argue that currently-awarded PPS should be measured as the elasticity of annual pay with respect to the value of the firm, i.e., our measure should additionally be normalized by annual pay (see their Eq. (8)). We then expect that coefficient estimates should be signed as in our earlier findings, for the Edmans et al. measure attempts to capture the same economic concept as our original measure of PPS. Panel A of Table 7 reports in columns (1)-(2) that the estimated coefficients for the fitted-value components of our two stock price informativeness measures are uniformly negative and highly statistically significant, irrespective of the institutional trading measure that is used in the first-stage regression to form the fitted values. In columns (3)-(4), the same panel shows that the estimated coefficients for our two accounting opacity indicators are strongly significantly positive at the one percent level. These robustness results fit the general pattern of our main results.

In Panels B and C of Table 7, we report the results of analogous exercises, except where the dependent variable is the dollar value of options pay (Panel B) and total incentive pay (Panel C). The pattern and statistical significance of results is similar to what we report for Panel A. Our conclusion is that our results do not depend on using our particular options delta measure of PPS as opposed to using options in general, or incentive pay in general.

In Panel D of Table 7, we use a historical (accumulated) measure of PPS, which reflects not only the year-specific decision of the board of directors in setting the current compensation contract, but also past compensation and manager decisions about what risks to keep and what risks to trade away in the stock market. This measure is economically different than ours, and so we expect to see it relate differently to opacity and institutional trading. Kang and Liu (2008) have shown that this measure is positively related to information flow variables (in contrast to our measure of current PPS which is negatively related, as we have shown. Based on Kang and Liu's results, we expect that coefficients' signs should reverse for this measure of PPS, which is driven by manager's willingness to hold the firm's risk rather than solely by the board's attempts to impose risk-based pay. Panel D of Table 7 shows that this measure of PPS is negatively related with opacity and positively related with stock price informativeness. The results, which are opposite to those we find for other measures, suggest that changes in market conditions and managers' portfolios over time offset some of the features initially put in place by boards via compensation contracts. We include these results to demonstrate that our results do not conflict with Kang and Liu's, but are simply distinct from theirs.

Table 8 reports a full set of our regressions, i.e., analogous to the set in each panel of Table 7, but now using only data for CEOs' PPS. A full set of control regressors, except for the CEO dummy, is included, but we suppress reporting the coefficients. We find that the pattern of results and levels of significance is the same as reported in our main results sections. Our conclusions are unchanged whether we study CEO incentives or all top executive incentives.

Table 9 presents results on two full sets of our regressions, but varying the estimation method. In Panel A, we use aggregated data at the firm-year level on executive incentives, as an alternative to our usual method of using executive-year level data. In Panel B, we use this firm-level data in a Fama-Macbeth (1973) rolling cross-sectional regression procedure, with the standard errors being computed from the time-series of the cross-sectional regression results. Both procedures alleviate concerns that cross-correlations among the observations are driving our results. Both procedures produce the same pattern of results we have seen in other tables, and further support our propositions.

6 Conclusion

Our study provides theoretical reasoning on the relationship between equity incentives and the opacity of firms. The key prediction is that when information flow is restricted, equity incentives are optimally determined in consideration of both private benefits and managerial risk participation. Equity incentives are predicted to be stronger for more opaque firms.

The prediction is empirically tested. We use institutional trading, a variable underlying information flow, to implement tests in a manner robust to reverse-causality and errors-in-variables biases. The results support the proposition of a positive opacity-to-incentives relation. We calculate institutional trading, information flow, and opacity, using multiple methods, and our results are robust across alternate measurements and statistical specifications.

These results imply that opacity/information flows are related to incentives, they also imply that institutional trading is a determinant of both opacity and information flows. We establish an information/opacity link for institutional trading which facilitates board compensation decisions. This, combined with already known findings regarding the relationship between institutional holdings and incentive levels, provides a more complete view regarding the role of institutions, opacity, and information flows in the governance function of firms.

Table 1: **Descriptive Statistics**

The table reports mean, standard deviation, maximum, and minimum values for each variable. The sample consists of executive-years for firms in the intersection of the CRSP, Compustat, and Execucomp databases over 1993-2004 that have non-missing values for the variables in this table. Variables used as regressors in our analysis are lagged. See Table A.1. for variable definitions.

