Information Asymmetry and Corporate Governance

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Abstract

In this study, we examine the impact of asymmetric information on three main mechanisms of corporate governance: the intensity of board monitoring, the exposure to market discipline, and the pay-for-performance sensitivity of CEO compensation. We find that firms facing greater asymmetric information tend to use less intensive board monitoring but rely more on market discipline and CEO incentive compensation. These results are consistent with the monitoring cost hypothesis. These results also support the notion that firms endogenously and optimally choose governance. Consistent with this viewpoint, we find that firm performance is not related to governance for the overall sample. However, firms suffer poor performance when they are forced to deviate from equilibrium. Our study therefore suggests that regulators should use caution when imposing uniform requirements on firms' corporate governance.

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1. Introduction

In recent years, corporate governance has received enormous attention due to a number of high-profile governance failures at the beginning of the century. Various parties—including the press, shareholders and regulators—are pressing for better governance for all firms. For example, in terms of board monitoring, shareholder activists demand a higher percentage of independent directors on the board and important board committees, more frequent director meetings and more hands-on involvement of the board with regard to daily operations. Laws and regulations (e.g., the Sarbanes-Oxley Act and amendments to NYSE and NASDAQ regulations) were passed to make some of the recommendations mandatory. In other words, "better" governance is often identified with "more" governance.

Despite the widespread sentiment, some researchers ask the important question: "Is governance one-size-fits-all?" This question itself is not a new one. Demsetz (1983) and Demsetz and Lehn (1985) show that firms optimally determine ownership structure (as a governance mechanism) based on firm characteristics. Hermalin and Weisbach (1991, 1998) theoretically and empirically demonstrate that board composition is endogenously chosen and is generally in equilibrium. Studies with recently available data provide additional evidence that confirms the general message that governance is endogenously determined and that one size does not fit all. Among others, see Gillan et al. (2003), Frye (2003), Crutchley et al. (2002), Mulherin (2005), Coles et al. (2006) and Boone et al. (2007).

In this paper, we study how one important firm characteristic—asymmetric information (i.e., the extent to which managers know more about a firm's value than does the rest of the world)—would affect a firm's choices of governance. The level of a firm's asymmetric information is not directly observable. We therefore measure asymmetric information by firm size (Vermaelen (1981) and Diamond and Verrecchia (1991)), R&D expenditures (Aboody and Lev (2000)), growth opportunity (Smith and Watts (1992) and McLaughlin et al. (1998)), number of analysts following the firm (Brennan and Subrahmanyam (1995)), analysts' forecast errors in

earnings (Gilson et al. (1998) and Krishnaswami and Subramanian (1998) and the firm's number of shareholders (Allen (1993)). We consider three governance mechanisms: board monitoring, exposure to monitoring from the takeover market (based on the firm's anti-takeover provisions) and CEO's incentive compensation. We choose these aspects of governance for their undisputable importance therein and also because these are mechanisms that are clearly at the discretion of the firms.[1]

Existing literature suggests that a firm's asymmetric information environment has an important impact on governance mechanisms. A number of papers make the case that the intensity of board monitoring should decrease with the extent of asymmetric information. For example, Demsetz and Lehn (1985) contend that the cost of monitoring management increases with the noisiness of a firm's operating environment. Gillan, Hartzell and Starks (2003) use this notion to argue that boards will monitor less in noisier environments. Raheja (2005) formalizes the idea in a theoretical model and demonstrates that firms optimally employ less independent boards when it is difficult for outsiders to verify projects. Several recent papers find supporting evidence for this hypothesis (Gillan et al. (2003), Boone et al. (2007) and Linck et al. (2007a)).

To the best of our knowledge, no prior empirical studies have examined the effects of asymmetric information on CEO compensation and anti-takeover provisions. The lack of empirical evidence is particularly striking considering that the theories have little consensus on these effects. Almazan and Suarez (2003) argue that firms with noisy signals regarding the CEO's influence on firm value should use less board monitoring as well as less incentive compensation. On the other hand, Hallman et al. (2005) argue that the threat of termination due to board monitoring and CEO incentive compensation can serve as alternative governance mechanisms. If that is the case, then higher asymmetric information might lead to less board monitoring but

[1] Some researchers consider other aspects of governance, such as monitoring by institutional shareholders and the use of leverage. However, to a large extent, institutional holding is not at the firm's discretion. A firm's use of leverage is first and foremost its capital structure policy and will depend on factors other than governance considerations.

higher CEO pay-for-performance. Similarly, Williamson (1983) argues that board monitoring and the market for corporate control can serve as substitutes for one another with regard to alternative governance mechanisms.[2] Combined with the monitoring cost hypothesis (Demsetz and Lehn (1985)), this argument suggests that firms with greater asymmetric information will employ less intensive board monitoring while relying more on the takeover market to discipline their managers.

Because optimal governance may be achieved via different channels, we believe that it is important to examine the effects of asymmetric information on all three governance mechanisms. Focusing on one and overlooking others may draw an incomplete and possibly misleading picture.

We first estimate OLS regressions for each of the three governance variables on the asymmetric information index, while controlling for other firm characteristics. We find that firms facing greater asymmetric information tend to impose less intensive board monitoring, install fewer anti-takeover provisions (i.e., have more exposure to external monitoring) and use higher-powered CEO compensation. This is consistent with the monitoring cost hypothesis, which states that asymmetric information increases direct monitoring costs, therefore resulting in firms' greater reliance on incentive compensation and external monitoring. We also recognize that the three governance variables might be jointly determined and that governance could also affect the extent of asymmetric information (e.g., through disclosure). In order to address these endogeneity issues, we estimate a simultaneous equation system. We find similar effects of asymmetric information on governance.

In order to further address the endogeneity issue, we identify a scenario in which firms experience an exogenous shock to their asymmetric information environment. We then examine

[2] Holding the market for corporate control as given for each firm, several papers examine how board compositions vary with different takeover environments. Results are mixed. Contrary to predictions of the substitution hypothesis, Brickley and James (1987) find that banks in non-acquisition states have more independent boards than do banks in acquisition states. Consistent with the substitution hypothesis, Kini et al. (1995) find that CEO turnover following takeovers is more likely when the target's board is dominated by inside directors. Mayers et al. (1997) find that in the insurance industry, mutual firms (with non-transferable ownership) use more independent boards than do stock firms.

whether their governance mechanisms change as predicted. Existing literature and our own examination suggest that Regulation FD, which became effective in 2000, increases the quantity of firms' voluntary information disclosure and reduces firms' asymmetric information. We calculate the average change in each of the three governance variables for the two years before and after Regulation FD became effective. We find that for an average firm, the intensity of board monitoring increases, the exposure to external monitoring decreases, and the pay-for-performance sensitivity of CEO compensation decreases. These changes are consistent with what the regression results predict for decreases in asymmetric information.

Our results therefore suggest that firms endogenously choose governance based on their own characteristics. If this is the case, then the governance mechanisms in equilibrium should not affect firm performance. Consistent with this prediction, we find little evidence that the intensity of the three governance mechanisms affect stock or operating performance for our overall sample.

