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Corporate Governance and Liquidity

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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. Our results are remarkably robust to alternative model specifications, across exchanges, and to different measures of liquidity.

I. Introduction

In this paper we examine how corporate governance affects stock market liquidity.[1] 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

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[1]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. See Shleifer and Vishny (1997), La Porta, Lopez-de-Silanes, Shleifer, and Vishny (2000), Mitton (2002), Gompers, Ishii, and Metrick (GIM) (2003), Bebchuk and Cohen (2005), Bebchuk, Cohen, and Ferrell (2009), Chi (2005), Ashbaugh-Skaife, Collins, and LaFond (2006), and Masulis, Wang, and Xie (2007). See Gillan (2006) for a recent survey of corporate governance literature.

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 shareholder protection results in poor liquidity. Similarly, Chung (2006) shows that American Depositary Receipts of companies operating in countries with stronger shareholder protection mechanisms exhibit narrower spreads.[2]

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 makes their exit less costly). Bhide (1993) and Maug (2002) suggest that high stock market liquidity discourages internal monitoring by large stockholders, with Maug (2002) showing that liquidity increases the incentive for large shareholders to trade on inside information rather than monitor. Bolton and von Thadden (1998) analyze this trade-off and show that the optimal level of ownership concentration depends on firm characteristics and operating environment.

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 (1998), and Noe (2002)). To our knowledge, however, the empirical relation between internal corporate governance and stock market liquidity has not yet been established.[3] The analysis of the relation between corporate governance and liquidity is important because it could shed some light on the channel through which corporate governance affects shareholder wealth.

We conjecture that corporate governance affects stock market liquidity because effective governance improves financial and operational transparency,[4] which decreases information asymmetries between insiders (e.g., managers and large shareholders) and outside investors (e.g., outside owners and liquidity providers), as well as among outside investors. Governance provisions may improve financial transparency by mitigating management's ability and incentive to

[2]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.

[3]Using a sample of Canadian stocks, Attig, Fong, Gadhoum, and Lang (2006) show that poor information disclosure by self-serving owners reduces stock market liquidity. They do not examine the relation between corporate governance and liquidity.

[4]Transparency, as described by the Organisation for Economic Co-Operation and Development (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.

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distort information disclosures (Leuz, Nanda, and Wysocki (2003)). These provisions make it less likely that management, acting in its self-interest, does not fully disclose relevant information to shareholders or discloses information that is less than credible. For example, governance provisions related to the independence of the audit committee are intended to improve the quality of the financial statements. Similarly, Ajinkya, Bhojraj, and Sengupta (2005) and Karamanou and Vafeas (2005) show that boards that do a more effective job of monitoring management enhance the quality and the frequency of information released by management. Specifically, these studies show that companies with more effective boards issue more frequent earnings forecasts and that these forecasts are more accurate. Higher board quality, therefore, should be associated with lower information asymmetry.

Corporate governance may improve operational transparency by improving the ability of shareholders to discern the quality of management and the true value of the firm. By strengthening the disciplinary threat of removing management (Manne (1965)), governance provisions protect shareholder interests and limit the extent to which management can expropriate firm value through shirking, empire building, risk aversion, and perquisites (see Bebchuk, Cohen, and Ferrell (2009), Bebchuk and Cohen (2005)).

Diamond (1985) analyzes the consequence of voluntary information disclosure and shows that increased disclosure reduces both the precision of private information (relative to the precision of public information) and the incentive for private information search. He shows that reducing information asymmetries between management and traders tends to decrease the latter's incentive to acquire private information, leading to less heterogeneity among trader beliefs and smaller 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 the stocks of companies with poor governance structure.

Theory therefore suggests that poor corporate governance may impair stock market liquidity to the extent that poor governance is associated with low financial and operational transparency. 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 and operational transparency.[5] Our governance index,

[5]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 U.S. Securities and Exchange Commission (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 a 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). Of course, determining whether such a relation between corporate governance and liquidity is systematic requires a more formal empirical analysis that controls in part for other relevant factors.