	Mean	Standard deviation	Maximum	Minimum
PPS of compensation contract	0.7063	1.4318	11.2052	0.0000
Idiosyncratic risk share	8.6465	6.7975	41.5354	1.0213
PIN	0.1542	0.0487	0.3028	0.0671
Accruals quality (Jones)	0.1110	0.3738	4.8026	0.0014
Accruals quality (Dechow Dichev)	0.0697	0.3403	15.4666	0.0009
Institutional trading	0.6119	0.2175	1.2551	0.0688
Institutional holdings percentage	57.0692	18.1863	103.4999	7.7982
Institutional holdings concentration	0.4254	0.1362	0.9945	0.1243
Market capitalization	4442.94	9682.48	79261.50	42.28
Change in market cap	450.31	2487.52	17372.04	-10087.53
Change in market cap (contemp.)	351.97	2628.56	17004.73	-10632.85
Tobin's q	1.8429	1.1707	10.1713	0.7734
CEO dummy	0.1817	0.3856	1.0000	0.0000
Observations	29932			

Table 2: **Tobit regressions of executive compensation PPS and levels on explanatory variables**

The table reports regression coefficeints for two analyses of executive compensation at US firms over 1993-2004. For Columns (1) and (2), the dependent variable is PPS. For Columns (3) and (4), the dependent variable is Total Pay. for Columns (5) and (6), the dependent variable is Cash Pay. All regressions use the specification of Hartzell and Starks (2003), augmented with several additional regressors. For Columns (1) and (2), the regression is estimated via Tobit methods; for other columns, estimation is via OLS. Data is for firm-years satisfying data requirements as in Table 1. All regresors are lagged one year, except where otherwise noted. Coefficients on market value (squared) regressors are multipled by one million (squared). All regressions include industry and year fixed effects (not tabulated). Firm-level cluster robust t-statistics are listed in parentheses.

	(1)	(2)	(3)	(4)	(5)	(6)
Estimation method	Tobit	Tobit	OLS	OLS	OLS	OLS
Dependent Variable	Delta	Delta	Total pay	Total pay	Cash pay	Cash pay
Institutional holdings percentage	0.0036	0.0039	0.0124	0.0149	2.7943	3.1411
	(2.589)	(2.813)	(7.508)	(8.306)	(6.447)	(6.866)
Institutional holdings concentration	0.9852	0.7880	-0.4717	-0.5335	-245.2267	-253.6965
	(5.296)	(4.077)	(-2.529)	(-2.832)	(-5.395)	(-5.593)
Market capitalization	-8.8353	-29.3048	144.79	138.31	39312.4	38424.57
	(-4.577)	(-6.913)	(11.255)	(10.597)	(13.384)	(12.945)
Square of market capitalization		334.1161	-1082.8	-1021.4	-385304	-376892
		(6.270)	(-5.572)	(-5.214)	(-9.148)	(-8.905)
Change in market cap	0.7300	-0.3401	22.7942	24.2317	6543.2	6740.2
	(0.190)	(-0.090)	(1.586)	(1.690)	(2.342)	(2.433)
Change in market cap (contemp.)	0.9166	3.8527	55.8780	55.3580	22053.3	21982.05
	(0.307)	(1.347)	(3.621)	(3.597)	(7.602)	(7.598)
Tobin's q	-0.0195	-0.0482	0.1573	0.1620	-46.4151	-45.7742
	(-0.793)	(-0.812)	(2.184)	(2.274)	(-2.839)	(-2.814)
Square of Tobin's q		0.0044	-0.0161	-0.0171	1.4566	1.3149
		(0.543)	(-1.914)	(-2.080)	(0.746)	(0.679)
CEO dummy	0.9559	0.9570	0.0661	0.0649	29.5283	29.3579
	(24.473)	(24.493)	(2.169)	(2.130)	(3.810)	(3.789)
Institutional trading (non-log)				-0.6580		-90.1468
				(-5.891)		(-3.080)
Constant	3.8956	4.1065	-0.0053	0.3080	836.9786	879.9051
	(7.085)	(7.426)	(-0.014)	(0.774)	(7.787)	(8.147)
Observations	29932	29932	29511	29511	29511	29511
Pseudo R-squared	0.0417	0.0425				
R-squared			0.244	0.246	0.242	0.242

Table 3: **Regressions of informativeness measures on institutional trading**

The table reports OLS regression coefficeints for two measures of stock price informativeness of US firms over 1993-2004. For Columns (1), (3) and (5), the dependent variable is the idiosyncratic risk share ("Share"). For Columns (2), (4) and (6), the dependent variable is the probability of informed trading ("PIN") of Easley, Hvidkjaer, and O'Hara (2002). Share is entered as a logistic transform, and PIN is entered as a log transform. Data is for firm-years satisfying data requirements as in Table 1. All regresors are lagged one year, except where otherwise noted. Coefficients on market value (squared) regressors are multipled by one million (squared). All regressions include industry and year fixed effects (not tabulated). Firm-level cluster robust t-statistics are listed in parentheses.

