Corporate Governance and Liquidity[#]

Kee H. Chung[a,*], John Elder[b], and Jang-Chul Kim[b]

[a] *School of Management, State University of New York (SUNY) at Buffalo*
Buffalo, NY 14260, USA
[b] *College of Business, North Dakota State University*
Fargo, ND 58105, USA

Current version: October 2007

EFM Code: 150
EFM Attending author: John Elder
Discussant Code: 310, 330,350,370

[#] The authors are solely responsible for the content. The authors thank Institutional Shareholder Service (ISS) for providing corporate governance data. The authors are grateful to two anonymous JFQA referees and the editor for their detailed comments which improve the paper greatly. The authors also thank Xin Zhao and Robert Van Ness for programming help, and Yang Cao, Pankaj Jain, Jacky Jiang, Robert Kieschnick, Diana Knyazeva, Kenneth Kim, Kaye Lee, Matthew Spiegel, Joakim Westerholm, Hao Zhang, and session participants at the 2007 FMA conference for valuable comments and discussion.
*Corresponding author. Tel.: 716-645-3262; Fax: 716-645-3823; e-mail: keechung@buffalo.edu.

Corporate Governance and Liquidity

Abstract

We investigate the empirical relation between corporate governance and stock market liquidity. We find that firms with better corporate governance have narrower spreads, higher market quality index, smaller price impact of trades, and lower probability of information-based trading. In addition, we show that changes in our liquidity measures are significantly related to changes in the governance index over time. These results suggest that firms may alleviate information-based trading and improve stock market liquidity by adopting corporate governance standards that mitigate informational asymmetries and deter insider trading. Our results are remarkably robust to alternative model specifications, across exchanges, and different measures of liquidity.

JEL Classification: G10, G34

Keywords: Corporate governance, Spreads, Price impact, Information-based trading, Liquidity

I. Introduction

Corporate governance aims to protect shareholder rights, enhance disclosure and transparency, and facilitate effective functioning of the board. La Porta et al. (2000) define corporate governance as "a set of mechanisms through which outside investors protect themselves against expropriation by the insiders." Prior research examines how internal corporate governance (e.g., board structure, managerial compensation, and charter provisions) and external corporate governance (e.g., legal/regulatory environments and markets for corporate control) affect firm value, cost of capital, and stock returns.[1] In this paper, we analyze the relation between corporate governance and stock market liquidity.

Several recent studies examine the relation between external corporate governance and liquidity utilizing cross country differences in legal and regulatory environments. For example, Bacidore and Sofianos (2002) show that, among New York Stock Exchange (NYSE)-listed companies, those based in the U.S. exhibit higher stock market liquidity than those based outside the U.S. Brockman and Chung (2003) show that, among companies listed on the Stock Exchange of Hong Kong, those based in Hong Kong have narrower spreads and greater depths than those based in mainland China. They interpret this finding as evidence that poor investor protection results in poor liquidity. Similarly, Chung (2006) shows that American Depository Receipts (ADRs) of companies operating in countries with stronger investor protection mechanisms exhibit narrower spreads. Eleswarapu and Venkataraman (2006) show that companies in countries with better judicial efficiency, higher accounting standards, and higher political stability exhibit higher stock market liquidity.

In contrast to the above studies that focus on differences in liquidity due to legal and regulatory environments, our study focuses on differences in liquidity due to internal corporate governance. The proposition that internal corporate governance is related to stock market liquidity is not original to our study. Coffee (1991), for example, argues that large investors have increasingly supported measures that improve internal corporate governance because such measures also improve stock market liquidity (which

[1] See Shleifer and Vishny (1997), La Porta et al. (2000), Mitton (2002), Gompers, Ishii, and Metrick (2003), Bebchuk and Cohen (2005), Bebchuk, Cohen, and Ferrell (2005), Chi (2005), Ashbaugh, Collins and LaFond (2006), and Masulis, Wang, and Xie (2006). See Gillan (2006) for a recent survey of corporate governance literature.

makes their exit less costly). Bhide (1993) holds that high stock market liquidity discourages internal monitoring (by active stockholders) and the benefits of market liquidity must be weighed against the cost of impaired shareholder activism. In contrast, Faure-Grimaud and Gromb (2004) show that information generated by liquid markets *increases* the large shareholder's incentive to undertake value-enhancing activities, such as monitoring. Using an alternative definition of liquidity (i.e., the ability to trade anonymously) several authors also show that liquidity increases the incentive to monitor by lowering the cost of acquiring large positions [see Kahn and Winton (1998), Maug (2002), and Noe (2002)]. To our knowledge, however, the empirical relation between internal corporate governance and stock market liquidity has not yet been established.[2]

We conjecture that corporate governance affects stock market liquidity because poor governance implies poor financial and operational transparency,[3] which increases information asymmetries between insiders (e.g., mangers and large shareholders) and outside investors (e.g., outside owners and liquidity providers), as well as among outside investors. Poor transparency insulates management and impedes the ability of traders to discern the extent to which management can expropriate firm value through shirking, empire building, risk aversion, and perquisites [see Gompers, Ishii, and Metrick (2003) and Bebchuk, Cohen, and Ferrell (2005)]. Diamond (1985) shows that such information asymmetries between management and traders increase the latter's incentive to acquire private information, leading to greater heterogeneity among trader beliefs and larger speculative positions among informed traders. Liquidity providers may therefore post wider spreads and smaller depths for stocks of poorly governed companies because they face greater adverse selection problems in these stocks (Glosten and Milgrom, 1985). For the same reason, the price impact of trades (Kyle, 1985) may tend to be greater for stocks of companies with poor governance structure.

[2] Attig et al. (2006) show that poor information disclosure by self-serving owners reduces stock market liquidity using a sample of Canadian stocks. They do not examine the relation between corporate governance and liquidity.
[3] Transparency, as described by the OECD Principles of Corporate Governance, involves the timely disclosure of adequate information concerning a company's financial performance, as well as commercial objectives, ownership structures, remuneration, related party transactions, governance structures, and internal controls.

Corporate governance may influence liquidity also because it is *easier* for insiders, including managers and large shareholders, to exploit private information through information-based trading when investor interests are poorly protected. Identifying such trading is difficult because corporate insiders rarely trade directly on their information, and also because large shareholders may not conduct discrete trading that are readily identified with inside information. Instead, insiders may give their information to confederates who trade on their behalf, or they may alter positions over long periods of time [see Giannetti and Simonov (2006) and Harris (2003)]. Consequently, liquidity providers are likely to maintain wider spreads and smaller depths for stocks of companies with poor investor protection (i.e., poor governance) in anticipation of greater losses to informed traders.

Theory therefore suggests that poor corporate governance may impair stock market liquidity to the extent that poor governance is associated with low transparency and poor investor protection. In this broad context, we examine the effect of corporate governance on liquidity using an index of governance attributes that are likely to affect financial/operational transparency and investor protection.[4] Our governance index, which is based on data compiled by Institutional Shareholder Services (ISS), consists of 24 such governance attributes. Our measures of liquidity include quoted spreads, effective spreads, and an index of market quality for a large sample of NYSE/AMEX and NASDAQ stocks. To examine the relation between corporate governance and information asymmetries more directly, we also estimate two measures of information-based trading, the price impact of trades and the probability of information-based trading as derived by Easley, Kiefer, O'Hara, and Paperman (1996).

Our results show that stocks of companies with better governance structure exhibit narrower quoted and effective spreads, higher market quality index, smaller price impact of trades, and lower

[4] In recent years many U.S. companies have adopted new standards to improve corporate governance. Some of these standards were mandated by new listing requirements (e.g., by the NYSE, AMEX, and NASDAQ), some were required by additional regulatory structure (e.g., by the SEC and the Sarbanes-Oxley Act), and others were neither mandated nor required. For example, our governance index for D.R. Horton, Inc. (DHI) increased sharply between 2002 and 2003 when it adopted several new governance standards, such as allowing shareholders to call special meetings and requiring only a majority shareholder vote (rather than supermajority) to approve mergers. Incidentally, DHI also experienced a dramatic improvement in liquidity over the same period, with a 50% increase in the market quality index (defined by the ratio of quoted depth to quoted spread). Whether such a relation between corporate governance and liquidity is systematic, of course, requires a more formal empirical analysis that, in part, controls for other relevant factors.

probability of information-based trading. The estimated improvement in liquidity is economically significant, with an increase in our governance index from the 25th to 75th percentile decreasing quoted spreads on NASDAQ by about 4.7%. Our results are robust to different estimation methods (including fixed effects and error component model regressions), across markets, and alternative measures of liquidity. In addition, we find that changes in our liquidity measures are significantly related to changes in governance scores over time. These results suggest that firms may alleviate information-based trading and improve stock market liquidity by adopting corporate governance standards that mitigate information asymmetries and deter informed trading.

The paper is organized as follows. Section II presents the detailed description of the measures of corporate governance and stock market liquidity and their descriptive statistics. Sections III presents our empirical findings. Section IV concludes the paper.

II. Variable Measurement, Data Sources, and Descriptive Statistics

In this section we discuss our variable measurement procedures, data sources, and descriptive statistics of the key variables used in the study.

A. Corporate Governance Metrics

An index of corporate governance that is relevant for stock market liquidity requires data on governance standards that would, in theory, improve financial/operational transparency and investor protection. Existing metrics of corporate governance are not completely adequate in this regard. For example, a well-known index of corporate governance developed by Gompers, Ishii, and Metrick (2003) (GIM) is designed primarily to capture anti-takeover provisions in a firm's charter, bylaws, and state law.

Because our application is based on a broader interpretation of corporate governance, we develop our own index using the data provided by Institutional Shareholder Service (ISS). The ISS data are very broad, consisting of 51 governance standards in eight categories. From the ISS data, we select 24 governance standards in six categories that are most closely related to financial/operational transparency

and investor protection. We determine whether a particular governance standard is met using the minimum standard provided in *ISS Corporate Governance: Best Practices User Guide and Glossary* (2003). We then create an index (Gov-Index) for each firm by awarding one point for each governance standard that is met. This method is similar to the coding method used in Brown and Caylor (2006) for their index.

Appendix A shows the 24 governance standards and their six categories. We use a governance standard related to the independence of the audit committee (Audit #1) to capture the extent to which governance may improve financial and operational transparency as well as protect shareholder interests. The audit committee reviews the adequacy and effectiveness of internal auditing, accounting, and financial controls of the company. The committee also reviews the audit performed by the company's independent auditors and makes recommendations concerning the appointment of the independent auditor. We conjecture that a firm's financial and operational transparency would be higher if the audit committee were composed solely of independent directors. The independent audit committee is also likely to protect shareholder interests better. For the same reason, we use nine governance standards that are related to the independence and effective functioning of the board, including key committees such as the nominating and compensation committees (Board #1-4, 6, 8-11).