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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 (PIN) as derived by Easley, Kiefer, O'Hara, and Paperman (EKOP) (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 PIN. 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 4.5%. Our results are robust to different estimation methods (including fixed-effects and error component model regressions), across markets, and to 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.

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 GIM (2003) is designed primarily to capture antitakeover provisions in a firm's charter, its bylaws, and state law.

Because our application is based on a broader interpretation of corporate governance, we develop our own index using data provided by 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 and operational transparency. 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 by Brown and Caylor (2009) for their index.

Appendix A shows the 24 governance standards and their six categories. Our index includes 10 governance standards related to the independence and effective functioning of the board, including key committees such as the audit committee, the nominating committee, and the compensation committee (Audit 1, Boards 1–4, 6, and 8–11). These governance standards tend to align the interests of management and shareholders by facilitating the board's role of monitoring management (Bebchuk (2007), Core, Holthausen, Larcker (1999)). For example, the audit committee reviews the adequacy and effectiveness of internal auditing, accounting, and financial controls. The committee also reviews the audit performed by the company's independent auditors and makes recommendations concerning the appointment of the independent auditor. By facilitating effective monitoring and limiting management's ability to expropriate firm value or misreport firm performance, we conjecture that these governance standards tend to improve financial and operational transparency.

We also include in our index governance standards related to director and executive stock compensation and stock ownership. Equity compensation and ownership programs are typically adopted with the intention of aligning the financial incentives of directors and executives with those of shareholders, as suggested by the literature on optimal contracting (Core, Guay, and Larcker (2003)). In practice, firms typically claim that equity-based compensation serves to "link the interests of executives with shareholders" and motivate executives to "achieve strong financial and operational performance," while balancing "rewards for short-term and long-term results" (Duke Energy, 2005 Proxy Statement, p. 19). To the extent that they align the interests of managers and outside shareholders, equity compensation and ownership programs may tend to improve financial and operational transparency because managers have little incentive to engage in activities that hurt outside shareholders.

Equity ownership programs may also, however, impair financial and operational transparency. For example, equity ownership may increase the incentive for management to commit fraud (Johnson, Ryan, and Tian (2009)), to misreport corporate performance (Bar-Gill and Bebchuk (2002)), and to reject positive but risky net present value projects (Smith and Stulz (1985)). Hence, equity ownership may increase the incentive for managers to disguise their rent-seeking behavior by choosing projects that are less transparent (Bebchuk and Fried (2003)). Some features of equity compensation and ownership programs may tend to mitigate these potential adverse effects on transparency. For example, Bebchuk and Fried (2003) note that equity-based compensation for directors increases the incentive for directors to monitor management, and Johnson et al. (2009) show that restrictions on management's ability to sell shares may limit management's ability to profit from fraud.

The four ISS governance standards related to equity ownership that we utilize are: Directors receive part of their compensation in stock (Compensation 1); directors own stock (Ownership 1); and the firm has adopted stock ownership

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guidelines for both directors and executives (Ownerships 2 and 3). As noted above, equity-based compensation for directors increases the incentive for directors to monitor management. The stock ownership guidelines for directors and executives may mitigate the potential adverse effects on transparency by specifying minimum levels of stock ownership for both directors and executives, as well as limits on shares sold (through requirements for maintaining significant stock ownership). We therefore expect that these ISS governance standards will be associated with greater transparency, although we recognize the potential for opposing effects.

Finally, attributes of corporate governance may also improve operational transparency to the extent that they mitigate the entrenchment of incumbent management. We therefore include nine governance standards (Boards 5 and 7, Charters 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 those in the GIM (2003) 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 et al. (2009).