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable	Share	PIN	Share	PIN	Share	PIN
Institutional trading	0.2276	0.1535				
	(4.328)	(7.208)				
Dedicated institutions' trading (log)			0.3706	0.1112		
			(7.705)	(5.032)		
Institutional trading against retail (log)					0.0403	0.0599
					(3.701)	(13.803)
Institutional holdings percentage	-0.0079	-0.0031	-0.0073	-0.0024	-0.0068	-0.0023
	(-11.189)	(-9.688)	(-10.518)	(-7.960)	(-9.970)	(-8.044)
Market capitalization	-41.4023	-34.1657	-43.0274	-35.3782	-41.9731	-33.7471
	(-13.313)	(-23.472)	(-13.974)	(-23.967)	(-13.708)	(-24.515)
Square of market capitalization	485.1188	362.6268	504.7965	373.3965	489.3383	355.9428
	(10.323)	(16.411)	(10.838)	(16.687)	(10.538)	(16.720)
Change in market cap	-0.3667	11.8404	-0.0098	12.3560	-2.0200	9.2658
	(-0.102)	(4.893)	(-0.003)	(5.006)	(-0.567)	(4.023)
Change in market cap (contemp.)	-14.7417	0.6652	-15.3908	0.5833	-14.6834	0.7957
	(-4.635)	(0.428)	(-4.881)	(0.363)	(-4.590)	(0.524)
Tobin's q	-0.1394	-0.0190	-0.1396	-0.0169	-0.1411	-0.0236
	(-5.683)	(-1.744)	(-5.641)	(-1.525)	(-5.738)	(-2.237)
Square of Tobin's q	0.0095	0.0029	0.0094	0.0025	0.0093	0.0032
	(3.516)	(2.360)	(3.460)	(2.058)	(3.450)	(2.634)
Constant	3.2248	-1.6649	3.2254	-1.6539	3.3410	-1.5229
	(29.880)	(-20.680)	(30.433)	(-21.660)	(31.891)	(-20.786)
Observations	29932	29932	29108	29108	29885	29885
R-squared	0.361	0.470	0.367	0.466	0.360	0.486

Table 4: **Regressions of PPS on fitted and residual components of informativeness measures; breakouts calculated from insitutional trading and its classes**

The table reports Tobit regression coefficeints for executive compensation contracts' PPS at US firms over 1993-2004. For each model, a first-stage regression of stock price informativeness (alternatively measured as idiosyncratic risk share or PIN) on a measure of institutional trading has been applied as the basis for forming "Fitted" and "Residual" components of the respective informativeness measure. For Columns (1) and (2), total institutional trading ("Total IT") is the first-stage variable. In Columns (3) and (4), dedicated institutional trading by Bushee's (1989) criteria ("Dedicated IT") is the basis variable. In Columns (5) and (6), the first-stage variable is net institutional trading against retail investors ("Net IT"). In all cases, the first stage regression also includes all control variables from the second-stage regression. Data is for firm-years satisfying data requirements as in Table 1. All regresors are lagged one year, except where otherwise noted. Coefficients on market value (squared) regressors are multipled by one million (squared). All regressions include industry and year fixed effects (not tabulated). Firm-level cluster robust t-statistics are listed in parentheses.

	(1)	(2)	(3)	(4)	(5)	(6)
Inst. trading to break out fitted & residual informativeness	Total IT	Total IT	Dedicated IT	Dedicated IT	Net IT	Net IT
Fitted Share explained by IT	-2.9392		-0.9371		-1.3484	
	(-5.393)		(-2.853)		(-2.608)	
Residual Share	0.1174		0.0946		0.0976	
	(3.800)		(2.968)		(3.113)	
Fitted PIN (log) explained by IT		-4.3440		-3.1215		-0.8997
		(-5.336)		(-2.840)		(-2.555)
Residual PIN (log)		0.2541		0.1648		0.2103
		(3.392)		(2.143)		(2.816)
Institutional holdings percentage	-0.0184	-0.0086	-0.0041	-0.0048	-0.0072	-0.0001
	(-4.592)	(-3.567)	(-1.638)	(-1.769)	(-1.814)	(-0.053)
Institutional holdings concentration	0.7662	0.7585	0.9402	0.9537	0.9504	0.9526
	(3.783)	(3.566)	(4.266)	(4.130)	(4.343)	(4.203)
Market capitalization	-161.0448	-187.8313	-73.0903	-143.0445	-90.5591	-64.2784
	(-6.531)	(-6.286)	(-4.758)	(-3.605)	(-3.966)	(-4.841)
Square of market capitalization	1,850.18	1,999.97	835.28	1,525.95	1,032.72	692.43
	(6.442)	(6.294)	(4.584)	(3.621)	(3.910)	(4.914)
Change in market cap	0.9621	53.5783	-0.4896	38.1355	0.3073	11.4151
	(0.248)	(5.219)	(-0.125)	(2.798)	(0.078)	(2.161)
Change in market cap (contemp.)	-40.2067	6.0225	-11.0670	5.2193	-16.2291	4.3012
	(-4.542)	(2.065)	(-1.819)	(1.780)	(-1.964)	(1.492)
Tobin's q	-0.4655	-0.1391	-0.2042	-0.1257	-0.2443	-0.0754
	(-5.040)	(-2.277)	(-2.563)	(-1.882)	(-2.790)	(-1.218)
Square of Tobin's q	0.0336	0.0183	0.0173	0.0162	0.0191	0.0094
	(3.582)	(2.196)	(1.884)	(1.793)	(2.004)	(1.115)
CEO dummy	0.9585	0.9585	0.9512	0.9510	0.9576	0.9575
	(24.493)	(24.504)	(23.917)	(23.926)	(24.422)	(24.432)
Constant	14.2653	-2.4359	7.5643	-0.6344	8.8844	3.0091
	(7.906)	(-1.612)	(6.571)	(-0.322)	(5.402)	(3.306)
Observations	29932	29932	29108	29108	29885	29885
Pseudo R-squared	0.0416	0.0414	0.0398	0.0396	0.0400	0.0399