Stock compensation and stock ownership serve to align the interests of directors and executives with those of shareholders. The board's legal charge of fulfilling its fiduciary obligations is put to the ultimate test through the task of setting its own compensation. Director compensation packages should be designed to provide value to directors for value received. Given that many directors are high-level executives whose personal income levels are generally high, cash compensation may hold little appeal. Stock-based incentives better reinforce the directors' role of protecting and enhancing shareholder value. Likewise, directors and executives who own company stock are more likely to act on behalf of shareholders because their own interests are aligned with those of shareholders.[5] Based on these

[5] According to compensation consultant Graef Crystal, a five-point increase in the aggregate stock ownership percentage among directors is associated with a 1.5 percentage point increase in annual shareholder returns.

considerations, we use four governance standards that are related to executive and director compensation and ownership (Compensation #1 and Ownership #1, 2, 3).

Finally, attributes of corporate governance may also improve operational transparency and protect shareholder interests to the extent that they mitigate the entrenchment of incumbent management. We therefore include nine governance standards (Board #5, 7 and Charter #1-7) that are related to provisions in the firm's charter and bylaws that, if not implemented, serve to delay or impede takeovers. These nine standards mirror eleven standards in the GIM index, including two that may be most relevant in this regard (annually elected boards and a poison pill) and four of the top five, as identified by Bebchuk and Cohen, and Ferrell (2005).

Appendix A shows the cross reference of our governance standards to the GIM standards. Eleven of GIM's 24 governance standards are captured in our Gov-Index, with seven of these clustered in the ISS category charter/bylaws. Gov-Index also includes all the standards in GIM's category Delay; four of six standards in GIM's category Voting; and one standard that proxies for GIM's category State.

There are two additional reasons why we use data from ISS, rather than the GIM index, in our study. First, the ISS data are available for a much larger number of firms in recent years, for which we have liquidity data (the ISS data are available for more than 2,400 firms at the beginning of our study period in 2001 and over 5,000 firms at the end of our study period in 2004). Second, the ISS data are available annually, rather than biannually.

B. Liquidity Measures: Spreads, Price Impact, and the Probability of Information-Based Trading

We obtain data for liquidity variables from the Trade and Quote database (TAQ) provided by the NYSE. Each quote observation in the data file includes ticker symbol, the quote date, time-stamp, bid price, ask price, bid depth, ask depth, and exchange code. The National Best Bid and Offer (NBBO) quotes are not included in the TAQ database. Hence, we first generate NBBO quotes using the program provided by Wharton Research Data Services (WRDS). We then apply the following data filters to trades and NBBO quotes, which are standard in the microstructure literature (see, e.g., Huang and Stoll, 1996),

to clean the data of errors and outliers: (1) delete quotes if either the bid or ask price is negative; (2) delete quotes if either the bid or ask size is negative; (3) delete quotes if the bid-ask spread is greater than $4 or negative; (4) delete trades and quotes if they are out of time sequence or involve an error; (5) delete before-the-open and after-the-close trades and quotes; (6) delete trades if the price or volume is negative; and (7) delete trades and quotes if they changed by more than 10% compared to the last transaction price and quote. We delete unlisted stocks, stocks with average annual share prices less than $5, and stocks not included in the NYSE's TAQ, the Center for Research in Security Prices (CRSP), Standard & Poor's COMPUSTAT, or the ISS databases.

We calculate the quoted percentage spread of stock (firm) i at time τ as

$$\text{Quoted Spread}_{i,\tau} = (\text{Ask}_{i,\tau} - \text{Bid}_{i,\tau})/M_{i,\tau}; \quad (1)$$

where $\text{Ask}_{i,\tau}$ is the ask price for stock i at time τ, $\text{Bid}_{i,\tau}$ is the bid price for stock i at time τ, and $M_{i,\tau}$ is the mean of $\text{Ask}_{i,\tau}$ and $\text{Bid}_{i,\tau}$. For each stock, we then calculate the time-weighted average quoted spread during each year from 2001 through 2004. The quoted spread is the implicit trading cost for market orders when a trade occurs at the quoted price with no price improvement.

To measure the cost of trading when it occurs at prices inside the posted bid and ask quotes, we also calculate the effective percentage spread of stock i at time τ as

$$\text{Effective Spread}_{i,\tau} = 2D_{i,\tau}(P_{i,\tau} - M_{i,\tau})/M_{i,\tau}; \quad (2)$$

where $P_{i,\tau}$ is the transaction price for stock i at time τ, $M_{i,\tau}$ is the midpoint of the most recently posted bid and ask quotes for stock i, and $D_{i,\tau}$ is a binary variable which equals one for customer buy orders and negative one for customer sell orders. We estimate $D_{i,\tau}$ using the algorithm in Ellis, Michaely, and O'Hara (2000). [See Bessembinder (2003) for detailed comparative analyses of different classification methods.] For each stock, we then calculate the trade-weighted average effective spread during each year.

To the extent that corporate governance can affect both the spread and depth simultaneously, a more comprehensive analysis of the effect of corporate governance on stock market liquidity requires an empirical measure that captures both dimensions of liquidity. One such measure is the market quality index originally suggested by Bollen and Whaley (1998), which is defined as the ratio of the quoted depth to quoted spread.[6]

$$\text{Market Quality Index}_{i,\tau} = \frac{(1/2)\text{Quoted Depth}_{i,\tau}}{\text{Quoted Spread}_{i,\tau}} \tag{3}$$

For each stock, we calculate the time-weighted average market quality index during each year. Note that the market quality index cannot be meaningfully calculated from TAQ data for NASDAQ firms because TAQ reports only the size of the first inside dealer quote for NASDAQ firms. We therefore report the market quality index for NYSE/AMEX firms only.

As noted earlier, another frequently used measure of stock market liquidity is the extent to which an asset can be bought or sold without affecting its price. We measure the price impact of trades by

$$\text{Price Impact}_{i,\tau} = 100\, D_{i,\tau}[(M_{i,\tau+5} - M_{i,\tau}) / M_{i,\tau}], \tag{4}$$

where $M_{i,\tau}$ and $M_{i,\tau+5}$ are quote midpoints at time τ and $\tau + 5$ minutes, respectively. The mean value of price impact during each year is calculated by weighting each trade equally. The price of impact of trades measures the extent to which a trade alters the share price. If a trade does not carry new information on the value of the share, its price impact should be zero on average. In contrast, if the trade is information motivated, it would move the price to the direction of the trade−buyer-initiated trades raise the price (i.e., quote midpoint) and seller-initiated trades lower the price.

To estimate the probability of information-based trading (PIN), we use the sequential trade model of Easley, Kiefer, O'Hara, and Paperman (EKOP) (1996), applied to each firm over each year. In the EKOP model, market makers observe trades, update their beliefs, and establish quotes. This process of trading, and learning from trading, results in prices converging to full information values. The EKOP

[6] This measure assumes a linear liquidity supply schedule (i.e., a linear tradeoff between the spread and depth), which may not correctly capture actual preferences of liquidity providers.

model provides a structure necessary to infer information based trading from observable variables such as the number of buys and sells.

The EKOP model of the trade process for firm i over trading day j is represented by the following likelihood function:

$$
\begin{aligned}
L_i(B_{i,j}, S_{i,j} \mid \theta_i) = {} & (1-\alpha_i) e^{-\varepsilon_i T_{i,j}} \frac{(\varepsilon_i T_{i,j})^{B_{i,j}}}{B_{i,j}!} e^{-\varepsilon_i T_{i,j}} \frac{(\varepsilon_i T_{i,j})^{S_{i,j}}}{S_{i,j}!} \\
& + \alpha_i \delta_i e^{-\varepsilon_i T_{i,j}} \frac{(\varepsilon_i T_{i,j})^{B_{i,j}}}{B_{i,j}!} e^{-(\mu_i+\varepsilon_i) T_{i,j}} \frac{[(\mu_i+\varepsilon_i) T_{i,j}]^{S_{i,j}}}{S_{i,j}!} \\
& + \alpha_i (1-\delta_i) e^{-(\mu_i+\varepsilon_i) T_{i,j}} \frac{[(\mu_i+\varepsilon_i) T_{i,j}]^{B_{i,j}}}{B_{i,j}!} e^{-\varepsilon_i T_{i,j}} \frac{(\varepsilon_i T_{i,j})^{S_{i,j}}}{S_{i,j}!};
\end{aligned} \tag{5}
$$

where $B_{i,j}$ is the number of buyer-initiated trades for the day, $S_{i,j}$ is the number of seller-initiated trades for the day, α_i is the probability that an information event has occurred, δ_i is the probability of a low signal given an event has occurred, μ_i is the probability that a trade comes from an informed trader given an event has occurred,[7] ε_i is the probability that the uninformed traders will actually trade, $T_{i,j}$ is total trading time for the day, and $\theta_i = (\alpha_i, \delta_i, \varepsilon_i, \mu_i)$ represents the vector of parameters to be estimated.

We estimate these parameters θ_i for firm i for each year by maximizing the joint likelihood over the J observed trading days in a calendar year:

$$
L_i(M_i \mid \theta_i) = \prod_{j=1}^{J} L_i(B_{i,j}, S_{i,j} \mid \theta_i). \tag{6}
$$

We then estimate the probability of information-based trading (PIN) for firm i for each year as

$$
PIN_i = \frac{\hat{\alpha}_i \hat{\mu}_i}{\hat{\alpha}_i \hat{\mu}_i + 2\hat{\varepsilon}_i}. \tag{7}
$$

C. Control Variables

Although our main research question is whether corporate governance affects liquidity, we include a number of control variables in our empirical analyses. They are share price, return volatility,

[7] The EKOP model assumes that buy and sell orders from uninformed traders are equally likely.

trading volume, firm size, company age, analyst following, institutional ownership, research and development (R&D) expenditure, and asset tangibility. We provide further details on these variables later in the paper.

We measure return volatility by the standard deviation of daily closing quote-midpoint returns, trading volume by the mean daily dollar trading volume, firm size by the book value of total assets, analyst following by the number of analysts following the company, institutional ownership by the percentage of shares held by institutions, and R&D expenditure by the ratio of R&D expenditure to sales. We obtain data on analyst following from the Institutional Brokers' Estimate System (I/B/E/S) database, institutional ownership from the CDA/Spectrum Institutional (13f) Holdings database, and all other data (i.e., company age, R&D expenditures, sales, and total assets) from the COMPUSTAT or CRSP databases. Following Berger et al. (1996) and Almeida and Campello (2007), we measure asset tangibility by [(0.715 * Receivables + 0.547 * Inventory + 0.535 * Capital) + Cash]/Assets, where Receivables is COMPUSTAT item #2, Inventory is item #3, Capital is item #8, Cash is the value of cash holdings (item #1), and Assets is the book value of total assets (#6).