However, if an exogenous shock forces firms away from their optimal governance choices, then we expect their performance to suffer. New regulations—such as the Sarbanes-Oxley Act and the amendments to NYSE and NASDAQ rules—impose explicit requirements on board compositions. We view these regulation changes as exogenous shocks to the intensity of firms' board monitoring. If firms are in equilibrium and the new rules force them to deviate, then their performance may suffer. Consistent with this prediction, we find that impacted firms (i.e., firms experiencing considerable increases in board monitoring intensity following the new regulations) experience negative abnormal returns while the remainder of firms do not. We also find that the operating performances for impacted firms experience more negative changes.

In summary, we document empirical evidence on how asymmetric information affects firms' governance choices. Our results support the monitoring cost hypothesis and the notion that firms endogenously and optimally choose governance. The policy implication is that caution should be used when imposing uniform governance requirements on all firms through laws and regulations, since these requirements may force some firms to deviate from their optimal choices.

The rest of the paper is as organized as follows. Section 2 describes the sample and the measures for asymmetric information and governance variables. Section 3 presents the regression results on the effects of asymmetric information on governance. Section 4 examines the governance changes around Regulation FD. Section 5 tests the general relationship between governance and firm performance. Section 6 examines the stock performances following the Sarbanes-Oxley Act. Section 7 concludes.

2. Data and Variables

Our initial sample includes all Compustat firm-years between 1996 and 2003 that meet the following criteria: 1) both assets and market value of equity of at least $10 million in 2003 dollars by the end of the fiscal year; 2) closing price of no lower than $3 at the end of the fiscal year; and 3) Tobin's Q (measured as book assets minus book value of equity plus market value of equity all divided by book assets) not missing.[3] We then require each firm-year observation to have at least one non-missing measure of the following three governance mechanisms: the intensity of board monitoring; the intensity of external monitoring based on the index of anti-takeover provisions by Gompers et al. (2003); or the pay-for-performance sensitivity of the CEO compensation structure. The final sample includes 12,706 firm-year observations from 1996 to 2003.

2.1 The Construction of Governance Variables

2.1.1 The intensity of board monitoring—the board index

Because the board of directors has the fiduciary duty to monitor management on behalf of shareholders, board monitoring is the most explicit form of corporate governance. It is widely agreed that boards with more independent directors have stronger monitoring capabilities (see Fama and Jensen (1983), Weisbach (1988), Brickly et al. (1994) and Borokhovich et al. (1996)). The existence and independence of board auditing, compensation and nominating committees

[3] Since the IRRC data on boards of directors starts from 1996, the sample starts from this year.

may also play an important role in board monitoring (See John and Senbet (1998), and Gillan and Starks (2000)). Jensen (1993) and Yermack (1996) argue that smaller boards are more efficient than larger ones. Jensen (1993) and Klein (1998) further argue that the separation of the CEO and the chair of the board as well as the presence of a lead director help to improve the effectiveness of board monitoring.

Following Gillan et al. (2003), we construct a board index to capture the various aspects of board monitoring capability. The board index increases in the percentage of independent directors, the separation of the CEO and the chair, the presence of a lead director, the existence of audit, nomination, compensation and governance committees, and the percentage of independent directors on audit, nomination and compensation committees; the index decreases in the size of the board.

We obtain board data from the Investor Responsibility Research Center (IRRC) Directors Database. For each individual board variable described above, we calculate its percentile ranking over the entire sample. For dummy variables, the rank equals 100 or 0. A higher score indicates stronger monitoring. The board index then equals the average percentile ranking across various board variables.

2.1.2 The intensity of external monitoring—the reverse G index

External monitoring refers to the discipline imposed by the market of corporate control. The less anti-takeover protection a company has in place, the more it is subject to external discipline. Our measure of external monitoring is based on the governance index constructed by Gompers et al. (2003) (hereafter G-index). G-index equals the number of anti-takeover provisions a firm has; its range is between zero and 24. For interpretation convenience, we calculate the reverse G-index (RG-index), which equals 24 minus the original G-index. Thus, a higher RG-index value indicates fewer anti-takeover provisions and a higher intensity of external monitoring.

We obtain anti-takeover provisions from the IRRC Governance database. The anti-

takeover provision data are collected as of September 1990, July 1993, July 1995, February 1998, November 1999 (for 2000 publication), January 2002, and January 2004, respectively. Since the rest of the data in our study are for each fiscal year's end, we match the anti-takeover provision data of year t+1 to the rest of the data in year t. For example, the board data of 1997 are matched with anti-takeover provision data collected as of February 1998. Following Gompers et al. (2003), in cases where data for the current year are missing, we use existing data from the preceding year that is closest in time. For example, the RG-index of 1996 is based on data collected as of July 1995. Gompers et al. (2003) argue that the noise introduced in this way is minor since a firm's governance index is fairly stable over time.

2.1.3 CEO pay-for-performance sensitivity

In addition to internal and external monitoring, CEO compensation is another important governance mechanism utilized to align managerial incentives with those of the shareholders. A CEO is said to be more aligned with shareholders if the pay-for-performance sensitivity (PPS) of her compensation is higher.[4]

A CEO's PPS is the change of her firm-related wealth per $1 change of shareholder value. Specifically, we measure the CEO PPS as the sum of her stock holdings and delta-weighted option holdings divided by the number of shares outstanding. To calculate option-related PPS, we follow the procedures of Cai and Vijh (2006) and infer the options' exercise prices, maturity dates and the number of shares of a CEO's option portfolio. We then calculate the option delta using the Black-Scholes model. We obtain CEO compensation and holdings data from Standard and Poor's ExecuComp database.

Table 1 presents descriptive statistics for the governance variables. Panel A shows the summary statistics for the full sample. The mean and median values of the board index are 44.4

[4] See Murphy (1999) for a survey on this topic.

and 46.4, respectively.[5] The board index exhibits a high degree of variation, where the lowest and highest values are 0.6 and 87.7, respectively. The mean and median of the RG-index are both equal to 15.0, which corresponds to 9 anti-takeover provisions. The least protected firm has an RG-index of 23 (only 1 anti-takeover provision), while the most protected firm has an RG-index of 5 (21 anti-takeover provisions). An average CEO has a PPS value of 4.1%, indicating that her firm-related wealth increases by $41 for every $1,000 increase in shareholder value. The median PPS is 1.6%.

Panel B of Table 1 shows the mean and median values of the three governance variables by year. There is a clear trend whereby the intensity of board-monitoring increases over our sample period. The mean value of the board index starts relatively low in 1996 and 1997 (36.1 and 23.0, respectively) and increases steadily to 56.1 in 2003. The median values follow a similar pattern. The peak of the board index in 2003 may reflect firms' efforts to improve corporate governance following the passage of the Sarbanes-Oxley Act of 2002. The average RG-index, on the other hand, is quite stable over time, hovering around the value of 15. The CEO PPS increases between 1996 and 1999 and decreases thereafter.