Table 5: **Regressions of accounting opacity measures on institutional trading**

The table reports OLS regression coefficeints for two measures of accounting opacity at US firms over 1993-2004. For Columns (1), (3) and (5), the dependent variable is the modified Jones inverse accruals quality measure ("AQ Jones"). For Columns (2), (4) and (6), the dependent variable is the Dechow Dichev inverse accruals quality measure ("AQ DD"). AQ Jones is entered as a logistic transform, and AQ DD is entered as a log transformation. Data is for firm-years satisfying data requirements as in Table 1. All regresors are lagged one year, except where otherwise noted. Coefficients on market value (squared) regressors are multipled by one million (squared). All regressions include industry and year fixed effects (not tabulated). Firm-level cluster robust t-statistics are listed in parentheses.

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent Variable	AQ Jones	AQ DD	AQ Jones	AQ DD	AQ Jones	AQ DD
Institutional trading	-0.5624	-0.2993				
	(-6.788)	(-3.664)				
Dedicated institutions' trading (log)			-0.1603	-0.1235		
			(-1.899)	(-2.005)		
Institutional trading against retail (log)					-0.0817	-0.0434
					(-4.540)	(-3.163)
Institutional holdings percentage	0.0011	0.0004	-0.0018	-0.0010	-0.0018	-0.0010
	(0.937)	(0.426)	(-1.622)	(-0.955)	(-1.655)	(-1.043)
Market capitalization	-12.5961	-32.1178	-8.9356	-30.4405	-10.8729	-31.0449
	(-3.081)	(-6.725)	(-2.135)	(-6.301)	(-2.621)	(-6.504)
Square of market capitalization	127.5911	367.5375	92.4804	353.9187	115.0031	359.2392
	(2.310)	(5.548)	(1.632)	(5.260)	(2.052)	(5.419)
Change in market cap	-13.1417	2.5143	-12.2290	0.3559	-10.1896	3.7548
	(-2.154)	(0.679)	(-1.969)	(0.095)	(-1.647)	(0.988)
Change in market cap (contemp.)	12.1833	8.0979	12.7953	8.0614	12.2078	8.1166
	(2.315)	(2.181)	(2.360)	(2.096)	(2.330)	(2.190)
Tobin's q	-0.0348	0.1090	-0.0485	0.1029	-0.0350	0.1098
	(-0.777)	(2.864)	(-1.046)	(2.639)	(-0.770)	(2.861)
Square of Tobin's q	0.0073	-0.0051	0.0093	-0.0040	0.0081	-0.0048
	(1.311)	(-1.200)	(1.604)	(-0.914)	(1.426)	(-1.103)
Constant	-3.2661	-2.4628	-3.3261	-2.4946	-3.5147	-2.5968
	(-9.531)	(-11.316)	(-8.979)	(-10.763)	(-9.318)	(-10.905)
Observations	29587	29932	28770	29108	29544	29885
R-squared	0.099	0.439	0.094	0.427	0.094	0.436

Table 6: **Instrumental variables regressions of PPS on accounting opacity measures**

The table reports maximum likelihood IV Tobit regression coefficeints for executive compensation contracts' PPS at US firms over 1993-2004. For Columns (1) and (2), total institutional trading ("Total IT"), along wiith other right hand side variables, is the instrument for accruals quality. In Columns (3) and (4), the instrument is dedicated institutional trading by Bushee's (1989) criteria ("Dedicated IT"). In Columns (5) and (6), the instrument is net institutional trading against retail investors ("Net IT"). Data is for firm-years satisfying data requirements as in Table 1. All regresors are lagged one year, except where otherwise noted. Coefficients on market value (squared) regressors are multipled by one million (squared). All regressions include industry and year fixed effects (not tabulated). Firm-level cluster robust t-statistics are listed in parentheses.