Appendix A shows the cross reference of our governance standards to the GIM (2003) standards. Nine of GIM's (2003) 22 governance standards are captured in our GOV-INDEX, with seven of these clustered in the ISS category charter/bylaws. GOV-INDEX includes all the standards in GIM's (2003) category, Delay; four out of six standards in GIM's (2003) category, Voting; and one standard that proxies for GIM's (2003) category, State. We also note that our GOV-INDEX is available for a much greater number of firms in recent years than the GIM (2003) index and that it is 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 (TAQ) database provided by the NYSE. Each quote observation in the data file includes ticker symbol, quote date, time stamp, bid price, ask price, bid depth, ask depth, and exchange code. We then apply the following data filters, which are standard in the microstructure literature (see, e.g., Huang and Stoll (1996)), to the trades and quotes to clean the data of errors and outliers: i) delete quotes if either the bid or ask price is negative; ii) delete quotes if either the bid or ask size is negative; iii) delete quotes if the bid-ask spread is greater than \$4 or negative; iv) delete trades and quotes if they are out of time sequence or involve an error; v) delete before-the-open and after-the-close trades and quotes; vi) delete trades if the price or volume is negative; and vii) 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 of 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

$$\text{Quoted_Spread}_{i,\tau} = (\text{ASK}_{i,\tau} - \text{BID}_{i,\tau})/M_{i,\tau}, \tag{1}$$

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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

$$\text{Effective_Spread}_{i,\tau} = 2D_{i,\tau}(P_{i,\tau} - M_{i,\tau})/M_{i,\tau}, \tag{2}$$

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 1 for customer buy orders and –1 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]

$$\text{Market_Quality_Index}_{i,\tau} = \frac{\frac{1}{2}\text{Quoted_Depth}_{i,\tau}}{\text{Quoted_Spread}_{i,\tau}}. \tag{3}$$

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

$$\text{Price_Impact}_{i,\tau} = 100D_{i,\tau}\left[\frac{M_{i,\tau+5} - M_{i,\tau}}{M_{i,\tau}}\right], \tag{4}$$

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

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

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of the share, its price impact should be 0 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 PIN, we use the sequential trade model of EKOP (1996), applied to each firm over each year (see Appendix B for details). 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 model provides a structure necessary to infer information-based trading from observable variables such as the number of buys and sells.

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, trading volume, firm size, company age, analyst following, institutional ownership, insider trading, 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, insider trading by the ratio of the number of shares traded by insiders to the total number of shares outstanding, 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 (IBES) database, institutional ownership from the CDA/Spectrum Institutional (13f) Holdings database, insider trading from the Thomson Financial Insider Filing Data Files,[7] and all other data (i.e., company age, shares outstanding, R&D expenditures, sales, and total assets) from the Compustat or CRSP databases. Following Berger, Ofek, and Swary (1996) and Almeida and Campello (2007), we measure asset tangibility by [(0.715 $\times$ RECEIVABLES + 0.547 $\times$ INVENTORY + 0.535 $\times$ 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 (item 6).

D. Descriptive Statistics

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 presents descriptive statistics on GOV-INDEX, liquidity measures, and

[7]The Thomson Financial Insider Filing Data Files are designed to capture all insider activity as reported on SEC Forms 3, 4, 5, and 144.

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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, respectively. 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.

TABLE 1

Descriptive Statistics

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, Insider_Trading is the ratio of the number of shares traded by insiders to the total number of shares outstanding, Asset_Tangibility is a measure of asset tangibility detailed in Almeida and Campello (2007), R&D_Expenditure is the ratio of annual research and development (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.

			Percentile				
Variable	Mean	Std Dev	Min	25th	50th	75th	Max
Panel A. Results for NYSE/AMEX Firms							
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 thous.)	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
Insider_Trading	0.0271	0.0847	0.00	0.0015	0.0050	0.0156	0.9964
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							
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 thous.)	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
Insider_Trading	0.0377***	0.0904	0.00	0.0033	0.0105	0.0297	0.9819
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	0.0115***	0.0114	0.0004	0.0040	0.0083	0.0148	0.1603
Effective_Spread	0.0087***	0.0083	0.0003	0.0032	0.0064	0.0113	0.0966
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

[8]For these descriptive statistics, we assume that a firm has no analyst following if its analyst following information is not included in the IBES 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.

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The summary statistics on the governance standards for NASDAQ firms are qualitatively similar, although somewhat smaller in magnitude.

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.

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 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 a 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

[9]See, for example, 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.