Panel C of Table 1 presents the correlation matrix of the three governance variables. The board index is negatively correlated with both the RG-index and the CEO PPS (with correlation coefficients of -0.1 and -0.2, respectively). The RG-index is positively correlated with the CEO PPS (with a correlation coefficient of 0.2). All correlations are highly significant. The simple correlations suggest that incentive compensation and external monitoring are substitutes for internal board monitoring, while incentive compensation and external monitoring are complementary to one another.

2.2 The Construction of Asymmetric Information Index

The literature has suggested various measures of information asymmetry. For example,

[5] The average board index does not equal 50% because, for some of the index's dummy variables, the average is not 50%.

information asymmetry tends to decrease with firm size (Vermaelen (1981)), increase with R&D expenditure (Aboody and Lev (2000)), increase with growth opportunity (Smith and Watts (1992)) and decrease with analyst coverage (Thomas (2002) and Krishnaswami and Subramaniam (1999)). These measures are correlated with each other but each contains unique information. Most empirical papers, however, focus on one or two variables to measure asymmetric information. In this paper, we use a comprehensive measure by constructing an index of asymmetric information based on the various dimensions of the concept. Specifically, our asymmetric information index (AI index) is based on the percentile rankings of firm size (assets and market value of equity), R&D expenditures, Tobin's Q, the number of analysts following the firm, analyst forecast errors and the number of shareholders over the sample period.

1. Firm size

   Large firms may face less information asymmetry because they tend to be more mature firms, have established and time-tested disclosure policies and practices, and receive more attention from the market and regulators (Diamond and Verrecchia (1991) and Harris (1994)). We use two measures of firm size: assets and market value of equity.

2. R&D expenditures

   Aboody and Lev (2000) document that insider trading gains are significantly higher in R&D-intensive firms than in firms without R&D. They conclude that R&D is a major contributor to information asymmetry. We measure a firm's R&D intensity by its R&D expenses scaled by assets. Consistent with prior studies, we set R&D expenses to zero if they are missing.

3. Tobin's Q

   Existing studies argue that the asymmetric information problem is more severe for firms with significant growth opportunities (Smith and Watts (1992)). Hence, proxies for firms' investment opportunities have also been used to measure information asymmetry (McLaughlin et al. (1998)). One such common proxy is Tobin's Q. We calculate Tobin's

Q as book value of assets minus book value of equity plus market value of equity divided by book value of assets.

4. Number of analysts following the firm

   The number of analysts is used as a proxy for the supply of information about a firm. It is intuitive that the more analysts follow the firm, the more information is discovered and revealed to the public and the less asymmetric information the firm suffers. For example, Brennan and Subrahmanyam (1995) argue that greater analyst coverage tends to reduce the adverse selection costs as measured by the inverse of market depth. Chemmanur and Paeglis (2001) find that analyst coverage increases after firms issue tracking stock, which finding is consistent with the notion that firms issue tracking stock to unlock hidden value.

5. Analysts' earnings forecast errors

   Financial analysts are professionals who seek and research firm information. To a large extent, their knowledge of a firm represents what the market knows about a firm. Analysts' forecast errors regarding a firm's earnings can therefore proxy the extent of asymmetric information between insiders and outsiders. Gilson et al. (1997) and Krishnaswami and Subramaniam (1998) use analysts' earnings forecasts errors as a proxy for information asymmetry. We obtain analyst and analyst forecast information from I/B/E/S. We measure analysts' forecast errors as the ratio of the absolute difference between actual annual earnings per share and the mean forecast, standardized by the stock price at the fiscal year end.

6. Number of shareholders

   Allen (1993) argues that the stock market aggregates information that all shareholders have. Some obtain information at a cost; some obtain serendipitous information at no cost. This suggests that a higher number of shareholders may increase the amount of information the market has, thus reducing information asymmetry.

We also consider including stock return volatility and analyst forecast dispersion in the AI index.[6] The criticism for both measures is that they may reflect the risk of a firm's investment more than they do the information difference between insiders and outsiders. Our results are robust when we include these variables in the AI index.

To estimate the AI index, we first calculate the percentile ranking for each variable over the entire sample. A higher score indicates a greater degree of information asymmetry. For example, we sort firm size in a descending order; a percentile ranking of 100 is thus associated with the smallest firms. We then average the percentile rankings across all the component variables in order to attain the value of the AI index.

Table 2 presents descriptive statistics of the AI index and its component variables. Panel A shows the summary statistics for the overall sample. The mean (median) value of firm assets is $10.2 billion ($1.4 billion) as measured by book value of assets.[7] The mean (median) market value of equity is $6.4 billion ($1.3 billion). R&D expenses account for 3% of total assets on average. The mean value of Tobin's Q is 2.1. The average firm has about 36,000 shareholders and is followed by 13 analysts. The mean analyst forecast error is 7%.

Panel B of Table 2 shows the Spearman correlation matrix between the AI index and its component variables, and between the component variables. The correlations among the component variables have magnitudes ranging from 0.02 to 0.78, indicating that the component variables are correlated with each other but that each contains unique information.

3. Corporate Governance and Asymmetric Information

In this section, we examine how a firm's information asymmetry environment affects its choice of governance mechanisms. We first examine the univariate relationships between

[6] Fama and Jensen (1983) note that firms with higher stock return volatility are more likely to have specific information unknown to outsiders. Gillan et al. (2003) and Linck et al. (2007a) use this variable as a proxy for asymmetric information. Dierkens (1991) and Krishnaswami and Subramaniam (1999) use analyst forecast dispersion as a proxy for asymmetric information.

[7] All dollar values are adjusted to year 2003 dollars using the CPI index.

asymmetric information and each of the three governance variables. We then examine the marginal effect of asymmetric information on the three governance mechanisms after controlling for other firm characteristics. Finally, we take into account the possibility that governance mechanisms and asymmetric information might be endogenously and jointly determined and we estimate a simultaneous regression system.

3.1 Univariate results

Table 3 reports the univariate relationships between each of the asymmetric information measures and each of the governance variables. Based on each asymmetric information component variable and the AI index, we divide the sample into two groups (above or below the median). We then compare the average values of each governance variable between these two groups. For interpretation convenience, we always calculate the difference as the mean governance variable value of the high AI subsample minus that of the low AI subsample. For example, when we divide the sample based on assets, the difference in the board index is calculated as the average board index value of smaller firms minus that of larger firms. However, when we divide the sample based on R&D expenses, we calculate the difference as the average board index value of higher R&D firms minus that of lower R&D firms.

The univariate results show remarkably consistent patterns between each governance mechanism and various asymmetric information measures. For each of the asymmetric information component variables and the AI index, firms with higher asymmetric information use less intensive board monitoring, more discipline in external monitoring and higher CEO PPS. This is consistent with the notion that it is more costly for firms with higher asymmetric information to monitor management directly, resulting in shareholders' higher reliance on incentive alignment and external market discipline.