	(1)	(2)	(3)	(4)	(5)	(6)
Intstrumental variable	Total IT	Total IT	Dedicated IT	Dedicated IT	Net IT	Net IT
Accruals quality (Jones, logistic)	1.1878		1.8750		0.6241	
	(4.467)		(1.907)		(2.487)	
Accruals quality (DD, log)		2.5166		2.0350		1.0550
		(2.832)		(2.094)		(2.396)
Institutional holdings percentage	0.0035	0.0012	0.0048	0.0020	0.0029	0.0018
	(1.876)	(0.428)	(1.744)	(0.820)	(1.918)	(1.006)
Institutional holdings concentration	0.6286	-0.5090	0.3572	-0.2171	0.7902	0.3724
	(2.570)	(-0.756)	(0.811)	(-0.331)	(3.738)	(1.109)
Market capitalization	-25.4099	26.6215	-22.2085	16.2950	-28.3948	-7.4543
	(-4.187)	(1.128)	(-2.348)	(0.662)	(-5.863)	(-0.620)
Square of market capitalization	285.0818	-343.1863	255.0302	-221.7717	315.9119	60.0631
	(3.567)	(-1.177)	(2.135)	(-0.740)	(5.082)	(0.405)
Change in market cap	17.4695	-2.7493	23.0744	0.0765	9.2020	-0.6944
	(1.903)	(-0.287)	(1.328)	(0.010)	(1.445)	(-0.133)
Change in market cap (contemp.)	-11.3834	-18.2910	-21.1643	-14.2120	-4.1368	-5.3891
	(-1.485)	(-1.501)	(-1.239)	(-1.210)	(-0.757)	(-0.865)
Tobin's q	-0.0358	-0.3902	-0.0246	-0.3385	-0.0555	-0.1989
	(-0.526)	(-2.695)	(-0.269)	(-2.113)	(-0.897)	(-2.375)
Square of Tobin's q	-0.0004	0.0248	-0.0043	0.0225	0.0041	0.0146
	(-0.055)	(2.071)	(-0.364)	(1.859)	(0.520)	(1.719)
CEO dummy	0.9430	0.9555	0.9280	0.9471	0.9466	0.9558
	(23.880)	(23.835)	(22.355)	(23.538)	(24.071)	(24.394)
Constant	8.8288	12.3825	11.4195	10.8625	6.7663	7.7635
	(7.242)	(4.224)	(3.050)	(3.463)	(6.372)	(5.281)
	29587	29932	28770	29108	29544	29885

Table 7: **Regressions of alternative incentive measures on opacity and information measures, using institutional trading (IT) for component breakouts and instruments**

The table reports two types of analyses. Columns (1)-(2) report Tobit regression coefficeints for executive compensation contract characteristics at U.S. firms over 1993-2004. For each model, a first-stage regression of stock price informativeness (alternatively measured as idiosyncratic risk share or PIN) on a measure of institutional trading has been applied as the basis for forming "Fitted" and "Residual" components of the respective informativeness measure. Total instiutional trading is the first-stage variable. In all cases, the first stage regression also includes all control variables from the second-stage regression. Columns (3)-(4) report maximum likelihood IV Tobit regression coefficeints for executive compensation contract characteristics at US firms over 1993-2004. All regressions include control variables identical to earlier tables (not tabulated to save space), and also industry and year fixed effects (not tabulated). All regresors are lagged one year, except where otherwise noted. Firm-level cluster robust t-statistics are listed in parentheses.

	(1)	(2)	(3)	(4)
Estimation method	Tobit	Tobit	IVTobit	IVTobit
Institutional trading measure	Total IT		Total IT	
Panel A: Elasticity of pay				
Fitted Share explained by IT	-1.0564			
	(-3.710)			
Residual Share not explained by IT	0.0142			
	(0.714)			
Fitted PIN (log) explained by IT		-1.5263		
		(-3.632)		
Residual PIN (log) not explained by IT		-0.1511		
		(-3.103)		
Accruals quality (Jones, logistic)			0.4350	
			(3.310)	
Accruals quality (DD, log)				0.9230
				(2.287)
Observations	29478	29478	29143	29478
Pseudo R-squared	0.0554	0.0558		
Panel B: Options pay				
Fitted Share explained by IT	-0.3167			
	(-4.809)			
Residual Share not explained by IT	0.0151			
	(3.888)			
Fitted PIN (log) explained by IT		-0.4669		
		(-4.746)		
Residual PIN (log) not explained by IT		0.0263		
		(5.081)		
Accruals quality (Jones, logistic)			0.1269	
			(4.023)	
Accruals quality (DD, log)				0.2610
				(2.721)
Observations	29511	29511	29176	29511
Pseudo R-squared	1.491	1.480		

Table 7: continued

	(1)	(2)	(3)	(4)
Estimation method	Tobit	Tobit	IVTobit	IVTobit
Institutional trading measure	Total IT		Total IT	
Panel C: Incentive pay				
Fitted Share explained by IT	-2,632.7			
	(-6.154)			
Residual Share	-3.9728			
	(-0.126)			
Fitted PIN (log) explained by IT		-3,812.3		
		(-5.985)		
Residual PIN (log)		-368.8		
		(-4.961)		
Accruals quality (Jones, logistic)			1,090.6	
			(4.506)	
Accruals quality (DD, log)				2,275.5
				(2.860)
Observations	29511	29511	29176	29511
Pseudo R-squared	1.491	1.480		
Panel D: Historical measures of delta				
Fitted Share explained by IT	1.6813			
	(1.970)			
Residual Share	0.0791			
	(2.184)			
Fitted PIN (log) explained by IT		2.3955		
		(1.917)		
Residual PIN (log)		0.5999		
		(5.446)		
Accruals quality (Jones, logistic)			-0.6735	
			(-1.889)	
Accruals quality (DD, log)				-1.2665
				(-1.662)
Observations	27325	27325	26999	27325
Pseudo R-squared	0.0466	0.0471		