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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. We include insider trading because stocks with greater insider trading are likely to have larger spreads. Finally, we include a dummy variable for firms included in the S&P 500 index as well as dummy variables for one-digit Standard Industrial Classification (SIC) industry codes to control for any index membership and industry effects. Based on these 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:

$$
\begin{aligned}
(5)\quad \text{Quoted_Spread}_{i,t} \text{ or } \text{Effective_Spread}_{i,t} \;=\; & \beta_0 + \beta_1 \log(\text{GOV-INDEX}_{i,t}) \\
& + \beta_2 (1/\text{PRICE}_{i,t}) + \beta_3 \text{Return_Volatility}_{i,t} + \beta_4 \log(\text{Trading_Volume}_{i,t}) \\
& + \beta_5 \log(\text{ASSETS}_{i,t}) + \beta_6 \text{AGE}_{i,t} + \beta_7 \text{Number_of_Analysts}_{i,t} \\
& + \beta_8 \text{Institutional_Ownership}_{i,t} + \beta_9 \text{Insider_Trading}_{i,t} \\
& + \beta_{10} \text{Asset_Tangibility}_{i,t} + \beta_{11} \text{R\&D_Expenditure}_{i,t} \\
& + \beta_{12} \text{S\&P_500_Dummy_Variable} \\
& + \text{Dummy_Variables_for_One-Digit_SIC_Industry_Code} + \varepsilon_{i,t},
\end{aligned}
$$

where $\text{Quoted_Spread}_{i,t}$ is the time-weighted mean quoted percentage spread of stock i in year t, $\text{Effective_Spread}_{i,t}$ 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, $\text{Return_Volatility}_{i,t}$ 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, $\text{Insider_Trading}_{i,t}$ is the ratio of the number of shares traded by insiders to the total number of shares outstanding, $\text{Asset_Tangibility}_{i,t}$ 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

[11] Harris (1994) uses firm size as a proxy for the degree of public information available about the stock.

Because we combine data from different sources (e.g., analyst following from the IBES database, liquidity measures from the TAQ database, and R&D data from the Compustat database), some variables have many missing observations in the merged data set. 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 IBES 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 IBES database and zero 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 2 presents the ordinary least squares (OLS) regression results using the first approach, and Panel B presents the results using the second approach.

The results indicate 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 Panels A and B of Table 2). 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 -4.5% of the mean quoted spread for the average priced NASDAQ firm. 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 about 4.5%, 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 related 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

[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 IBES database and that only 1,782 (44.1%) of the 4,042 NASDAQ companies included in the Compustat database are covered by the IBES database in 1996.

[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.

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TABLE 2

Ordinary Least Squares Regression Results

Table 2 presents the ordinary least squares (OLS) results of the following regression model:

$$\begin{aligned}\text{Quoted_Spread}_{i,t},\ \text{Effective_Spread}_{i,t},\ \text{or Market_Quality_Index}_{i,t} \quad = \quad & \beta_0 + \beta_1 \log(\text{GOV-INDEX}_{i,t}) \\ & + \beta_2(1/\text{PRICE}_{i,t}) \text{ or } \log(\text{PRICE}_{i,t}) + \beta_3 \text{Return_Volatility}_{i,t} + \beta_4 \log(\text{Trading_Volume}_{i,t}) \\ & + \beta_5 \log(\text{ASSETS}_{i,t}) + \beta_6 \text{AGE}_{i,t} + \beta_7 \text{Number_of_Analysts}_{i,t} + \beta_8 \text{Institutional_Ownership}_{i,t} \\ & + \beta_9 \text{Insider_Trading}_{i,t} + \beta_{10} \text{Asset_Tangibility}_{i,t} + \beta_{11} \text{R\&D_Expenditure}_{i,t} \\ & + \beta_{12} \text{S\&P_500_Dummy_Variable} + \text{Dummy_Variables_for_One-Digit_SIC_Industry_Code} + \varepsilon_{i,t},\end{aligned}$$

where $\text{Quoted_Spread}_{i,t}$ is the time-weighted mean quoted percentage spread of stock i in year t, $\text{Effective_Spread}_{i,t}$ is the trade-weighted mean effective percentage spread, $\text{Market_Quality_Index}_{i,t}$ is the market quality index, $\text{GOV-INDEX}_{i,t}$ 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, $\text{Insider_Trading}_{i,t}$ is the ratio of the number of shares traded by insiders to the total number of shares outstanding, $\text{Asset_Tangibility}_{i,t}$ is a measure of asset tangibility, $\text{R\&D_Expenditure}_{i,t}$ is the ratio of annual 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. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Panel A. Regression Results When Missing Observations on Analyst Following and R&D Expenditure Are Replaced with 0