3.2 Multivariate Regression Results

In this section, we examine the marginal effects of asymmetric information on governance mechanisms after controlling for other firm characteristics. Specifically, we run multivariate regressions of each governance variable on the AI index and control variables. We include the natural logarithm of assets, Tobin's Q and a regulated industry dummy (SIC codes of 4900-4999 or 6000-6999) as control variables in all regressions. Firm size has been shown to affect various aspects of governance mechanisms. Large firms tend to have larger but also more independent boards of directors (Boone et al. (2007)). Large firms are less likely to be acquired and therefore may not need anti-takeover provisions in order to deter takeover bids (Hasbrouck (1985) and Palepu (1986)). Large firms also tend to have lower CEO PPS due to the CEOs' wealth constraints and risk aversions (Schaefer (1998)). Similarly, investment opportunities and regulations affect a firm's general corporate environment and may also have implications for the firm's governance choices. Since both firm size and Tobin's Q are component variables in the AI index, we first estimate a regression of total assets (or Q) on the AI index and then we use the residuals in the governance regressions.

In addition to the three common variables, we also include different control variables for each of the three governance variable regressions. For the board monitoring regression, we include industry-adjusted EBIT change from the prior year and an interaction term of EBIT change times CEO tenure. Hermalin and Weisbach (1998) argue that the prior year's earnings are a good predictor for the rise and fall of the CEO's bargaining power relative to that of the board. Brick et al. (2006) find that EBIT change is negatively related to board monitoring and that the bargaining power of the CEO increases with his tenure. Thus, we expect the board index to be negatively related to the product of the prior year's accounting performance and the CEO's tenure.

For the RG-index regression, we include prior year stock return as a control variable. Carleton et al. (1998) and Mitchell and Lehn (1990) document that the likelihood of being

acquired increases when a firm's stock performance is poor. A firm may therefore wish to install anti-takeover provisions (lower RG-index value) when its stock return is low.

In the regression of the CEO PPS, we include stock return volatility as a control variable. Holmstrom and Milgrom (1987) argue that the optimal performance-related compensation component (the PPS) for risk-averse managers should be inversely related to firm risk. Aggarwal and Samwick (1997) document evidence supporting this hypothesis.

Table 4 presents the OLS regression results. Column (1) shows the results of the univariate regression of the board index on the AI index and Column (2) shows the multivariate regression results. The coefficient on the AI index is -0.034 in the univariate regression and -0.046 in the multivariate regression. Both are significant at the 1% level. This result suggests that the intensity of board monitoring decreases as asymmetric information rises, which notion is consistent with the monitoring cost hypothesis.

Columns (3) and (4) in Table 4 show results of the univariate and multivariate regressions of the RG-index, respectively. The coefficient on the AI index is 0.032 in the univariate regression and 0.037 in the multivariate regression. Both are significant at the 1% level. This result suggests that firms use more external market discipline as asymmetric information rises.

Columns (5) and (6) in Table 4 show results of the univariate and multivariate regressions of the CEO PPS, respectively. The coefficient on the AI index is 0.084 in the univariate regression and 0.082 in the multivariate regression. Both are significant at the 1% level.

Examined collectively, the results of the OLS regressions suggest that information asymmetry plays an important role in firms' governance decisions. Firms facing greater information asymmetry use less intensive board monitoring, install fewer anti-takeover provisions and make CEO compensation more closely linked to shareholder value change. All of these results are consistent with the monitoring cost hypothesis. That is to say, firms with greater information asymmetry incur higher costs from direct monitoring and therefore rely more on external market monitoring and incentive compensation.

3.3 Results of Simultaneous Equations

The OLS regressions above do not address two types of endogeneity issues. First, firms may determine the optimal system of governance (i.e., the combination of various governance mechanisms) simultaneously rather than choosing each governance mechanism separately. In other words, the optimal level of one governance mechanism not only depends on the exogenous firm characteristics and environment, but also depends on other governance mechanisms. For example, if a firm is having difficulty putting an efficient and effective board of directors in place, it might want to give its managers more incentive compensation to align their interests, or to expose its management to a larger degree of external market discipline. Second, the design of the corporate governance system may also affect the level of a firm's asymmetric information. Healy and Palepu (2001) show that firms with higher board strength tend to disclose information more timely. On the other hand, CEOs with higher-powered compensation may have an incentive to delay the disclosure of certain information (Aboody and Kasznik (2000)).

To address these endogeneity issues, we estimate a system of simultaneous equations, allowing the various governance mechanisms and the level of asymmetric information to be jointly determined. Specifically, we estimate the following regression system:

$$\text{Board index} = a_1 + a_2*\text{AI index} + a_3*\text{RG index} + a_4*\text{CEO PPS} + a_5*\text{instruments} + a_6*\text{control variables}$$

$$(\text{RG index})_{it} = b_1 + b_2*\text{AI index} + b_3*\text{board index} + b_4*\text{CEO PPS} + b_5*\text{instruments} + b_6*\text{control variables}$$

$$\text{CEO PPS} = c_1 + c_2*\text{AI index} + c_3*\text{board index} + c_4*\text{ CEO PPS} + c_5*\text{instruments} + c_6*\text{control variables}$$

$$\text{AI index} = d_1 + d_2*\text{board index} + d_3*\text{RG index} + d_4*\text{ CEO PPS} + d_5*\text{instruments} + d_6*\text{control variables}$$

The control and instrumental variables used in the first three equations are the same as those discussed in the previous subsection. For the AI index, we use firm age, an S&P 500 dummy and a NYSE listing dummy as instruments. Firms with longer histories tend to be better

understood by the market and thus should have lower levels of asymmetric information. Firms traded on the NYSE—especially those included in the S&P 500 index—receive more investor attention and analyst coverage. As a result, their information environments should be more transparent. Our main interest is still the coefficients of the AI index in the first three governance equations.

Table 5 reports the results of the simultaneous equations. First of all, we find that the coefficients of the AI index in the first three equations are consistent with what we find from the OLS regressions. It equals -0.053 in the board equation, 0.038 in the RG-index equation, and 0.078 in the CEO PPS equation. All three are statistically significant at the 1% level. Thus, after controlling for endogeneity, our earlier findings hold: firms with greater asymmetric information tend to use less intensive board monitoring, more market discipline and more CEO incentive compensation.

Second, results in Table 5 confirm that the three governance mechanisms indeed affect each other. In particular, the results suggest that board monitoring and external monitoring could be substitutes for one another and that external monitoring and CEO PPS are complements to one another, which findings are consistent with the simple correlation results. Third, results confirm that a firm's asymmetric information is also affected by its governance system.

In summary, after controlling for endogeneity issues, results from simultaneous equations confirm earlier OLS results regarding how asymmetric information affects governance mechanisms. In addition to this econometric treatment of endogeneity, we also identify a scenario in which firms experience exogenous shocks to their asymmetric information environments and examine the changes in their governance mechanisms afterwards. We conduct this experiment in the next section.