D. Descriptive Statistics and Correlation Matrix

Given the differences in both market structure and governance standards for listing, we report our results separately for NYSE/AMEX and NASDAQ firms. Table 1 shows descriptive statistics on Gov-Index, liquidity measures, and other stock attributes for our study sample of firms.[8] For the NYSE/AMEX firms in our sample, the minimum and maximum values of Gov-Index are 3 and 20. The mean (median) value of Gov-Index is 11.49 (12), indicating that, on average, our sample firms meet about half of the governance standards. The summary statistics on the governance standards for NASDAQ firms are qualitatively similar, although somewhat smaller in magnitude.

[8] For these descriptive statistics, we assume that a firm has no analyst following if its analyst following information is not included in the I/B/E/S database and zero R&D expenditure if its R&D expenditure is not reported in the COMPUSTAT database. See Section III.A for further details on our coding of these variables.

The descriptive statistics show that NYSE/AMEX firms in our sample tend to be larger in total assets, have greater trading volume, and exhibit lower return volatility than NASDAQ firms. NYSE/AMEX firms tend to be more liquid with lower effective spreads and exhibit smaller price impact than NASDAQ firms. In addition, NYSE/AMEX firms are older, followed by more analysts, and exhibit higher institutional ownership. For example, the mean number of analysts (6.92) for the NYSE/AMEX sample is significantly greater than the corresponding figure (4.57) for the NASDAQ sample. Similarly, the mean percentage (60.33%) of shares held by institutional investors for our NYSE/AMEX sample is significantly higher than the corresponding figure (46.58%) for the NASDAQ sample. Note that R&D expenditure ratios of some NASDAQ firms are very high (the maximum value is 71.4473), indicating that these firms' R&D spending is much larger than their sales in relative terms.

Table 2 reports the correlation matrix of the variables. As expected, Gov-Index is significantly related to our stock market liquidity measures (i.e., quoted and effective spreads, market quality index, price impact, and PIN). Not surprisingly, analyst following is positively correlated with firm size, trading volume, and institutional ownership. The results also show that larger firms tend to have higher governance indices, higher share prices, lower return volatility, and better stock market liquidity (i.e., narrower spreads, greater market quality index, smaller price impact, and smaller PIN values).

III. Regression Results

In this section, we examine how our liquidity measures are related to corporate governance after controlling for other possible determinants of stock market liquidity.

A. Corporate Governance, Spreads, and Market Quality Index

To examine the relation between liquidity and corporate governance, we first regress both the quoted and effective spreads on Gov-Index and a number of control variables using the pooled cross-sectional and time-series data. Prior studies show that a significant portion of cross-sectional and time-series variation in spreads can be explained by select stock attributes such as dollar trading volume, share

price, and return volatility.[9] To isolate the effect of corporate governance on spreads, we include 1/price, return volatility, and trading volume (in log) in the regression model as control variables. We use the reciprocal of share price (instead of share price) because such specification captures more accurately the effect of the tick-size induced binding constraint on spreads when spreads are measured in relative terms [see Harris (1994, p. 160)].[10]

We note that Gov-Index and our measures of market liquidity could be spuriously correlated because they are related to a common set of variables. Including the variables that are related to both Gov-Index and market liquidity in the regression model reduces the possibility that any estimated relation between Gov-Index and our measures of market liquidity is spurious. For example, firms that are widely followed by analysts and/or held by institutional investors may be pressured to adopt better corporate governance and, at the same time, exhibit lower spreads due to greater trading activity. Similarly, larger firms may simultaneously exhibit better governance structure because of higher investor interest and lower spreads because of smaller adverse selection risks (e.g., more information is available on larger firms).[11] To examine whether corporate governance has an independent, direct impact on liquidity, we therefore include analyst following (i.e., the number of analysts following the company), institutional ownership (i.e., the percentage of shares held by institutions), and firm size (i.e., the book value of total assets) in the regression model.

For the same reason, we also include company age, asset tangibility, and R&D expenditure ratio as additional control variables. Note also that asset tangibility could reduce asymmetric information problems because tangible assets' payoffs are easier to observe. In contrast, high R&D intensity may increase asymmetric information problems because payoffs from R&D are difficult to predict. Finally, we include a dummy variable for firms included in the S&P 500 index as well as dummy variables for one-digit SIC industry codes to control for any index membership and industry effects. Based on these

[9] See, e.g., McInish and Wood (1992), Chung, Van Ness, and Van Ness (1999), and Stoll (2000).
[10] We obtain qualitatively similar results when we use log(price) instead of 1/price. The results are available from the authors upon request.
[11] Harris (1994) uses firm size as a proxy for the degree of public information available about the stock.

considerations, we estimate the following regression model for our study sample of NYSE/AMEX firms, NASDAQ firms, and the combined sample of NYSE/AMEX and NASDAQ firms, respectively:

$$\begin{aligned}\text{Quoted Spread}_{i,t} \text{ or Effective Spread}_{i,t} &= \beta_0 + \beta_1 \text{ Log(Gov-Index}_{i,t}) + \beta_2 \text{ (1/Price}_{i,t}) \\ &+ \beta_3 \text{ Return Volatility}_{i,t} + \beta_4 \text{ Log(Trading Volume}_{i,t}) + \beta_5 \text{ Log(Assets}_{i,t}) + \beta_6 \text{ Age}_{i,t} \\ &+ \beta_7 \text{ Number of Analysts}_{i,t} + \beta_8 \text{ Institutional Ownership}_{i,t} + \beta_9 \text{ Asset Tangibility}_{i,t} \\ &+ \beta_{10} \text{ R\&D}_{i,t} \text{ Expenditure} + \beta_{11} \text{ S\&P 500 Dummy} \\ &+ \text{Dummy Variables for One-Digit SIC Industry Code} + \varepsilon_{i,t};\end{aligned} \tag{8}$$

where Quoted $\text{Spread}_{i,t}$ is the time-weighted mean quoted percentage spread of stock i in year t, Effective $\text{Spread}_{i,t}$ is the trade-weighted mean effective percentage spread, $\text{Gov-Index}_{i,t}$ is the governance index, $\text{Price}_{i,t}$ is the mean stock price, Return $\text{Volatility}_{i,t}$ is the standard deviation of daily closing quote-midpoint returns, Trading $\text{Volume}_{i,t}$ is the mean daily dollar trading volume, $\text{Assets}_{i,t}$ is the book value of total assets, $\text{Age}_{i,t}$ is the company age, Number of $\text{Analysts}_{i,t}$ is the number of analysts following firm i in year t, Institutional $\text{Ownership}_{i,t}$ is the percentage of shares held by institutions, Asset $\text{Tangibility}_{i,t}$ is a measure of asset tangibility, and $\varepsilon_{i,t}$ is the error term. We calculate t-statistics using White's (1980) standard errors and report them in parentheses.

Because we combine data from different sources (e.g., analyst following from the I/B/E/S database, liquidity measures from the TAQ database, and R&D data from the COMPUSTAT database), some variables have many missing observations in the merged dataset. The frequency of missing observations is particularly high for the number of analysts and R&D expenditure because many firms are not included in the I/B/E/S database and also because many firms do not report R&D expenditure.[12] To maximize data utilization and also to assess the sensitivity of our results to different variable measurement methods, we employ two approaches. In the first approach, we assume that a firm has no analyst following if its analyst following information is not included in the I/B/E/S database and zero

[12] Chung (2000) shows that only 1,947 (62.9%) of the 3,097 NYSE/AMEX companies included in the COMPUSTAT database are covered by the I/B/E/S database and only 1,782 (44.1%) of the 4,042 NASDAQ companies include in the COMPUSTAT database are covered by the I/B/E/S database in 1996.

R&D expenditure if its R&D expenditure is not reported in the COMPUSTAT database. In the second approach, we simply drop all missing observations before we estimate the above regression model. Panel A of Table 3 shows the OLS regression results using the first approach and Panel B shows the results using the second approach.

The results show that the coefficients on Gov-Index in the quoted spread model are all negative and significant for NYSE/AMEX firms, NASDAQ firms, and the combined sample of NYSE/AMEX and NASDAQ firms, regardless of how we treat missing observations on analyst following and R&D expenditure (i.e., in both Panel A and Panel B). We obtain qualitatively similar results for the effective spread, except that the regression coefficient on Gov-Index is insignificant for NASDAQ stocks and the combined sample in Panel A.

We can gauge the effect of governance on liquidity by calculating the marginal effect of an increase in the governance index from the 25th to 75th percentile. For NASDAQ firms, this corresponds to an increase in the governance index from 8 to 12. Multiplying the change in the (log) governance index by the coefficient on governance in the quoted spread model yields a change in spreads that is approximately -4.7% of the mean quoted spread for NASDAQ firms. Hence, our results suggest that introducing governance standards that raise a NASDAQ firm's Gov-Index from the 25th to 75th percentile would decrease its quoted spread by 4.7%, which is economically significant. Overall, these results are in line with our conjecture that better corporate governance leads to higher stock market liquidity.[13]

Consistent with the finding of prior research, the quoted and effective spreads are significantly and positively related to 1/price and return volatility, and negatively to trading volume in both markets. The relation between spreads and firm size is negative and significant for the NASDAQ sample, but the relation is mixed for the NYSE/AMEX sample. The quoted and effective spreads are positively and significantly related to the number of analysts in both markets, regardless of how we treat the missing observations on analyst following and R&D expenditure. This result is in line with the finding of Chung

[13] We have identified a total of 30 stocks that are cross-listed on the London Stock Exchange or Toronto Stock Exchange in our final study sample. Our main results remain the same when we include a dummy variable representing these stocks. The results are available from the authors upon request.

et al. (1995) and Van Ness, Van Ness, and Warr (2001). Chung et al. (1995) interpret the result as evidence that financial analysts have a greater incentive to follow a stock with greater information asymmetry because the value of private information increases with informational asymmetry, and market makers post wider spreads for stocks that are followed by more analysts.[14]

The results show that spreads are negatively and significantly related to institutional ownership for NYSE/AMEX stocks in both panels. One possible interpretation of this result is that institutional investors provide effective monitoring of corporate managers and thus reduce the information asymmetry between insiders and liquidity providers. For NASDAQ firms, however, we do not find a significant relation between spreads and institutional ownership, indicating perhaps that the role of institutional investors in corporate monitoring is much weaker on NASDAQ.

We find that stocks included in the S&P 500 index have wider quoted and effective spreads. Given the finding of Gompers, Ishii, and Metrick (2003) that firms in the S&P 500 have, on average, poorer governance than others, our regression may be capturing governance features in S&P 500 firms that are not included in our governance index. We find mixed results for other control variables (e.g., firm age, asset tangibility, and R&D expenditure). Our regression models capture a large fraction of the variation in quoted and effective spreads, with the R^2 for each regression in excess of 0.56.