Table 8: **Regressions of PPS for CEOs only on opacity and information measures, using institutional trading (IT) for component breakouts and instruments**

The table reports two types of analyses of pay for performance sensitivity (PPS) for CEOs only for U.S. firms over 1993-2004. Columns (1)-(2) report Tobit regression coefficeints. For each model, a first-stage regression of stock price informativeness (alternatively measured as idiosyncratic risk share or PIN) on a measure of institutional trading has been applied as the basis for forming "Fitted" and "Residual" components of the respective informativeness measure. Total institutional trading is the first-stage variable. In all cases, the first stage regression also includes all control variables from the second-stage regression. Columns (3)-(4) report maximum likelihood IV Tobit regression coefficeints. Total institutional trading, along wiith other right hand side variables, is the instrument for accruals quality. Data is for firm-years satisfying data requirements as in Table 1. All regresors are lagged one year, except where otherwise noted. All regressions include industry and year fixed effects (not tabulated). Firm-level cluster robust t-statistics are listed in parentheses.

	(1)	(2)	(3)	(4)
Estimation method	Tobit	Tobit	IVTobit	IVTobit
Instrument	Total IT		Total IT	
Fitted Share explained by IT	-5.0674			
	(-4.437)			
Residual Share	0.2442			
	(3.677)			
Fitted PIN (log) explained by IT		-7.5096		
		(-4.420)		
Residual PIN (log)		0.5545		
		(3.284)		
Accruals quality (Jones, logistic)			2.0889	
			(3.735)	
Accruals quality (DD, log)				4.2060
				(2.465)
Observations	5439	5439	5382	5439
Pseudo R-squared	0.0351	0.0350		

Table 9: **Regressions of aggregate firm-wide PPS (of all executives together) on opacity and information measures, using institutional trading (IT) for component breakouts and instruments**

The table reports several analyses of pay for performance sensitivity (PPS) of firm-level aggregate data for all executives together. In Panel A, Columns (1)-(2) report Tobit regression coefficeints for executive compensation contract characteristics at US firms over 1993-2004. For each model, a first-stage regression of stock price informativeness (alternatively measured as idiosyncratic risk share or PIN) on a measure of institutional trading has been applied as the basis for forming "Fitted" and "Residual" components of the respective informativeness measure. Total institutional trading is the first-stage variable. In all cases, the first stage regression also includes all control variables from the second-stage regression. Columns (3)-(4) report maximum likelihood IV Tobit regression coefficeints for executive compensation contract characteristics. Total institutional trading, along wiith other right hand side variables, is the instrument for accruals quality. For Panel B, Columns (1)-(2) report Fama-Macbeth regression estimates of the same models as in the matching columns of Panel A. Data is for firm-years satisfying data requirements as in Table 1. All regresors are lagged one year, except where otherwise noted. All regressions include the same set of control variables as in previous tables (not tabulated to save space), and also industry and year fixed effects (not tabulated; year only for Fama Macbeth regressions). Firm-level cluster robust t-statistics are listed in parentheses.

	(1)	(2)	(3)	(4)
Instrument/First-stage	Total IT		Total IT	
Panel A: Panel regression				
Fitted Share explained by IT	-13.7346			
	(-6.263)			
Residual Share	0.4679			
	(3.745)			
Fitted PIN (log) explained by IT		-20.3232		
		(-6.194)		
Residual PIN (log)		1.1230		
		(3.542)		
Accruals quality (Jones, logistic)			5.5498	
			(4.919)	
Accruals quality (DD, log)				11.0230
				(3.209)
Observations	6407	6407	6333	6407
Pseudo R-squared	0.0354	0.0354		
Panel B: Fama Macbeth regression				
Fitted Share explained by IT	-13.1758			
	(-9.494)			
Residual Share	0.4113			
	(7.190)			
Fitted PIN (log) explained by IT		-19.6332		
		(-10.248)		
Residual PIN (log)		1.1263		
		(4.909)		
Observations	6407	6407		
R-squared	0.236	0.237		

Table A.1: Variable Definitions

This table provides definitions of the major empirical variables used in this study. Except as noted, non-compensation variables are measured for the year prior to compensation variables. The main data source for each variable is listed in parentheses.