4. Regulation FD and Corporate Governance

Regulation FD, which became effective on October 23 of 2000, represents an exogenous shock to firms' information environments. The regulation governs the practice of voluntary disclosure for corporations with publicly traded securities. It prohibits corporations from disclosing material information to selected investors or to securities market professionals before disclosing the information to the public. The intent of Regulation FD is to eliminate superior trading opportunities for beneficiaries of firms' selective disclosures. Straser (2002), Bailey et al. (2003) and Heflin et al. (2003) document evidence that firms increase disclosures following Regulation FD, suggesting that asymmetric information decreases with this event.[8]

Panel A of Table 6 compares the averages of the AI index in the two years prior to (1998-1999) and following (2000-2001) the time that Regulation FD went into effect. The mean value of the AI index decreases significantly by 2.2 after the regulation, which is a 4.5% decrease from the mean value of 48.6 between 1998 and 1999. We also divide the sample into high and low AI subsamples (above and below the median) based on their average AI index values between 1998 and 1999. The AI index value decreases significantly for both subsamples. However, the high AI firms have much larger changes, suggesting that Regulation FD has a bigger direct impact on firms with high asymmetric information. We therefore view Regulation FD as a negative shock to asymmetric information and examine whether the governance variables change as predicted by our regression results. That is to say, when asymmetric information decreases, we expect to see more intensive board monitoring, less external discipline and lower PPS.

In Panel B of Table 6, we compare the governance variables before and after Regulation FD. The first column reports the t-tests of the changes in each of the governance variables for all

[8] Mixed results have been found for changes in asymmetric information following Regulation FD using microstructure measures, such as bid-ask spread and PIN (probability of informed trading). Bushee et al. (2004), Chiyachantana et al. (2004), Eleswarapu et al. (2004), Gintschel and Markov (2004) and Topaloglu (2003) document decreases in effective bid-ask spreads after Regulation FD. Straser (2002) and Sidhu et al. (2005) find that the adverse selection component of the bid-ask spread increases after Regulation FD. Duarte et al. (2006) document that the probability of informed trading increases after Regulation FD.

firms in the sample. The change in the mean value of the board index is 3.6, which is a 7.8% increase from the mean value of 46.2 between 1998 and 1999. The change in the mean value of the RG-index is -0.6, which is a 3.9% decrease from 15.2 between 1998 and 1999. The change in the mean PPS is -0.007, which is a 15.6% decrease from the mean value of 0.045 between 1998 and 1999. These results indicate that there is more intensive board monitoring, less external monitoring and lower CEO PPS following the introduction of Regulation FD.

We are also interested to see whether Regulation FD has different impact on firms with different levels of asymmetric information. In Columns (2) and (3) of Panel B of Table 6, we look at the changes in the governance variables in the high and low AI subsamples, respectively. For each governance variable, the change is in the same direction within both subsamples. However, the magnitudes of the changes in the RG-index and the CEO PPS are much greater in the high AI subsample than in the low AI subsample. These firms, with their asymmetric information decreases more comparable to those of low AI firms, tend to adjust their governance variables to a large extent as well.

Overall, the case analysis surrounding Regulation FD provides evidence to support the regression results. We show that firms adjust to more intensive board monitoring, less external discipline and lower CEO PPS when information asymmetry decreases.

5. Corporate governance and performance

In this paper, we study the ways in which firms determine their optimal governance systems. A natural question arises as to whether or not—and if so, how—corporate governance affects firm performance. Empirical results are mixed. Some authors show that firm performance depends on governance. For example, see Gompers et al. (2003), Cremers and Nair (2005), Brown et al. (2005) and Baek et al. (2004). Other authors find no evidence that firm performance is significantly related to governance. For example, see Hermalin and Weisbach (1991) and Chidambaran et al. (2006). The findings of no relationship are usually interpreted as evidence that

firms have endogenously chosen their optimal governance systems and that there is no additional gain to be found by changing the levels of various governance mechanisms.

In the previous sections, we show that firms' governance choices depend on their asymmetric information levels. The relationships between firm performance and governance variables may therefore be different for firms with different levels of information environments. In this section, we divide the sample based on the AI index and examine whether differences in governance variables lead to differences in performance within each subsample.

At the end of June each year (starting from 1997), we first sort firms into high and low AI subsamples based on their AI index values (above and below the median) at the end of the previous fiscal year. Within each subsample, we further sort firms into deciles based on one of the three governance variables. We then construct a portfolio that buys stocks of firms in the top decile of the governance variable and sells those in the bottom decile. We follow the monthly returns of this portfolio for one year starting from July of the portfolio-formation year to June of the next year. Repeating the procedure for each year, we have a time-series of 96 monthly returns (July 1997 to June 2005) for the portfolio that buys firms in the top decile of a governance variable and sells firms in the bottom decile.

If, on average, firms' governance choices are not at an optimum level, we would expect the higher portfolio to generate significant abnormal returns. We estimate the Fama-French-Carhart four-factor model and use the intercept—alpha—as the measure of the governance portfolio's abnormal return.[9]

Table 7 reports the alphas of these regressions. Panel A shows the alphas for both equal- and value-weighted portfolios formed based on the board index. We find that all four portfolios (equal- and value-weighted portfolios in the high and low AI subsamples) yield insignificant abnormal returns. This finding suggests that, on average, firms' board monitoring is optimal. Panel B (Panel C) shows the alphas for portfolios based on the RG-index (CEO PPS). With one

[9] We thank Kenneth French for providing the factor data on his website.

exception, all these portfolios' alphas are insignificantly different from zero, suggesting that firms' exposure to external monitoring and their use of CEO PPS are also optimal.

We also examine whether firms' operating performances change as their governance variables change. Specifically, for both the high and low AI subsamples, we sort firms into deciles based on each of the three governance variables and we compare the differences in ROE and profit margin. We find little evidence that differences in governance lead to differences in ROE or profit margin for either the high or low AI subsample (not reported).

These results are consistent with Chidambaran et al. (2006), who also find that differences in governance mechanisms do not lead to differences in firm performance and conclude that firms are, on average, at optimum levels for their choices of governance.

6. Sarbanes-Oxley Act and Stock Returns

If firms optimally choose governance on their own, then regulations that force them to change may actually lead them off equilibrium. In that case, firms could suffer poor performance. Following a wave of accounting frauds and the infamous bankruptcy of Enron, new regulations were passed to improve corporate transparency and board governance. The Sarbanes-Oxley Act (SOX) was signed into law on July 30, 2002. NYSE and Nasdaq approved their new listing requirements on corporate governance around the same time. SOX and the new exchange rules impose explicit requirements on board structure.[10] We therefore view this change of regulatory environment as an exogenous shock to firms' board governance. These new regulations will force some firms to change their board monitoring practices. If those firms were in equilibrium prior to

[10] Linck et al. (2007b) summarize the major governance provisions as follows: 1) SOX mandates that the audit, compensation and nominating committees be composed entirely of independent directors. The audit committee must have a minimum of three members and be composed of independent directors only. Further, each member of the audit committee must be financially literate. One member must possess financial expertise or the firm must disclose that it does not have such an expert and explain why; and 2) the NYSE and Nasdaq new listing requirements mandate that each NYSE and Nasdaq listed firm must have an independent director-dominated board. The independent director must meet a refined definition of independence.

the shock, then they are forced to deviate from their optimal governance systems, which in turn could have adverse effects on their performances.