If corporate governance affects the spread and depth simultaneously, then our empirical analysis of the relation between spreads and Gov-Index is an incomplete characterization of the relation between liquidity and corporate governance. To examine the relation between corporate governance and liquidity more fully, we regress the market quality index on Gov-Index and the control variables. Because the dependent variable is no longer the spread, we use Log(Price) instead of 1/Price in the regression model. As noted in Section II.B, because meaningful market depth data are not available (from TAQ) for NASDAQ-listed stocks, we estimate the model using only our study sample of NYSE/AMEX stocks and report the regression results in Table 3.

[14] Van Ness, Van Ness, and Warr (2001) also show that the adverse selection component of the spread is positively related to the number of analysts following the firm.

The results show that the coefficients on Gov-Index are positive and significant in both panels, indicating that firms with higher governance scores exhibit higher market quality. The results also show that market quality is higher for firms with lower return volatility, greater trading volume, larger assets, higher institutional ownership, smaller R&D expenditure, and lower asset tangibility. In contrast, we find that younger firms and firms included in the S&P 500 index exhibit a lower market quality index. Our regression models explain a large fraction of the variation in market quality, with R^2 of 0.9 and 0.88 in each panel.

Our hypothesis linking corporate governance to stock market liquidity is that poor governance gives rise to greater information asymmetry between the insiders (e.g., mangers/controlling shareholders) and outside owners. Such information asymmetries, in turn, amplify information asymmetries among market participants, which adversely affects liquidity. Our results show that shares of the companies with higher Gov-Index tend to be significantly more liquid, with narrower spreads and higher market quality index, than shares of the companies with lower Gov-Index. These results are remarkably robust across our sample of both NYSE/AMEX firms and NASDAQ firms and with respect to different variable measurement methods. Our empirical results thus far support the hypothesis that better corporate governance is associated with higher stock market liquidity.

B. Robustness Tests

In this section, we check the robustness of our results with respect to different estimation methods. In particular, we analyze the relation between liquidity and corporate governance using two panel-data regression methods. We first use the fixed effects regression method, which controls for omitted variables that differ across firms but are constant over time. This method focuses on changes in the variables over time to estimate the effects of the independent variables on the dependent variable. Because the fixed-effects regression method estimates the relation between stock market liquidity and corporate governance from the time-series variation in these and other control variables, and because a

causal relation between variables can be tested using their time-series co-variation, this method sheds additional light on the empirical link between corporate governance and stock market liquidity.

We report the results of the fixed effects regression in Panel A of Table 4. Our results are qualitatively similar regardless of how we treat the missing observations on analyst following and R&D expenditures, so we report only the results from the inclusive data hereafter (e.g., a firm that is not included in the I/B/E/S database is assumed to have no analyst following). We find again that quoted and effective spreads are negatively and significantly related to Gov-Index, while the market quality index is positively and significantly related to Gov-Index for both NYSE/AMEX and NASDAQ stocks. These results provide further evidence that better corporate governance improves stock market liquidity. Note also that the regression coefficients on the control variables are qualitatively similar to those in Table 3.

To further examine the sensitivity of our results to different estimation methods, we also employ the Fuller and Battese (1974) error component model that permits a more general error structure. This model assumes that the error term is composed of three independent components: one associated with the cross-sectional units, another associated with time, and the third varying in both dimensions (i.e., $\varepsilon_{i,t} = \mu_i + \upsilon_t + \omega_{i,t}$). If the behavior of the cross-sectional error component is different from the behavior of the error term of a given cross-sectional unit over time, the Fuller-Battese model would give more accurate coefficient estimates. Because the Fuller-Battese model requires that the number time-series observations be identical across all cross-sectional units (i.e., companies), we include only those companies with complete data during the entire four-year study period. This reduces our sample size significantly, so we report results from the combined sample of NYSE/AMEX and NASDAQ stocks, although the results obtained from each market separately are similar.

Panel B of Table 4 reports the results of the Fuller-Battese model. The results indicate that the quoted and effective spreads are significantly and negatively related to Gov-Index, and the market quality index is significantly and positively related to Gov-Index, providing additional evidence to support our hypothesis that firms with better corporate governance exhibit greater liquidity. Note again that the coefficients on the control variables are qualitatively similar to those in Table 3 and Panel A of Table 4.

C. Regression Results using Changes in the Variables

To further assess the robustness of the relation between the governance index and market liquidity, we also estimate our regression models using changes in both the dependent and independent variables instead of levels. Regression analyses using changes in the variables have at least two advantages over those using the level variables. First, these regressions are generally less likely to show spurious relations between the variables than the regressions using the level variables.[15] Second, these regressions allow us to examine the longer-term effect of corporate governance on stock market liquidity. We have assumed so far that the relation between corporate governance and liquidity is contemporaneous, at least on a yearly basis. However, the effect of corporate governance on stock market liquidity may be gradual. For example, a change in Gov-Index in year t may have an impact on stock market liquidity in both year t and year t + 1. To examine this possibility, we include both the contemporaneous and previous year's changes in Gov-Index in the regression model, together with contemporaneous changes in the control variables. As in Table 5, we report the results from the combined sample of NYSE/AMEX and NASDAQ stocks.

The results (see Table 5) show that the coefficient on the change in Gov-Index is negative and significant in both the quoted and effective spread models, indicating that a decrease in spreads tends to be associated with an increase in the firm's Gov-Index. The results also show that an improvement in the market quality index occurs when the firm's Gov-Index increases. We find that the coefficient on the previous year's change in Gov-Index is not significantly different from zero in both the quoted and effective spread model, indicating that the negative relation between spreads and Gov-Index is contemporaneous. We find that the coefficient on the previous year's change in Gov-Index in the market quality index model is positive and significant at the 10% level. However, the coefficient (0.073) on the

[15] Year-to-year changes in variables provide a stronger test of causal relations than do levels of these variables because the levels of many variables are cross-sectionally correlated without any direct causal link. While correlations in changes do not imply causality either, a failure to find correlation in changes is likely to indicate no causal relation.

previous year's change in Gov-Index is much smaller than the corresponding figure (0.2493) for the contemporaneous change in Gov-Index. Hence, it appears that the positive relation between the market quality index and Gov-Index is largely contemporaneous also.

D. Corporate Governance, Price Impact, and Information-Based Trading

Does good corporate governance reduce the price impact of trades? To address this question, we regress Price Impact on Gov-Index and the control variables that are included in the spread regression model. Panel A of Table 6 shows the OLS results and Panel B shows the results of the fixed-effects regression. Both the OLS and fixed-effects regression results show that Price Impact is negatively related to Gov-Index for both NYSE/AMEX and NASDAQ stocks, although the relation is statistically significant only for the NASDAQ sample. These results suggest that firms with better governance mechanisms exhibit smaller price impacts of trades, especially for those listed on NASDAQ.

The smaller average price impact of trades for the companies with higher governance scores is likely to be driven by their smaller information-based trading. To examine whether better corporate governance results in lower information-based trading, we regress the probability of information-based trading (PIN) on Gov-Index and the same control variables used above. Panel A of Table 6 shows the OLS results and Panel B shows the results of the fixed-effects regression. Both the OLS and fixed-effects regression results show that PIN is negatively related to Gov-Index for both NYSE/AMEX and NASDAQ stocks and the relation is statistically significant only for the NASDAQ sample. These results are consistent with the above result that companies with better governance structure exhibit smaller price impacts.

IV. Summary and Concluding Remarks

The separation of corporate ownership and managerial control gives rise to a variety of issues that are collectively known as the principal-agent problem. Prior studies show that companies with poor corporate governance have worse operating performance and lower market values. In the present study,

we address another problem associated with the separation of ownership and control that can be mitigated through good corporate governance. We hold that companies with good corporate governance are likely to have liquid secondary markets for their shares because good governance generally encompasses high transparency, which reduces information asymmetries between the insiders and outside owners/liquidity providers. Liquidity providers are therefore likely to post smaller spreads and larger depths for stocks of these companies. Corporate governance influences stock market liquidity also because it is difficult for insiders to exploit private information when investor interests are well-protected. Liquidity providers are therefore likely to maintain smaller spreads and larger depths for stocks of companies with good investor protection in anticipation of smaller losses to informed traders. Whether these effects on liquidity are discernable and economically significant is an empirical question, and our study addresses this question.

We isolate a number of governance standards that are likely to be related to stock market liquidity and, using these standards, create a composite index of corporate governance for each company. Our empirical results show that companies with better corporate governance generally have greater stock market liquidity as measured by narrower quoted and effective spreads, higher market quality index, smaller price impact of trades, and lower probability of information based trading. We also find that changes in our liquidity measures are significantly related to changes in governance index over time, suggesting that firms can improve stock market liquidity by adopting better governance standards. Our results are robust to alternative estimation methods, across markets, and different measures of liquidity.

To the extent that investors require higher returns in stocks with lower liquidity, our finding of a positive relation between stock market liquidity and corporate governance quality provides at least a partial explanation of why firms with poor governance structure have lower market values. By establishing a clear empirical link between corporate governance and liquidity, our study shows that it is important for companies to adopt corporate governance standards that improve financial/operational transparency and better protect shareholder interests.

Our results also suggest that, all things being equal, firms in countries with more stringent and fairer disclosure rules and better legal protection of minority shareholders are likely to be valued higher

(through their enhanced liquidity) than firms in countries with poor disclosure rules and poor legal protection of investors. In this perspective, the implementation of Regulation Fair Disclosure (Reg FD) by the U.S. Securities and Exchange Commission (SEC), which prohibits selective disclosure by public companies to market professionals and certain shareholders, should ultimately prove to make U.S. corporations more competitive in global financial markets.[16] The Sarbanes-Oxley Act (SOX) of 2002 requires *all* publicly-traded companies to submit an annual report of the effectiveness of their internal accounting controls to the SEC. To the extent that SOX improves corporate governance and financial disclosure, the results of our study also suggest that SOX will ultimately likely increase market liquidity and firm value.

[16] In the past, many firms released important information in meetings and conference calls where most shareholders and the general public were excluded. The goal of Reg FD is to even the playing field between individual investors and institutional investors by mandating that publicly traded companies must disclose material information to all investors at the same time. Reg FD sought to stamp out selective disclosure, in which large institutional investors received market moving information before smaller, individual investors. Reg FD changed fundamentally how companies communicate with investors by bringing *better transparency* and more frequent and timely communications -- perhaps more than any other regulation in the history of the SEC.

References

Almeida, H., Campello, M., 2007. Financial constraints, asset tangibility, and corporate investment. Review of Financial Studies 20, 1429-1460.

Ashbaugh-Skaife, H., Collins, D., LaFond, R., 2006. The effects of corporate governance on firms' credit ratings. Journal of Accounting and Economics 42, 203-243.

Attig, N., Fong, W., Gadhoum, Y., Lang, L., 2006. Effects of large shareholding on information asymmetry and stock liquidity. Journal of Banking and Finance 30, 2875-2892.