Variable	Definition
PPS of compensation contract	the value-impact on the year's option grants per $1,000 change in shareholder value, calculated following the method of Yermack (1995) (S&P Execucomp).
Accruals quality (Jones)	the absolute value of discretionary accruals, calculated according to the modified Jones model as described in Dechow, Sloan and Sweeney (1995) (S&P Compustat).
Accruals quality (Dechow Dichev)	the standard deviation of residuals from regressions of total current accruals on lead, contemporaneous, and lagged operating cash flows, calculated according to the methodology of Rajgopal and Venkatachalam (2008). (S&P Compustat).
Institutional trading	the absolute value of the quarterly change in institutional holding, aggregated over all institutions trading shares in the firm, divided by total shares outstanding (Thomson 13-f).
Dedicated institutional trading	the absolute value of the quarterly change in institutional holding, aggregated over all dedicated institutions trading shares in the firm, divided by total shares, outstanding where dedicated institutions are defined using the criteria in
Bushee (1998). (Thomson 13-f).	
Net nstitutional trading	the signed value of the quarterly change in institutional holding, aggregated over all institutions trading shares in the firm, divided by total shares outstanding (Thomson 13-f).
Idiosyncratic risk share	the logarithm of the ratio of idiosyncratic volatility to total volatility (CRSP).
PIN	the Easley, Hvidkjaer and O'Hara (2002) measure of the probability of informed trading (www.rhsmith.umd.edu/faculty/hvidkjaer).
Institutional holdings percentage	the percentage of shares held by institutional investors (Thomson 13-f).
Institutional holdings concentration	the percentage of shares held by the five largest institutional investors, normalized by total institutional holdings (Thomson 13-f).
Market capitalization	the market value of equity, calculated as the product of the number of shares outstanding and share price, in millions of dollars.
Change in market cap	the change in market value of equity of the firm over the prior fiscal year; when denoted with *(t)*, for the current year (S&P Compustat).
Tobin's q	the sum of the market value of equity and book value of assets, less book value of equity and deferred taxes, divided by the book value of assets (S&P Compustat).
Total pay	the sum of the executive's salary, bonus, equity grants, and other annual compensation, in millions of dollars (S&P Execucomp).
Cash pay	the sum of the executive's yearly cash salary and bonus, in millions of dollars (S&P Execucomp).

References

Aggarwal, Rajesh, and Andrew Samwick, 1999, The other side of the tradeoff: The impact of risk on executive compensation, *Journal of Political Economy* 107, 65–105.

Almeida, Heitor, and Daniel Wolfenzon, 2005, The effect of external finance on the equilibrium allocation of capital, *Journal of Financial Economics* 75, 133–164.

Axelson, Ulf, and Sandeep Baliga, 2009, Liquidity and manipulation of executive incentive schemes, *Review of Financial Studies* 22, 3907–3939.

Bebchuk, Lucien, and Jesse Fried, 2004, *Pay Without Performance* (Harvard University Press).

Bergstresser, Daniel, and Thomas Philippon, 2006, CEO incentives and earnings management, *Journal of Financial Economics* 80, 511–529.

Bertrand, Marianne, and Sehdil Mullainathan, 2001, Are CEOs paid for luck? the ones without principals are., *The Quarterly Journal of Economics* 116, 901–932.

Boehmer, Ekhart, Joachim Gramming, and Erik Thiessen, 2005, Estimating the probability of informed trading - does trade misclassification matter?, *Journal of Financial Markets* 10, 26–47.

Bowen, Robert, Shiva Rajgopal, and Mohan Venkatachalam, 2008, Accounting discretion, corporate governance and firm performance, *Contemporary Accounting Research* 25, 351–405.

Bushee, Brian, 1998, The influence of institutional investors on myopic R&D investment behavior, *The Accounting Review* 73, 305–333.

Chemmanur, Thomas, Shan He, and Gang Hu, 2010, The role of institutional investors in seasoned equity offerings, *Journal of Financial Economics* 94, 384–411.

Chen, Qi, Itay Goldstein, and Wei Jiang, 2007, Price informativeness and investment sensitivity to stock price, *Review of Financial Studies* 20, 619–650.

Cheng, Qiang, and Terry Warfield, 2005, Equity incentives and earnings management, *The Accounting Review* 80, 441–476.

Core, John, Robert Holthausen, and David Larcker, 1999, Corporate governance, chief executive officer compensation, and firm performance, *Journal of Financial Economics* 51, 371–406.

Cornett, Marcia Millon, Alan Marcus, and Hassan Tehranian, 2008, Corporate governance and pay-for-performance: The impact of earnings management, *Journal of Financial Economics* 87, 357–373.

Cragg, J.G., 1971, Some statistical models for limited dependent variables with application to the demand for durable goods, *Econometrica* 39, 829–844.

Dechow, Patricia, and Ilia Dichev, 2002, The quality of accruals and earnings, *The Accounting Review* 77, 35–59.

Dechow, Patricia, Richard Sloan, and Amy Sweeney, 1995, Detecting earnings management, *The Accounting Review* 70, 193–226.

Duarte, Jefferson, and Lance Young, 2009, Why is PIN priced?, *Journal of Financial Economics* 80, 119–138.

Durnev, Artyom, Randall Morck, and Bernard Yeung, 2004, Value-enhancing capital budgeting and firm-specific stock return variation, *Journal of Finance* 59, 65–105.

Easley, David, Soeren Hvidkjaer, and Maureen O'Hara, 2002, Is information risk a determinant of asset returns?, *Journal of Finance* 57, 2185–2221.

Edmans, Alex, Xavier Gabaix, and Augustin Lanier, 2009, A multiplicative model of optimal CEO incentives in market equilibrium, *Reveiw of Financial Studies* 22, 4881–4917.