We examine whether firms that are forced to comply with the stricter board requirements suffer poor stock performances, under the assumption that firms experiencing bigger increases in board index values are more likely to be forced to change. We calculate the changes in the board index between years 2001 and 2003. We then divide firms into two groups based on their changes in the board index: impacted firms and non-impacted firms. A firm is considered to be impacted by the new regulations if its change in board index is in the top 25 percentile. (Changes are all positive in this group.) If impacted firms tend to be forced to deviate from their optimum, we expect a portfolio of these firms to yield poor stock performance during 2003. We use daily returns and estimate the abnormal returns using the Fama-French-Carhart four-factor model as the benchmark.

Table 8 reports the Fama-French-Carhart four-factor regressions for impacted and non-impacted firms, respectively. The first two columns present the regression results for the equal- and value-weighted portfolios of impacted firms. The last two columns present the regression results for equal- and value-weighted portfolios of non-impacted firms.

The regression intercepts measure the abnormal returns. For non-impacted firms, the equal- and value-weighted portfolios have abnormal daily returns of -0.004% and -0.003%, respectively. Both are statistically insignificant. In contrast, the daily abnormal returns for impacted firms are -0.018% for the equal-weighted portfolio and -0.034% for the value-weighted portfolio, the latter of which result is significant at the 5% level. The annualized abnormal returns are -4.4% and -8.2%, respectively. We also look at the changes in operating performance for impacted and non-impacted firms between 2001 and 2003. For both profit margin and ROE, the changes are more negative for impacted firms than for non-impacted firms. These results are consistent with the hypothesis that firms suffer poor performance when forced to deviate from their equilibrium governance.

7. Conclusions

We study the impact of asymmetric information on three main mechanisms of corporate governance: the intensity of board monitoring, the exposure to market discipline (based on the use of anti-takeover provisions) and the pay-for-performance (PPS) sensitivity of CEO compensation. We find that firms facing greater asymmetric information tend to use less intensive board monitoring, have more exposure to market discipline, and have higher CEO PPS. These results are consistent with the monitoring cost hypothesis. That is to say, asymmetric information leads to higher costs of direct board monitoring and therefore causes firms to rely more on indirect governance mechanisms, such as CEO incentive compensation and market discipline. Our results hold after controlling for endogeneity among governance mechanisms and between governance and asymmetric information.

The results that governance depends on asymmetric information provide additional evidence to support the notion that firms endogenously and optimally choose governance. Consistent with this viewpoint, we find that firm performance is not related to governance for our overall sample and that firm performance suffers when firms are forced to deviate from equilibrium. Our study therefore suggests that caution should be used in imposing uniform requirements on firms' corporate governance.

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Table 1
Descriptive statistics of governance variables

The sample period is from 1996 to 2003. Board index equals the average percentile rankings of board size, percentage of independent directors on the board, a dummy variable equal to one if there exists an audit committee, percentage of independent directors on the audit committee, a dummy variable equal to one if there exists a compensation committee, percentage of independent directors on the compensation committee, a dummy variable equal to one if there exists a nominating committee, percentage of independent directors on the nominating committee and percentage of independent directors on the governance committee, a CEO-board chair duality dummy and a dummy variable equal to one if there exists a lead director. RG-index equals 24 minus the governance index as defined in Gompers et al. (2003), i.e., 24 minus the number of anti-takeover provisions a company has. CEO PPS equals the sum of CEO stock holdings and delta-adjusted option holdings divided by the number of outstanding shares of a company.

Panel A: Descriptive statistics

	N	Mean	Median	St. dev.	Min	Max
Board index	12,068	44.41	46.36	14.20	0.63	87.71
RG-index	12,862	14.99	15.00	2.74	5.00	23.00
CEO PPS (%)	12,705	4.07	1.60	7.00	0.00	77.08

Panel B: Year-by-year distribution

		Board index		RG-index		CEO PPS (%)	
Year	N	Mean	Median	Mean	Median	Mean	Median
1996	1,577	36.13	34.67	14.68	15	3.95	1.45
1997	1,770	22.97	22.22	15.22	15	4.17	1.49
1998	1,638	46.08	46.50	15.24	15	4.35	1.52
1999	1,693	46.59	46.64	15.01	15	4.51	1.66
2000	1,609	47.44	47.70	14.97	15	4.31	1.80
2001	1,708	48.52	48.95	14.92	15	3.87	1.69
2002	1,586	50.82	51.73	14.85	15	3.78	1.60
2003	1,810	56.08	57.36	14.94	15	3.51	1.61

Panel C: Correlation matrix (p-value in parentheses)

	Board index		RG-index		CEO PPS	
Board index	1.00	(<0.0001)	-0.12	(<0.0001)	-0.19	(<0.0001)
RG-index			1.00	(<0.0001)	0.20	(<0.0001)
CEO PPS					1.00	(<0.0001)

Table 2
Descriptive statistics of asymmetric information variables

The sample period is from 1996 to 2003. Assets and market value of equity are measured at the fiscal year end in millions of year 2003 dollars. Tobin's Q equals book value of assets minus book value of equity plus market value of equity, all divided by book value of assets. Analysts' forecast error is equal to the actual annual EPS minus the mean analysts' forecast, standardized by the closing price at the fiscal year end. AI (asymmetric information) index equals the average of the percentile rankings of the seven asymmetric information variables.

Panel A: Descriptive statistics

	N	Mean	Median	Stdev	Min	Max
Assets ($million)	15,211	10,215	1,378	47,038	14	1264,032
Market value of equity ($million)	15,211	6,377	1,276	22,411	11.44	561,420
R&D/assets	15,211	0.03	0.00	0.07	0.00	1.46
Tobin's Q	15,211	2.14	1.48	2.79	0.41	105.09
Number of analysts	14,159	12.91	11.00	9.34	1.00	65.00
Analysts' forecast error	14,140	0.07	0.00	1.97	0.00	192.17
Number of shareholders (thousand)	14,497	36.29	4.12	853.59	0.001	97649.45
AI Index	15,211	47.17	46.75	17.09	2.00	98.00

(Table 2 continued)

Panel B: Spearman correlation (p-value in parentheses)

	Total assets	Market value of equity	R&D/assets	Q	Number of analysts	Analysts' forecast error	Number of shareholders	AI index
Total assets	1.00	0.78 (<0.0001)	-0.28 (<0.0001)	-0.28 (<0.0001)	0.56 (<0.0001)	-0.13 (<0.0001)	0.57 (<0.0001)	-0.89 (<0.0001)
Market value of equity		1.00	-0.04 (<0.0001)	0.29 (<0.0001)	0.70 (<0.0001)	-0.11 (<0.0001)	0.50 (<0.0001)	-0.70 (<0.0001)
R&D/assets			1.00	0.37 (<0.0001)	0.02 (0.06)	0.09 (<0.0001)	-0.12 (<0.0001)	0.52 (<0.0001)
Q				1.00	0.18 (<0.0001)	0.03 (=0.0005)	-0.08 (<0.0001)	0.30 (<0.0001)
Number of analysts					1.00	-0.05 (<0.0001)	0.36 (<0.0001)	-0.59 (<0.0001)
Analysts' forecast error						1.00	-0.11 (<0.0001)	0.33 (<0.0001)
Number of shareholders							1.00	-0.66 (<0.0001)
AI index								1.00

Table 3
Does asymmetric information affect governance characteristics?