Bacidore, J. M., Sofianos, G., 2002. Liquidity provision and specialist trading in NYSE-listed non-U.S. stocks. Journal of Financial Economics 63, 133-158.

Bebchuk, L. A., Cohen, A., 2005. The costs of entrenched boards. Journal of Financial Economics 78, 409-433.

Bebchuk, L. A., Cohen, A., Ferrell, A., 2005. What matters in corporate governance? Working paper, Harvard Law School.

Berger, P., Ofek, E., Swary, I., 1996. Investor valuation and abandonment option. Journal of Financial Economics 42, 257-287.

Bessembinder, H., 2003. Issues in assessing trade execution costs. Journal of Financial Markets 6, 233-257.

Bhide, A., 1993. The Hidden Costs of Stock Market Liquidity. Journal of Financial Economics 34, 31-51.

Bollen, N., Whaley, R., 2004. Does net buying pressure affect the shape of implied volatility functions? Journal of Finance 59, 711-753.

Bolten, P., Thadden, E., 1998. Blocks, liquidity, and corporate control. Journal of Finance 53, 1-25.

Brockman, P., Chung, D.Y., 2003. Investor protection and firm liquidity. Journal of Finance 58, 921-937.

Brown, L., Caylor, M., 2006. Corporate governance and firm operating performance. Available at SSRN: http://ssrn.com/abstract=814205.

Chi, J., 2005. Understanding the endogeneity between firm value and shareholder rights. Financial Management 34, 65-76.

Chung, K.H., 2000. Marketing of stocks by brokerage firms: The role of financial analysts. Financial Management 29, 35-54.

Chung, H., 2006. Investor protection and the liquidity of cross-listed securities: Evidence from the ADR market. Journal of Banking and Finance 30, 1485-1505.

Chung, K.H, McInish, T., Wood, R., Wyhowsky, D., 1995. Production of information, information asymmetry, and the bid-ask spread: Empirical evidence from analysts' forecasts. Journal of Banking and Finance 1025-1046.

Chung, K.H., Van Ness, B., Van Ness, R., 1999. Limit orders and the bid-ask spread. Journal of Financial Economics 53, 255-87.

Coffee, J.C., 1991. Liquidity versus control: The institutional investor as corporate monitor. Columbia Law Review 91, 1277-1368.

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

Easley, D., Kiefer, N., O'Hara, M., Paperman, J., 1996. Liquidity, information, and infrequently traded stocks. Journal of Finance 51, 1405-1436.

Eleswarapu, V., Venkataraman, K., 2006. The impact of legal and political institutions on equity trading costs: A cross-country analysis. Review of Financial Studies 19, 1081-1111.

Ellis, K., Michaely, R., O'Hara, M., 2000. The accuracy of trade classification rules: Evidence from NASDAQ. Journal of Financial and Quantitative Analysis 35, 529–552.

Faure-Grimaud, A., Gromb, D., 2004. Public trading and private incentives. Review of Financial Studies 17, 985-1014.

Giannetti, M., Simonov, A., 2006. Which investors fear expropriation? Evidence from investors' portfolio choice. Journal of Finance 61, 1507-1547.

Gillan, S., 2006. Recent developments in corporate governance: An overview. Journal of Corporate Finance 12, 381-402

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

Gompers, P., Ishii, J., Metrick, A., 2003. Corporate governance and equity prices. Quarterly Journal of Economics 118, 107-155.

Harris, L., 1994. Minimum price variations, discrete bid-ask spreads, and quotation sizes. Review of Financial Studies 7, 149-178.

Harris, L., 2003. Trading & Exchanges: Market Microstructure for Practitioners. Oxford University Press.

Huang, R. D., Stoll, H. R., 1996. Dealer versus auction markets. Journal of Financial Economics 41, 313-357.

Kahn, C., Winton, A., 1998, Ownership structure, speculation, and shareholder intervention. Journal of Finance 53, 99-129.

Kyle, A., 1985. Continuous auctions and insider trading, Econometrica 53, 1315-1336.

La Porta, R., Lopez-de-Silanes, F., Shleifer, A., Vishny, R., 2000. Investor protection and corporate governance. Journal of Financial Economics 58, 3-27.

Masulis, R., Wang, C., Xie, F., 2006. Corporate governance and acquirer returns. Journal of Finance, forthcoming.

Maug, E., 1998. Large shareholders as monitors: Is there a trade-off between liquidity and control. Journal of Finance 53, 65-98.

McInish, T., Wood, R., 1992. An analysis of intraday patterns in bid/ask spreads for NYSE stocks. Journal of Finance 47, 753-64.

Mitton, T., 2002. A cross-firm analysis of the impact of corporate governance on the East Asian financial crisis. Journal of Financial Economics 64, 215–241.

Noe, T.H., 2002. Investor activism and financial market structure. Review of Financial Studies 15, 289-318.

Shleifer, A., Vishny, R., 1997. A survey of corporate governance, Journal of Finance, 52(2), 737-82.

Stoll, H., 2000. Friction. Journal of Finance 55, 1479-1514.

Van Ness, B., Van Ness, R., Warr, R., 2001. How well do adverse selection components measure adverse selection? Financial Management 30, 77-98.

White, H., 1980. A heteroskedasticity-consistent covariance estimator and a direct test for heteroskedasticity. Econometrica 48, 817-838.

TABLE 1
Descriptive Statistics

Panel A. Results for NYSE/AMEX Firms

Variable	Mean	Standard Deviation	Percentile				
			Min	25	50	75	Max
Gov-Index	11.49	2.84	3	9	12	13	20
Price ($)	29.75	24.70	5.01	15.89	25.56	37.65	500.31
Return Volatility	0.0239	0.0157	0.0027	0.0158	0.0211	0.0288	0.5685
Trading Volume ($ in thousands)	21,554	48,805	12	1,221	5,011	19,800	717,106
Assets ($ in millions)	14,008	68,470	6	695	1,939	6,316	1,484,101
Age	25.15	19.74	1	9	19	34	80
Number of Analysts	6.92	7.06	0	1	5	11	38
Institutional Ownership (%)	60.33	23.23	0.01	45.65	64.43	78.09	99.81
Asset Tangibility	0.40	0.18	0.00	0.32	0.44	0.52	0.99
R&D Expenditure	0.0193	0.1866	0.00	0.00	0.00	0.0087	9.8670
Quoted Spread	0.0036	0.0043	0.0003	0.0011	0.0020	0.0042	0.0542
Effective Spread	0.0026	0.0032	0.0002	0.0008	0.0014	0.0029	0.0328
Market Quality Index	8,168	10,721	50	2,138	4,998	10,207	174,400
Price Impact	0.1859	0.1599	-0.2567	0.0873	0.1353	0.2232	1.4676
PIN	0.1826	0.0827	0.00	0.1350	0.1654	0.2180	0.8786

Panel B. Results for NASDAQ Firms

Variable	Mean	Standard Deviation	Percentile				
			Min	25	50	75	Max
Gov-Index	10.45***	2.65	2	8	10	12	20
Price ($)	19.67***	13.23	5.01	10.16	17.04	25.71	319.56
Return Volatility	0.0460***	0.0293	0.0079	0.0304	0.0421	0.0559	0.9654
Trading Volume ($ in thousands)	14,465***	76,946	9	319	1,448	6,226	2,198,750
Assets ($ in millions)	1,433***	4,840	3	143	360	961	94,500
Age	11.44***	7.78	1	6	9	15	45
Number of Analysts	4.57***	5.52	0	0	3	7	43
Institutional Ownership (%)	46.58***	26.97	0.01	22.51	46.61	69.21	99.74
Asset Tangibility	0.56***	0.17	0.00	0.46	0.55	0.66	0.99

R&D Expenditure	0.5432***	3.3739	0.00	0.00	0.00	0.1367	71.4473
Quoted Spread	0.0217***	0.0201	0.0005	0.0069	0.0153	0.0304	0.1694
Effective Spread	0.0154***	0.0138	0.0005	0.0054	0.0116	0.0216	0.1413
Price Impact	0.4110***	0.2400	-0.6694	0.2122	0.3994	0.5993	1.2215
PIN	0.1729***	0.1075	0.00	0.1115	0.1724	0.2437	0.6941

Gov-Index denotes the governance index. We determine whether a particular governance standard is met using the minimum standard provided in *ISS Corporate Governance: Best Practices User Guide and Glossary* (2003). We then obtain Gov-Index for each firm by awarding one point for each governance standard that is met. Price is the mean stock price, Return Volatility is the standard deviation of daily closing quote-midpoint returns, Trading Volume is the mean daily dollar trading volume, Assets is the book value of total assets, Age is the company age, Number of Analysts is the mean number of analysts, Institutional Ownership is the percentage of shares held by institutions, Asset Tangibility is a measure of asset tangibility detailed in Almeida and Campello (2007), R&D Expenditure is the ratio of annul R&D expenditure to sales, Quoted Spread is the time-weighted mean quoted percentage spread, Effective Spread is the trade-weighted mean effective percentage spread, Market Quality Index is the ratio of the time weighted mean quoted depth to the time-weighted mean quoted percentage spread, Price Impact is the mean price impact, and PIN is the probability of information-based trading. *** denotes that the mean value of the variable for NASDAQ firms is significantly (at the 1% level) different from the corresponding value for NYSE/AMEX firms.