Ferreira, Miguel, and Paul Laux, 2007, Corporate governance, idiosyncratic risk and information flow, *Journal of Finance* 62, 951–989.

Greene, William, 2002, *Econometric Analysis* (Pearson Education, New York).

Hall, Brian, and Jeffery Liebman, 1998, Are CEOs really paid like bureaucratc, *Quarterly Journal of Economics* 112, 653–691.

Hartzell, Jay, and Laura Starks, 2003, Institutional investors and executive compensation, *Journal of Finance* 58, 2351–2374.

Holmstrom, Bengt, and Paul Milgrom, 1987, Aggregation and linearity in the provision of intertemporal incentives, *Econometrica* 55, 303–328.

Holmstrom, Bengt, and Jean Tirole, 1993, Market liquidity and performance monitoring, *Journal of Political Economy* 101, 678–709.

Holthausen, Robert, and Ross Watts, 2001, The relevance of the value relevance literature for financial accounting standard setting, *Journal of Accounting and Economics* 31, 3–75.

Jayaraman, Sudarshan, and Todd Milbourn, 2009, The role of stock liquidity in executive compensation, Working paper.

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

Jin, Li, and Stewart Myers, 2006, R^2 around the world: New theory and new tests, *Journal of Financial Economics* 79, 257–292.

Kang, Qiang, and Qiao Liu, 2008, Stock market, information production and executive incentives, *Journal of Corporate Finance* 14, 484–498.

Keim, Donald, and Ananth Madhavan, 1996, The upstairs market for large block transactions: Analysis and measurement of stock price effects, *Review of Financial Studies* 9, 1–36.

Keim, Donald, and Ananth Madhavan, 2007, Transactions costs and investment style: An inter-exchange analysis of institutional equity trades, *Journal of Financial Economics* 46, 265–292.

Kerschenheiter, Michael, and Nahum Melumad, 2002, Can "big bath" and earnings smoothing co-exist as financial reporting strategies?, *Journal of Accounting Research* 40, 761–796.

Kim, Kyonghee, 2007, Pay-performance sensitivity of CEO compensation in firms with high blockholder turnover: Is it compensation risk or pay for luck, Working paper.

Kothari, S.P., Susan Shu, and Peter Wysocki, 2009, Do managers withhold bad news?, *Journal of Accounting Research* 25, 241–276.

Lee, Dong, and Mark Liu, 2006, Does more information in stock price lead to greater or smaller idiosyncratic return volatility, Working paper.

Mohanram, Partha, and Shiva Rajgopal, 2009, Is information risk (PIN) priced?, *Journal of Accounting and Economics* 47, 226–243.

Morck, Randall, Bernard Yeung, and Wayne Yu, 2000, The information content of stock markets: Why do emerging markets have synchronous stock price movements?, *Journal of Financial Economics* 58, 215–260.

Murphy, Kevin J., 1999, Executive compensation, in Orley Ashenfelter and David Card, (eds.) *Handbook of Labor Economics*, 2485–?563 (North Holland, Amsterdam).

Myers, Stewart, 2000, Outside equity, *Journal of Finance* 55, 1005–1037.

Piotroski, Joseph, and Darren Roulstone, 2004, The influence of analysts, institutional investors, and insiders on the incorporation of market, industry, and firm-specific information into stock prices, *The Accounting Review* 79, 1119–1151.

Prendergast, Canice, 2000, What trade-off of risk and incentives?, *American Economic Review* 90, 421–425.

Prendergast, Canice, 2002, The tenuous trade-off between risk and incentives, *Journal of Political Economy* 110, 1071–1102.

Roll, Richard, 1988, R^2, *Journal of Finance* 43, 541–566.

Shleifer, Andrei, and Robert Vishny, 1997, A survey of corporate governance, *Journal of Finance* 52, 737–783.

Sias, Richard, Laura Starks, and Sheridan Titman, 2006, Changes in institutional ownership and stock returns: Assessment and methodology, *Journal of Business* 79, 2869–2910.

Sloan, Richard, 1996, Do stock prices fully reflect information in accruals and cash flows about future earnings?, *The Accounting Review* 71, 289–315.

Smith, C. W., and R. L. Watts, 1992, The investment opportunity set and corporate financing, dividend and compensation policies, *Journal of Financial Economics* 32, 263–292.

Smith, Gavin, and Peter Swan, 2009, Too good to be true: Do concentrated institutional investors really reduce executive compensation whilst raising incentives, Working paper.

Vega, Clara, 2006, Stock price reaction to public and private information, *Journal of Financial Economics* 82, 103–133.

Vega, Clara, and Jin Wu, 2006, Stock market microstructure measures of information asymmetry are related to marketwide information, Working paper.

Yermack, David, 1995, Do corporations award CEO stock options effectively?, *Journal of Financial Economics* 39, 237–269.

Yermack, David, 2006, Flights of fancy: Corporate jets, CEO perquisites, and inferior shareholder returns, *Journal of Financial Economics* 80, 211–242.