The sample period is from 1996 to 2003. Board index equals the average percentile rankings of board size, percentage of independent directors on the board, a dummy variable equal to one if there exists an audit committee, percentage of independent directors on the audit committee, a dummy variable equal to one if there exists a compensation committee, percentage of independent directors on the compensation committee, a dummy variable equal to one if there exists a nominating committee, percentage of independent directors on the nominating committee and percentage of independent directors on the governance committee, a CEO-board chair duality dummy and a dummy variable equal to one if there exists a lead director. RG-index equals 24 minus the governance index as defined in Gompers et al. (2003), i.e. 24 minus the number of anti-takeover provisions a company has. CEO PPS equals the sum of CEO stock holdings and delta-adjusted option holdings divided by the number of outstanding shares of a company. Assets and market value of equity are measured at the fiscal year end in millions of year 2003 dollars. Tobin's Q equals book value of assets minus book value of equity plus market value of equity, all divided by book value of assets. Analysts' forecast error is equal to the actual annual EPS minus the mean analysts' forecast, standardized by the closing price at the fiscal year end. AI index equals the average of the percentage rankings of the seven asymmetric information variables: assets, market value of equity, R&D expenses standardized by assets, Tobin's Q, number of analysts, analysts' forecast error and number of shareholders. High and Low AI refer to above and below median subsamples based on each of the asymmetric information variables.

	Board index			RG-index			CEO PPS (%)		
Asymmetric information variables	High AI	Low AI	t-test (high-low)	High AI	Low AI	t-test (high-low)	High AI	Low AI	t-test (high-low)
Assets	43.52	45.14	-6.27	15.53	14.51	21.57	5.70	2.56	25.45
Market value of equity	44.14	44.63	-1.86	15.36	14.66	14.57	5.46	2.82	21.19
R&D/Assets	43.65	45.50	-7.07	15.03	14.94	1.83	4.40	3.60	6.37
Q	43.44	45.30	-7.22	15.26	14.74	10.95	4.60	3.51	8.77
Number of analysts	43.78	44.70	-3.46	15.17	14.79	7.77	5.10	2.92	17.81
Analysts' forecast error	42.91	45.59	-10.17	15.07	14.73	8.08	4.36	3.52	6.77
Number of shareholders	43.39	45.25	-7.04	15.67	14.41	26.17	5.42	2.94	19.51
AI Index	43.60	45.07	-5.69	15.53	14.51	21.39	5.71	2.88	22.39

Table 4
OLS regressions

The sample period is from 1996 to 2003. Board index equals the average percentile rankings of board size, percentage of independent directors on the board, a dummy variable equal to one if there exists an audit committee, percentage of independent directors on the audit committee, a dummy variable equal to one if there exists a compensation committee, percentage of independent directors on the compensation committee, a dummy variable equal to one if there exists a nominating committee, percentage of independent directors on the nominating committee and percentage of independent directors on the governance committee, a CEO-board chair duality dummy and a dummy variable equal to one if there exists a lead director. RG-index equals 24 minus the governance index as defined in Gompers et al. (2003), i.e. 24 minus the number of anti-takeover provisions a company has. CEO PPS equals the sum of CEO stock holdings and delta-adjusted option holdings divided by the number of outstanding shares of a company. AI index equals the average of the percentage rankings of the seven asymmetric information variables: assets, market value of equity, R&D expenses standardized by assets, Tobin's Q, number of analysts, analysts' forecast error and number of shareholders. Tobin's Q residual is from the OLS regressions with the AI index as the independent variable and Q as the dependent variable. Assets residual is similarly defined. The regulated industry dummy equals one if a firm is in either the financial (SIC codes 6000 – 6999) or utilities (SIC codes 4900 – 4900) industry, and zero otherwise. ΔEBIT is the change in EBIT between year t and year t-1, scaled by book value of assets of year (t-1), net of the mean change in the industry (defined by 2-digit SIC). ΔEBIT *tenure is the product of ΔEBIT and CEO tenure. Prior year return is the annual return during the fiscal year. Volatility is the daily stock volatility over the fiscal year. ***, **, and * denote statistical significance at 1%, 5%, and 10% levels, respectively.

Independent variables and statistics	Dependent variables: Board Index (1)	Board Index (2)	RG-Index (3)	RG-Index (4)	CEO PPS (5)	CEO PPS (6)
Intercept	57.55 (153.82)***	58.71 (139.19)***	13.498 (153.38)***	13.191 (131.57)***	-0.254 (-1.11)	-0.454 (-1.75)*
AI Index	-0.034 (-6.07)***	-0.046 (-7.07)***	0.032 (23.49)***	0.037 (24.09)***	0.084 (25.21)***	0.082 (19.88)***
Q residual		-0.097 (-1.87)*		0.121 (8.53)***		0.037 (1.68)*
Assets residual		0.403 (3.23)***		0.010 (0.33)		-0.886 (-11.91)***
Regulated Industry dummy		-1.078 (-3.72)***		0.374 (5.71)***		0.129 (0.75)
ΔEBIT		11.239 (10.49)***				
ΔEBIT *tenure		-1.775 (-21.94)***				
Prior year stock return				-0.023 (-0.56)		
Volatility						10.676 (2.03)**
Year dummy	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.442	0.520	0.045	0.052	0.050	0.063

Table 5
Simultaneous regressions

The sample period is from 1996 to 2003. Board index equals the average percentile rankings of board size, percentage of independent directors on the board, a dummy variable equal to one if there exists an audit committee, percentage of independent directors on the audit committee, a dummy variable equal to one if there exists a compensation committee, percentage of independent directors on the compensation committee, a dummy variable equal to one if there exists a nominating committee, percentage of independent directors on the nominating committee and percentage of independent directors on the governance committee, a CEO-board chair duality dummy and a dummy variable equal to one if there exists a lead director. RG-index equals 24 minus the governance index as defined in Gompers et al. (2003), i.e., 24 minus the number of anti-takeover provisions a company has. CEO PPS equals the sum of CEO stock holdings and delta-adjusted option holdings divided by the number of outstanding shares of a company. AI index equals the average of the percentage rankings of the seven asymmetric information variables: assets, market value of equity, R&D expenses standardized by assets, Tobin's Q, number of analysts, analysts' forecast error and number of shareholders. Tobin's Q residual is from the OLS regressions with the AI index as the independent variable and Q as the dependent variable. Assets residual is similarly defined. The regulated industry dummy equals one if a firm is in either the financial (SIC codes 6000 – 6999) or utilities (SIC codes 4900 – 4900) industry, and zero otherwise. S&P dummy is equal to one if the firm is included in S&P 500. NYSE dummy is equal to one if the stock is traded on NYSE. ΔEBIT is the change in EBIT between year t and year t-1, scaled by book value of assets of year (t-1), net of the mean change in the industry (defined by 2-digit SIC). ΔEBIT *tenure is the product of ΔEBIT and CEO tenure. Prior year return is the annual return during the fiscal year. Volatility is the daily stock volatility over the fiscal year. ***, **, and * denote statistical significance at 1%, 5%, and 10% levels, respectively.