TABLE 2
Correlation Matrix

	Price	Return Volatility	Trading Volume	Assets	Age	Number of Analysts	Institu-tional Owner-ship	Asset Tangibilit y	R&D Expen-diture	Quoted Spread	Effective Spread	Market Quality Index	Price Impact	PIN
Gov-Index	0.1039 (0.0001)	-0.1247 (0.0001)	0.1379 (0.0001)	0.1031 (0.0001)	0.2045 (0.0001)	0.1994 (0.0001)	0.2499 (0.0001)	-0.0955 (0.0001)	-0.0013 (0.9011)	-0.2219 (0.0001)	-0.2138 (0.0001)	0.3169 (0.0001)	-0.3023 (0.0001)	-0.1098 (0.0001)
Price		-0.2350 (0.0001)	0.2018 (0.0001)	0.1439 (0.0001)	0.2206 (0.0001)	0.2585 (0.0001)	0.2182 (0.0001)	-0.1414 (0.0001)	-0.0292 (0.0001)	-0.2840 (0.0001)	-0.2825 (0.0001)	0.1144 (0.0001)	-0.3394 (0.0001)	-0.0718 (0.0001)
Return Volatility			-0.0224 (0.0327)	-0.0822 (0.0001)	-0.2497 (0.0001)	-0.1311 (0.0001)	-0.2016 (0.0001)	0.2811 (0.0001)	0.0284 (0.006)	0.4923 (0.0001)	0.4942 (0.0001)	-0.1194 (0.0001)	0.4026 (0.0001)	-0.0113 (0.3021)
Trading Volume				0.3539 (0.0001)	0.1510 (0.0001)	0.2252 (0.0001)	0.0438 (0.0001)	-0.0333 (0.0015)	-0.0077 (0.4646)	-0.0989 (0.0001)	-0.0999 (0.0001)	0.4400 (0.0001)	-0.1415 (0.0001)	-0.0668 (0.0001)
Assets					0.1143 (0.0001)	0.2252 (0.0001)	0.0438 (0.0001)	-0.0333 (0.0015)	-0.0077 (0.4646)	-0.09887 (0.0001)	-0.0999 (0.0001)	0.4400 (0.0001)	-0.1415 (0.0001)	-0.0668 (0.0001)
Age						0.2063 (0.0001)	0.1375 (0.0001)	-0.1326 (0.0001)	-0.0299 (0.0044)	-0.2379 (0.0001)	-0.2487 (0.0001)	0.2682 (0.0001)	-0.3039 (0.0001)	-0.0549 (0.0001)
Number of Analysts							0.4121 (0.0001)	-0.0120 (0.2534)	-0.0172 (0.1010)	-0.3812 (0.0001)	-0.3680 (0.0001)	0.5435 (0.0001)	-0.5155 (0.0001)	-0.2792 (0.0001)
Institutional Ownership								-0.1147 (0.0001)	-0.0126 (0.2320)	-0.4987 (0.0001)	-0.4807 (0.0001)	0.2224 (0.0001)	-0.6103 (0.0001)	-0.2389 (0.0001)
Asset Tangibility									0.1024 (0.0001)	0.2183 (0.0001)	0.2292 (0.0001)	-0.0057 (0.7066)	0.2371 (0.0001)	-0.0610 (0.0001)
R&D Expenditure										0.0070 (0.5081)	0.0077 (0.4615)	0.0056 (0.7114)	0.0085 (0.4370)	-0.0287 (0.0086)
Quoted Spread											0.9408 (0.0001)	-0.3664 (0.0001)	0.6697 (0.0001)	0.1739 (0.0001)
Effective Spread												-0.3511 (0.0001)	0.6522 (0.0001)	0.1641 (0.0001)
Market Quality Index													-0.3829 (0.0001)	-0.1866 (0.0001)
Price Impact														0.3109 (0.0001)

This table shows the Pearson correlation coefficients between the variables used in the study. Gov-Index denotes the governance index. We determine whether a particular governance standard is met using the minimum standard provided in *ISS Corporate Governance: Best Practices User Guide and Glossary* (2003). We then obtain Gov-Index for each firm by awarding one point for each governance standard that is met. Price is the mean stock price, Return Volatility is the standard deviation of daily closing quote-midpoint returns, Trading Volume is the mean daily dollar trading volume, Assets is the book value of total assets, Age is the company age, Number of Analysts is the mean number of analysts, Institutional Ownership is the percentage of shares held by institutions, Asset Tangibility is a measure of asset tangibility detailed in Almeida and Campello (2007), R&D Expenditure is the ratio of annul R&D expenditure to sales, Quoted Spread is the time-weighted mean quoted percentage spread, Effective Spread is the trade-weighted mean effective percentage spread, Market Quality Index is the ratio of the time weighted mean quoted depth to the time-weighted mean quoted percentage spread, Price Impact is the mean price impact, and PIN is the probability of information-based trading. Figures in parentheses are p-values.

TABLE 3
Ordinary Least Squares (OLS) Regression Results

Panel A. Regression Results When Missing Observations on Analyst Following and R&D Expenditure are Replaced with Zero

	Quoted Spread			Effective Spread			Market Quality Index
	NYSE/AMEX	NASDAQ	Combined	NYSE/AMEX	NASDAQ	Combined	NYSE/AMEX
Intercept	0.0256***	0.1337***	0.0859***	0.0192***	0.0841***	0.0552***	0.8437***
	(25.74)	(12.69)	(14.34)	(26.53)	(12.73)	(14.66)	(6.98)
Log(Gov-Index)	-0.0009***	-0.0025***	-0.0012**	-0.0006***	-0.0013*	-0.0007	0.3281***
	(-5.57)	(-3.45)	(-2.41)	(-4.86)	(-1.68)	(-1.54)	(13.65)
1/Price or Log(Price)	0.0260***	0.0440***	0.0305***	0.0189***	0.0310***	0.0217***	-0.4578***
	(8.78)	(6.33)	(4.53)	(8.66)	(6.44)	(4.70)	(-16.01)
Return Volatility	0.0453***	0.1777***	0.2183***	0.0335***	0.1265***	0.1522***	-8.5476***
	(3.13)	(4.39)	(5.40)	(3.08)	(4.35)	(5.38)	(-2.74)
Log(Trading Volume)	-0.0015***	-0.0063***	-0.0042***	-0.0011***	-0.0041***	-0.0027***	0.5349***
	(-18.89)	(-27.45)	(-24.02)	(-19.02)	(-24.25)	(-21.18)	(43.29)
Log(Assets)	-0.0001	-0.0024***	-0.0017***	-0.0001**	-0.0013***	-0.0011***	0.0553***
	(-1.22)	(-7.74)	(-7.77)	(-2.54)	(-5.56)	(-7.27)	(6.36)
Age	-0.0000	0.0001***	-0.0000	-0.0000	0.0000**	-0.0000**	0.0011***
	(-0.41)	(3.91)	(-1.05)	(-0.21)	(2.38)	(-2.46)	(2.83)
Number of Analysts	0.0001***	0.0002***	0.0002***	0.0000***	0.0001***	0.0001***	0.0005
	(9.99)	(4.99)	(9.55)	(10.48)	(3.88)	(8.60)	(0.41)
Institutional Ownership (%)	-0.0027***	-0.0012	-0.0044***	-0.0022***	-0.0001	-0.0029***	0.1245***
	(-13.49)	(-1.08)	(-5.62)	(-14.20)	(-0.13)	(-5.24)	(3.67)
Asset Tangibility	0.0008***	-0.0058***	0.0036***	0.0008***	-0.0028***	0.0034***	-0.2206***
	(2.76)	(-5.10)	(3.72)	(3.62)	(-3.60)	(4.91)	(-4.40)
R&D Expenditure	0.0010***	-0.0000**	-0.0000**	0.0006***	-0.0000***	-0.0000***	-0.0551**
	(4.38)	(-2.54)	(-2.51)	(3.95)	(-3.08)	(-3.03)	(-2.53)
S&P 500 Dummy	0.0019***	0.0128***	0.0091***	0.0016***	0.0088***	0.0058***	-0.0519***
	(18.66)	(11.39)	(25.08)	(18.40)	(10.34)	(23.84)	(-2.79)
Adjusted R^2	0.73	0.63	0.59	0.72	0.56	0.56	0.90
# of Observations	4,449	4,629	9,078	4,449	4,629	9,078	4,449

TABLE 3 (Continued)

Panel B. Regression Results When Missing Observations on Analyst Following and R&D Expenditure are Dropped

	Quoted Spread			Effective Spread			Market Quality Index
	NYSE/AMEX	NASDAQ	Combined	NYSE/AMEX	NASDAQ	Combined	NYSE/AMEX
Intercept	0.0190***	0.1027***	0.0632***	0.0135***	0.0697***	0.0434***	0.8119***
	(26.05)	(19.12)	(25.90)	(22.56)	(16.83)	(24.16)	(6.35)
Log(Gov-Index)	-0.0005***	-0.0037***	-0.0018***	-0.0003***	-0.0024***	-0.0013***	0.3070***
	(-4.30)	(-5.50)	(-4.08)	(-3.84)	(-5.20)	(-3.85)	(11.19)
1/Price or Log(Price)	0.0272***	0.0517***	0.0365***	0.0198***	0.0302***	0.0213***	-0.5076***
	(10.18)	(8.58)	(5.38)	(10.09)	(6.58)	(3.99)	(-11.92)
Return Volatility	0.0345***	0.2071***	0.2116***	0.0246***	0.1690***	0.1659***	-10.1562**
	(2.63)	(8.71)	(5.93)	(2.59)	(7.42)	(5.68)	(-2.12)
Log(Trading Volume)	-0.0012***	-0.0054***	-0.0033***	-0.0008***	-0.0038***	-0.0023***	0.5604***
	(-18.96)	(-21.41)	(-16.81)	(-17.27)	(-17.66)	(-13.46)	(31.18)
Log(Assets)	0.0001***	-0.0012***	-0.0014***	0.0001**	-0.0005**	-0.0009***	0.0469***
	(2.70)	(-4.80)	(-6.82)	(2.12)	(-2.47)	(-5.46)	(4.54)
Age	-0.0000***	0.0001***	-0.0000	-0.0000***	0.0001***	-0.0000	0.0010**
	(-3.72)	(4.72)	(-0.86)	(-3.65)	(4.06)	(-1.62)	(2.10)
Number of Analysts	0.0000***	0.0002***	0.0002***	0.0000***	0.0001***	0.0001***	0.0004
	(6.33)	(3.43)	(7.06)	(6.57)	(3.37)	(6.57)	(0.25)
Institutional Ownership (%)	-0.0018***	0.0007	-0.0035***	-0.0014***	0.0014*	-0.0022***	0.0868
	(-9.49)	(0.67)	(-4.98)	(-9.85)	(1.69)	(-3.92)	(0.25)
Asset Tangibility	0.0002	-0.0040***	0.0019**	0.0002	-0.0020**	0.0019***	-0.2335**
	(0.88)	(-3.69)	(2.50)	(1.28)	(-2.53)	(3.31)	(2.57)
R&D Expenditure	0.0017**	0.0000**	0.0000**	0.0012**	0.0000**	0.0000**	-0.1048***
	(2.56)	(-2.08)	(-2.12)	(2.52)	(-2.18)	(-2.37)	(-3.72)
S&P 500 Dummy	0.0011***	0.0086***	0.0067***	0.0008***	0.0063***	0.0045***	-0.0677***
	(13.56)	(8.93)	(21.03)	(12.24)	(8.52)	(19.82)	(-3.44)
Adjusted R^2	0.73	0.58	0.56	0.72	0.57	0.56	0.88
# of Observations	3,758	3,559	7,317	3,758	3,559	7,317	3,758

This table shows the OLS results of the following regression model: Quoted $Spread_{i,t}$, Effective $Spread_{i,t}$, or Market Quality $Index_{i,t} = \beta_0 + \beta_1 Log(Gov\text{-}Index_{i,t}) + \beta_2 (1/Price_{i,t})$ or $Log(Price_{i,t}) + \beta_3 Return\ Volatility_{i,t} + \beta_4 Log(Trading\ Volume_{i,t}) + \beta_5 Log(Assets_{i,t}) + \beta_6 Age_{i,t} + \beta_7 Number\ of\ Analysts_{i,t} + \beta_8 Institutional\ Ownership_{i,t} + \beta_9 Asset\ Tangibility_{i,t} + \beta_{10} R\&D_{i,t}\ Expenditure + \beta_{11} S\&P\ 500\ Dummy$ + Dummy Variables for One-

Digit SIC Industry Code + $\varepsilon_{i,t}$; where Quoted Spread$_{i,t}$ is the time-weighted mean quoted percentage spread of stock i in year t, Effective Spread$_{i,t}$ is the trade-weighted mean effective percentage spread, Market Quality Index $_{i,t}$ is the market quality index, Gov-Index$_{i,t}$ is the governance index, Price$_{i,t}$ is the mean stock price, Return Volatility$_{i,t}$ is the standard deviation of daily closing quote-midpoint returns, Trading Volume$_{i,t}$ is the mean daily dollar trading volume, Assets$_{i,t}$ is the book value of total assets, Age$_{i,t}$ is the company age, Number of Analysts$_{i,t}$ is the number of analysts following firm i in year t, Institutional Ownership$_{i,t}$ is the percentage of shares held by institutions, Asset Tangibility$_{i,t}$ is a measure of asset tangibility, R&D Expenditure is the ratio of annul R&D expenditure to sales, and $\varepsilon_{i,t}$ is the error term. We calculate t-statistics using White's (1980) standard errors and report them in parentheses.

***Significant at 1% level.

**Significant at 5% level.

*Significant at 10% level.

TABLE 4
Regression Results from Alternative Estimation Methods

Panel A. Fixed-Effects Regression Results

	Quoted Spread			Effective Spread			Market Quality Index
	NYSE/AMEX	NASDAQ	Combined	NYSE/AMEX	NASDAQ	Combined	NYSE/AMEX
Intercept	0.0000	0.0008	0.0002	0.0000	0.0005	0.0001	0.0125
	(0.17)	(0.33)	(0.11)	(0.43)	(0.26)	(0.13)	(0.22)
Log(Gov-Index)	-0.0007***	-0.0080***	-0.0036***	-0.0005***	-0.0066***	-0.0030***	0.5375***
	(-5.22)	(-9.54)	(-7.66)	(-5.22)	(-9.68)	(-8.52)	(19.91)
1/Price or Log(Price)	0.0212***	0.1675***	0.1141***	0.0180	0.0962***	0.0665***	-0.4249***
	(6.55)	(20.17)	(14.03)	(8.13)	(14.30)	(9.14)	(-10.91)
Return Volatility	0.0236**	0.1673***	0.1411***	0.0173***	0.1279***	0.1080***	-6.8021***
	(2.45)	(27.86)	(6.01)	(2.67)	(26.28)	(5.79)	(-2.78)
Log(Trading Volume)	-0.0014***	-0.0028***	-0.0023***	-0.0010***	-0.0028***	-0.0022***	0.4715***
	(-13.48)	(-9.14)	(-6.53)	(-13.13)	(-11.33)	(-5.28)	(19.39)
Log(Assets)	-0.0001	0.0061***	0.0028***	-0.0001	0.0044***	0.0022***	0.1856***
	(-0.53)	(7.90)	(6.09)	(-0.80)	(7.08)	(5.84)	(4.82)
Number of Analysts	-0.0000	0.0002**	0.0001***	-0.0000	0.0002***	0.0001***	0.0118***
	(-1.53)	(2.14)	(3.73)	(-1.13)	(2.80)	(4.25)	(4.88)
Institutional Ownership (%)	-0.0048***	0.0073***	0.0029**	-0.0032***	0.0070***	0.0035***	0.9870***
	(-10.55)	(3.40)	(2.09)	(-10.43)	(4.04)	(2.79)	(8.59)
Asset Tangibility	0.0000	0.0041*	0.0014	0.0003	0.0046**	0.0024*	0.1599
	(0.05)	(1.68)	(0.87)	(0.67)	(2.35)	(1.67)	(1.45)
R&D Expenditure	0.0012***	-0.0000***	-0.0000***	0.0010***	-0.0000**	-0.0000***	0.0280
	(4.26)	(-2.62)	(-4.07)	(4.07)	(-1.99)	(-4.25)	(0.48)
S&P 500 Dummy	-0.0000	0.0003	0.0001	-0.0000	-0.0001	0.0000	0.0096
	(-0.22)	(0.50)	(0.66)	(-0.16)	(-0.15)	(0.14)	(1.06)
Adjusted R^2	0.50	0.29	0.24	0.50	0.25	0.21	0.52
# of Observations	4,449	4,629	9,078	4,449	4,629	9,078	4,449

TABLE 4 (Continued)

Panel B. Results of the Fuller-Battese Error-Component Model using the Combined Sample of NYSE/AMEX and NASDAQ Stocks

	Quoted Spread	Effective Spread	Market Quality Index
Intercept	0.0429***	0.0338***	2.1366***
	(15.21)	(16.14)	(10.12)
Log(Gov-Index)	-0.0012***	-0.0007**	0.0644**
	(-2.75)	(-2.01)	(2.19)
1/Price or Log(Price)	0.0336***	0.0125***	-0.5790***
	(8.65)	(4.35)	(-30.85)
Return Volatility	0.2873***	0.2456***	-17.0498***
	(38.54)	(43.70)	(-22.10)
Log(Trading Volume)	-0.0030***	-0.0025***	0.5206***
	(-25.08)	(-28.33)	(46.32)
Log(Assets)	-0.0000	0.0001	0.0693***
	(-0.09)	(1.19)	(5.91)
Number of Analysts	0.0001**	0.0001***	0.0006
	(2.10)	(3.92)	(0.97)
Institutional Ownership (%)	-0.0002	0.0004	0.0047***
	(-0.22)	(0.81)	(2.96)
Asset Tangibility	0.0023***	0.0018***	0.1294**
	(3.18)	(3.52)	(2.45)
R&D Expenditure	-0.0000	-0.0000	-0.2071***
	(-1.13)	(-1.07)	(-3.41)
S&P 500 Dummy	0.0036***	0.0028***	-0.0271
	(8.19)	(8.72)	(-0.89)
Adjusted R^2	0.48	0.51	0.76
# of Observations	4,480	4,480	2,580

This table shows the fixed-effects (Panel A) and Fuller-Battese error component model (Panel B) results of the following regression model: Quoted $Spread_{i,t}$, Effective $Spread_{i,t}$, or Market Quality $Index_{i,t} = \beta_0 + \beta_1 Log(Gov\text{-}Index_{i,t}) + \beta_2 (1/Price_{i,t})$ or $Log(Price_{i,t}) + \beta_3 Return\ Volatility_{i,t} + \beta_4 Log(Trading\ Volume_{i,t}) + \beta_5 Log(Assets_{i,t}) + \beta_6 Number\ of\ Analysts_{i,t} + \beta_7 Institutional\ Ownership_{i,t} + \beta_8 Asset\ Tangibility_{i,t} + \beta_9 R\&D_{i,t}\ Expenditure + \beta_{10} S\&P\ 500\ Dummy + \varepsilon_{i,t}$; where Quoted $Spread_{i,t}$ is the time-weighted mean quoted percentage spread of stock i in year t, Effective $Spread_{i,t}$ is the trade-weighted mean effective percentage spread, Market Quality $Index_{i,t}$ is the market quality index, $Gov\text{-}Index_{i,t}$ is the governance index, $Price_{i,t}$ is the mean stock price, Return $Volatility_{i,t}$ is the standard deviation of daily closing quote-midpoint returns, Trading $Volume_{i,t}$ is the mean daily dollar trading volume, $Assets_{i,t}$ is the book value of total assets, Number of $Analysts_{i,t}$ is the number of analysts following firm i in year t, Institutional $Ownership_{i,t}$ is the percentage of shares held by institutions, Asset $Tangibility_{i,t}$ is a measure of asset tangibility, R&D Expenditure is the ratio of annul R&D expenditure to sales, and $\varepsilon_{i,t}$ is the error term. We calculate t-statistics in Panel A using White's (1980) standard errors and report them in parentheses.

***Significant at 1% level.

**Significant at 5% level.

*Significant at 10% level.

TABLE 5
Regression Results with Changes in the Variables

	Quoted Spread	Effective Spread	Market Quality Index
Intercept	0.0021***	0.0017***	0.1986***
	(7.25)	(7.53)	(16.91)
ΔLog(Gov-Index)	-0.0104***	-0.0077***	0.2493***
	(-11.99)	(-11.60)	(7.63)
$\Delta Log(Gov\text{-}Index)_{t-1}$	0.0008	0.0007	0.0730*
	(0.82)	(0.88)	(1.91)
Δ1/Price or ΔLog(Price)	0.1289***	0.0652***	-0.2584***
	(6.29)	(3.74)	(-6.04)
ΔReturn Volatility	0.2942***	0.2751***	-4.9827***
	(9.16)	(9.05)	(-4.85)
ΔLog(Trading Volume)	-0.0020***	-0.0024***	0.4189***
	(-2.67)	(-2.75)	(14.19)
ΔLog(Assets)	0.0022*	0.0020**	-0.0972**
	(1.89)	(2.11)	(-2.21)
ΔNumber of Analysts	0.0000	0.0000	0.0019
	(0.49)	(1.29)	(1.02)
ΔInstitutional Ownership (%)	-0.0026	-0.0005	0.7956
	(-0.84)	(-0.17)	(5.80)
ΔAsset Tangibility	0.0035	0.0030	-0.2759
	(0.89)	(0.97)	(-1.64)
ΔR&D Expenditure	0.0000**	0.0000	-0.3434
	(-2.30)	(-1.63)	(-0.89)
Adjusted R^2	0.36	0.40	0.27
# of Observations	2,756	2,756	1,614

This table shows the OLS results of the following regression model: $\Delta Quoted\ Spread_{i,t}$, $\Delta Effective\ Spread_{i,t}$, or $\Delta Market\ Quality\ Index_{i,t} = \beta_0 + \beta_1\ \Delta Log(Gov\text{-}Index_{i,t}) + \beta_2\ \Delta Log(Gov\text{-}Index_{i,t-1}) + \beta_3\ \Delta(1/Price_{i,t})$ or $\Delta Log(Price_{i,t}) + \beta_4\ \Delta Return\ Volatility_{i,t} + \beta_5\ \Delta Log(Trading\ Volume_{i,t}) + \beta_6\ \Delta Log(Assets_{i,t}) + \beta_7\ \Delta Number\ of\ Analysts_{i,t} + \beta_8\ \Delta Institutional\ Ownership_{i,t} + \beta_9\ \Delta Asset\ Tangibility_{i,t} + \beta_{10}\ \Delta R\&D_{i,t}\ Expenditure + \varepsilon_{i,t}$; where $Quoted\ Spread_{i,t}$ is the time-weighted mean quoted percentage spread of stock i in year t, $Effective\ Spread_{i,t}$ is the trade-weighted mean effective percentage spread, $Market\ Quality\ Index_{i,t}$ is the market quality index, $Gov\text{-}Index_{i,t}$ is the governance index, $Price_{i,t}$ is the mean stock price, $Return\ Volatility_{i,t}$ is the standard deviation of daily closing quote-midpoint returns, $Trading\ Volume_{i,t}$ is the mean daily dollar trading volume, $Assets_{i,t}$ is the book value of total assets, $Number\ of\ Analysts_{i,t}$ is the number of analysts following firm i in year t, $Institutional\ Ownership_{i,t}$ is the percentage of shares held by institutions, $Asset\ Tangibility_{i,t}$ is a measure of asset tangibility, R&D Expenditure is the ratio of annul R&D expenditure to sales, and $\varepsilon_{i,t}$ is the error term. We calculate t-statistics in Panel A using White's (1980) standard errors and report them in parentheses.