Independent variables and statistics	Dependent variables: Board Index	RG-Index	CEO PPS	AI index
Intercept	74.448 (28.28)***	13.098 (71.15)***	-8.989 (-6.68)***	-273.841 (-6.54)***
AI Index	-0.053 (-2.88)***	0.038 (14.75)***	0.078 (12.48)***	
Board Index		-0.009 (-3.20)***	-0.033 (-4.86)***	3.748 (6.58)***
CEO PPS	0.210 (1.57)	0.077 (5.71)***		4.371 (7.47)***
RG-index	-1.695 (-8.44)***		0.762 (7.83)***	6.788 (7.21)***
Q residual	0.243 (2.72)***	0.129 (8.15)***	0.052 (1.45)	
Assets residual	0.413 (1.90)*	0.133 (3.60)***	-0.895 (-11.20)***	
Regulated Industry dummy	-2.038 (-4.33)***	0.267 (3.12)***	0.254 (1.29)	-7.998 (-4.98)***
ΔEBIT	6.112 (2.98)***			
ΔEBIT *tenure	-2.138 (-9.42)***			
Prior year stock return		-0.032 (-0.64)		
Volatility			-25.559 (-3.86)***	
S&P dummy				-11.411 (-9.00)***
NYSE dummy				-1.276 (-0.95)
Firm age				0.052 (1.26)
Year dummy	No	No	No	Yes

Table 6
Regulation FD and governance

This table reports firm governance changes around Regulation FD, which became effective in 2000. Board index equals the average percentile rankings of board size, percentage of independent directors on the board, the existence of an audit committee dummy, percentage of independent directors on the audit committee, the existence of a compensation committee dummy, percentage of independent directors on the compensation committee, the existence of a nominating committee dummy, percentage of independent directors on the nominating committee and percentage of independent directors on the governance committee, a CEO-board chair duality dummy and the existence of a lead director dummy. RG-index equals 24 minus the governance index as defined in Gompers et al. (2003), i.e., 24 minus the number of anti-takeover provisions a company has. CEO PPS equals the sum of CEO stock holdings and delta-adjusted option holdings divided by the number of outstanding shares of a company. AI index equals the average of the ranks of the seven asymmetric information variables: assets, market value of equity, R&D expenses standardized by assets, Tobin's Q, number of analysts, analysts' forecast error and number of shareholders. High and low AI subsamples are based on the AI index in 1999. ***, **, and * denote statistical significance at 1%, 5%, and 10% levels, respectively.

Panel A: change in information asymmetry around FD

	Entire Sample	High AI firms (AI index >median)	Low AI firms (AI index <=median)	Difference
	(1)	(2)	(3)	(2)-(3)
Change in mean AI $Index_{(2001,2002)-(1998,1999)}$	-2.17 (-11.34)***	-3.56 (-12.12)***	-0.79 (-3.32)***	-2.77 (-7.36)***

Panel B: change in governance around FD

	Entire sample	High AI firms (AI index >median)	Low AI firms (AI index <=median)	Difference
	(1)	(2)	(3)	(2)-(3)
Change in mean Board $Index_{(2001,2002)-(1998,1999)}$ (t-statistic)	3.60 (17.75)***	3.26 (10.74)***	3.87 (14.21)***	-0.61 (-1.49)
Change in mean RG- $Index_{(2001,2002)-(1998,1999)}$ (t-statistic)	-0.55 (-18.80)***	-0.63 (-5.75)***	-0.50 (-12.70)***	-0.13 (-3.22)***
Change in mean CEO $PPS_{(2001,2002)-(1998,1999)}$ (%) (t-statistic)	-0.66 (-5.49)***	-1.06 (-13.98)***	-0.28 (-1.81)*	-0.78 (-2.19)**

Table 7
Corporate Governance and Stock Performance

This table reports the abnormal returns of portfolios sorted by asymmetric information and governance variables. At the end of June each year, we first sort firms into high and low AI subsamples based on their AI index values as of the end of the previous fiscal year. Within each subsample, we further sort firms into deciles based on a governance variable. We then construct a portfolio that buys stocks of firms in the top decile of the governance variable and sells those in the bottom decile. We follow the monthly returns of this portfolio for one year starting from July of the portfolio-formation year to June of next year. Repeating the procedure for each year, we have a time-series of 96 monthly returns (July 1997-June 2005) for the portfolio that buys firms in the top decile of a governance variable and sells firms in the bottom decile of the variable. We estimate the abnormal return using Fama-French-Carhart four-factor model as the benchmark. The intercept from the model—alpha—is the measure of the portfolio's abnormal return. ***, **, and * denote statistical significance at 1%, 5%, and 10% levels, respectively.

Panel A: Portfolios formed based on Board index				
	Equally-weighted		Value-weighted	
	Alpha (%)	t-statistic	Alpha (%)	t-statistic
High AI firms	-0.258	(-0.95)	-0.047	(-0.11)
Low AI firms	0.153	(0.59)	0.408	(1.01)
Panel B: Portfolios formed based on RG-index				
	Equally-weighted		Value-weighted	
	Alpha (%)	t-statistic	Alpha (%)	t-statistic
High AI firms	0.843	(2.37)**	-0.179	(-0.27)
Low AI firms	0.196	(0.98)	0.274	(0.94)
Panel C: Portfolios formed based on CEO PPS				
	Equally-weighted		Value-weighted	
	Alpha (%)	t-statistic	Alpha (%)	t-statistic
High AI firms	-0.121	(-0.44)	-0.922	(-1.51)
Low AI firms	0.191	(0.57)	0.605	(1.44)

Table 8
SOX and stock performance

This table reports Fama-French-Carhart four-factor regressions for portfolios formed based on firms' changes in board index around SOX and its concurrent regulations (year 2003 minus year 2001). A firm is considered to be impacted by the new regulations if its change in board index is in the top 25 percentile. (Changes are all positive in this group.) ***, **, and * denote statistical significance at 1%, 5%, and 10% levels, respectively.

	Impacted firms		Non-impacted firms	
	Equal-weighted	Value-weighted	Equal-weighted	Value-weighted
Intercept	-0.018	-0.034	-0.004	-0.003
	(-1.40)	(-1.96)**	(-0.61)	(-0.75)
R_m-R_{rf}	1.147	1.177	1.094	1.014
	(83.04)***	(61.98)***	(140.55)***	(242.83)***
SMB	0.621	0.074	0.657	-0.067
	(23.94)***	(2.10)**	(44.99)***	(-8.68)***
HML	0.162	-0.076	0.289	-0.031
	(3.90)***	(-1.34)	(12.34)***	(-2.51)***
UMD	-0.111	-0.024	-0.142	0.008
	(-4.82)***	(-0.76)	(-10.93)***	(1.13)
N	252	252	252	252
Adjusted R^2	0.974	0.953	0.991	0.997