***Significant at 1% level.

**Significant at 5% level.

*Significant at 10% level.

TABLE 6
Regression Results for PIN and Price Impact

Panel A. OLS Results

	Price Impact			Probability of Information-Based Trading (PIN)		
	NYSE/AMEX	NASDAQ	Combined	NYSE/AMEX	NASDAQ	Combined
Intercept	1.1863***	1.6869***	1.4125***	0.3032***	0.5234***	0.4456***
	(44.45)	(21.08)	(32.20)	(14.58)	(11.73)	(18.59)
Log(Gov-Index)	-0.0092*	-0.0589***	-0.0396***	-0.0048	-0.0102*	-0.0055
	(-1.70)	(-7.00)	(-7.13)	(-0.99)	(-1.89)	(-1.47)
Log(Price)	-0.0252***	-0.0159***	-0.0304***	0.0035	0.0050*	0.0068***
	(-5.22)	(-3.12)	(-8.74)	(1.25)	(1.69)	(3.33)
Return Volatility	4.0587***	0.3687**	1.7728***	0.4402***	-0.1387*	-0.0854
	(9.84)	(2.04)	(6.94)	(3.30)	(-1.73)	(-1.20)
Log(Trading Volume)	-0.0625***	-0.0657***	-0.0598***	-0.0089***	-0.0234***	-0.0214***
	(-23.34)	(-20.26)	(-26.50)	(-5.11)	(-14.48)	(-18.70)
Log(Assets)	-0.0005	-0.0138***	-0.0125***	0.0001	0.0033*	0.0075***
	(-0.23)	(-3.86)	(-5.93)	(0.03)	(1.86)	(6.83)
Age	-0.0001	-0.0025***	-0.0011***	-0.0002**	-0.0006***	-0.0001
	(-1.17)	(-7.78)	(-11.15)	(-2.46)	(-2.86)	(-1.00)
Number of Analysts	0.0018***	-0.0036***	-0.0001	-0.0003	-0.0016***	-0.0010***
	(8.24)	(-5.71)	(-0.42)	(-1.41)	(-4.72)	(-4.69)
Institutional Ownership (%)	-0.1063***	-0.1740***	-0.1627***	0.0032	0.0072	0.0101*
	(-13.03)	(-11.21)	(-15.77)	(0.43)	(0.97)	(1.87)
Asset Tangibility	0.0166*	-0.0144	0.0871***	-0.0097	-0.0100	-0.0188***
	(1.69)	(-0.94)	(9.43)	(-1.18)	(-1.19)	(-3.34)
R&D Expenditure	0.1112***	1.6869*	-0.0002*	0.0136	-0.0001	-0.0001
	(2.74)	(-1.87)	(-1.92)	(0.66)	(-1.17)	(-1.24)
S&P 500 Dummy	0.0678***	0.0647***	0.0823***	-0.0033	-0.0247***	0.0116***
	(17.27)	(5.04)	(18.91)	(-0.80)	(-3.80)	(3.19)
Adjusted R^2	0.73	0.65	0.70	0.07	0.29	0.17
# of Observations	4,257	4,128	8,385	4,258	4,128	8,386

Panel B. Fixed-Effects Regression Result

	Price Impact			Probability of Information-Based Trading (PIN)		
	NYSE/AMEX	NASDAQ	Combined	NYSE/AMEX	NASDAQ	Combined
Intercept	0.0065	-0.0000	0.0033	-0.0073	-0.0000	-0.0041
	(0.74)	(-0.00)	(0.11)	(-1.11)	(-0.00)	(-0.33)
Log(Gov-Index)	-0.0082	-0.1267***	-0.0595***	-0.0082	-0.0245***	-0.0117**
	(-1.54)	(-12.20)	(-9.79)	(-1.17)	(-3.34)	(-2.30)
Log(Price)	-0.0201***	0.0092	-0.0273***	-0.0066	0.0372***	0.0147***
	(-2.90)	(0.65)	(-3.01)	(-1.00)	(5.43)	(3.04)
Return Volatility	1.9481***	0.1371	0.4813***	0.0757	0.0114	0.0503
	(5.03)	(0.81)	(3.07)	(0.60)	(0.13)	(0.69)
Log(Trading Volume)	-0.0524***	-0.0387***	-0.0314***	-0.0020	-0.0314***	-0.0193***
	(-11.13)	(-4.12)	(-4.71)	(-0.51)	(-7.74)	(-6.57)
Log(Assets)	-0.0120	-0.1480***	-0.0894***	-0.0231***	-0.0341***	-0.0282***
	(-1.55)	(-13.13)	(-12.37)	(-3.70)	(-6.31)	(-6.77)
Number of Analysts	-0.0009***	-0.0002	-0.0011***	-0.0005	-0.0012***	-0.0007**
	(-3.69)	(-0.18)	(-3.13)	(-1.17)	(-2.65)	(-2.49)
Institutional Ownership (%)	-0.1538***	-0.6667***	-0.4498***	0.0196	-0.1070***	-0.0359***
	(-7.56)	(-21.05)	(-20.27)	(1.03)	(-6.52)	(-2.79)
Asset Tangibility	0.0549**	0.0499	0.1027***	0.0408	0.0319*	0.0434***
	(2.06)	(1.52)	(4.33)	(1.55)	(1.94)	(3.11)
R&D	-0.0572	-0.0002	-0.0002*	0.0833	0.0001	0.0001
	(-0.83)	(-1.29)	(-1.72)	(1.58)	(0.81)	(0.59)
S&P 500 Dummy	-0.0004	-0.0000	-0.0017	-0.0012	-0.0000	-0.0010
	(-0.29)	(-0.01)	(-1.08)	(-0.59)	(-0.01)	(-0.58)
Adjusted R^2	0.34	0.42	0.34	0.00	0.09	0.04
# of Observations	4,257	4,128	8,385	4,258	4,128	8,386

This table shows the OLS results (Panel A) and fixed effects results (Panel B) of the following regression model: $\text{Price Impact}_{i,t}$ or $\text{PIN}_{i,t} = \beta_0 + \beta_1 \text{Log(Gov-Index}_{i,t}) + \beta_2 \text{Log(Price}_{i,t}) + \beta_3 \text{Return Volatility}_{i,t} + \beta_4 \text{Log(Trading Volume}_{i,t}) + \beta_5 \text{Log(Assets}_{i,t}) + \beta_6 \text{Age}_{i,t} + \beta_7 \text{Number of Analysts}_{i,t} + \beta_8 \text{Institutional Ownership}_{i,t} + \beta_9 \text{Asset Tangibility}_{i,t} + \beta_{10} \text{R\&D}_{i,t} \text{ Expenditure} + \beta_{11} \text{S\&P 500 Dummy} + \varepsilon_{i,t}$; where $\text{Price Impact}_{i,t}$ is the mean price impact of firm i in year t and $\text{PIN}_{i,t}$ is the probability of information-based trading, $\text{Gov-Index}_{i,t}$ is the governance index, $\text{Price}_{i,t}$ is the mean stock price, $\text{Return Volatility}_{i,t}$ is the standard deviation of daily closing quote-midpoint returns, $\text{Trading Volume}_{i,t}$ is the mean daily dollar trading volume, $\text{Assets}_{i,t}$ is the book value of total assets, $\text{Age}_{i,t}$ is the company age, $\text{Number of Analysts}_{i,t}$ is the number of analysts following firm i in year t, $\text{Institutional Ownership}_{i,t}$ is the percentage of shares held by institutions, $\text{Asset Tangibility}_{i,t}$ is a measure of asset tangibility, R&D Expenditure is the ratio of annul R&D expenditure to sales, and $\varepsilon_{i,t}$ is the error term. We calculate t-statistics using White's (1980) standard errors and report them in parentheses.

***Significant at 1% level. **Significant at 5% level. *Significant at 10% level.

Appendix A. Governance categories and factors used by Institutional Shareholder Service (ISS)

This appendix reports the 24 governance standards related to financial and operational transparency that comprise our index. The standards are drawn from data compiled by Institutional Shareholder Service (ISS). Where appropriate, the associated category and variable in Gompers, Ishii, and Metrick (GIM) is also reported. GIM's index is based on 22 governance standards and six state laws, as collected by the Investor Responsibility Research Center (IRRC), and is designed to capture anti-takeover provisions in a firm's charter, bylaws, and state law.

ISS Governance Categories and Standards		GIM (#)
Audit		
1	Audit committee consists solely of independent outside directors.	
Board		
1	Board is controlled by more than 50% independent outside directors.	
2	Nominating committee is comprised solely of independent outside directors.	
3	Compensation committee is comprised solely of independent outside directors.	
4	Governance committee meets at least once during the year.	
5	Board members are elected annually.	Delay (#2)
6	Size of board of directors is at least six but not more than 15 members.	
7	Shareholders have cumulative voting rights to elect directors.	Voting (#3)
8	CEO serves on no more than two additional boards of other public companies.	
9	No former CEO serves on board.	
10	The CEO and chairman duties are separated or a lead director is specified.	
11	Board guidelines are disclosed publicly.	
Charter		
1	Company has no poison pill.	Other (#5)
2	A majority vote is required to amend charter/bylaws (not supermajority).	Voting (#5)
3	A simple majority vote is required to approve a merger (not supermajority).	Voting (#5)
4	Shareholders may act by written consent and the consent is non-unanimous.	Delay (#4)
5	Shareholders are allowed to call special meetings.	Delay (#3)
6	Board cannot amend bylaws without shareholder approval or only in limited circumstances	Voting (#1,2)
7	Company is not authorized to issue blank check preferred stock.	Delay (#1)
Compensation		
1	Directors receive all or a portion of their fees in stock.	
Ownership		
1	All directors with more than one year of service own stock.	
2	Executives are subject to stock ownership guidelines.	
3	Directors are subject to stock ownership guidelines.	
State		
1	Incorporate in a state without any anti-takeover provisions.	