	Quoted_Spread			Effective_Spread			Market_Quality_Index
Independent Variables	NYSE/AMEX	NASDAQ	Combined	NYSE/AMEX	NASDAQ	Combined	NYSE/AMEX
Intercept	0.0256***	0.1334***	0.0859***	0.0192***	0.0838***	0.0551***	0.8429***
	(25.74)	(12.64)	(14.34)	(26.53)	(12.67)	(14.65)	(6.97)
log(GOV-INDEX)	–0.0009***	–0.0024***	–0.0012**	–0.0006***	–0.0012	–0.0007	0.3291***
	(–5.57)	(–3.37)	(–2.41)	(–4.86)	(–1.61)	(–1.52)	(13.72)
1/PRICE or log(PRICE)	0.0260***	0.0444***	0.0305***	0.0189***	0.0314***	0.0217***	–0.4573***
	(8.78)	(6.38)	(4.53)	(8.66)	(6.52)	(4.71)	(–16.00)
Return_Volatility	0.0453***	0.1774***	0.2183***	0.0335***	0.1262***	0.1522***	–8.5715***
	(3.13)	(4.39)	(5.40)	(3.08)	(4.34)	(5.37)	(–2.75)
log(Trading_Volume)	–0.0015***	–0.0063***	–0.0042***	–0.0011***	–0.0041***	–0.0027***	0.5339***
	(–18.87)	(–27.50)	(–24.04)	(–19.00)	(–24.32)	(–21.20)	(43.29)
log(ASSETS)	–0.0001	–0.0024***	–0.0017***	–0.0001**	–0.0013***	–0.0011***	0.0558***
	(–1.22)	(–7.68)	(–7.76)	(–2.54)	(–5.48)	(–7.25)	(6.48)
AGE	–0.0008	0.0001***	–0.0103	–0.0004	0.0001**	–0.0163**	0.0011***
	(–0.42)	(4.03)	(–1.03)	(–0.25)	(2.55)	(–2.40)	(3.05)
Number_of_Analysts	0.0001***	0.0003***	0.0002***	0.0487***	0.0001***	0.0001***	0.0007
	(9.98)	(5.11)	(9.56)	(10.48)	(4.06)	(8.64)	(0.55)
Institutional_Ownership (%)	–0.0027***	–0.0011	–0.0044***	–0.0022***	–0.0179	–0.0029***	0.1311***
	(–13.47)	(–1.00)	(–5.61)	(–14.14)	(–0.02)	(–5.20)	(3.85)
Insider_Trading	–0.0437	0.0035***	0.0002	–0.0001	0.0035***	0.0007	0.1583*
	(–0.13)	(2.63)	(0.21)	(–0.41)	(3.22)	(0.77)	(1.81)
Asset_Tangibility	0.0008***	–0.0057***	0.0036***	0.0008***	–0.0028***	0.0034***	–0.2208***
	(2.76)	(–5.05)	(3.72)	(3.62)	(–3.55)	(4.92)	(–4.41)
R&D_Expenditure	0.0010***	–0.0148**	–0.0150**	0.0006***	–0.0114***	–0.0118***	–0.0532**
	(4.37)	(–2.49)	(–2.51)	(3.95)	(–3.01)	(–3.02)	(–2.50)
S&P_500_Dummy_Variable	0.0019***	0.0128***	0.0091***	0.0016***	0.0088***	0.0059***	–0.0498***
	(18.71)	(11.39)	(25.09)	(18.47)	(10.35)	(23.84)	(–2.67)
Adjusted R^2	0.73	0.63	0.59	0.72	0.56	0.56	0.90
No. of observations	4,449	4,629	9,078	4,449	4,629	9,078	4,449

(continued on next page)

TABLE 2 (continued)

Ordinary Least Squares Regression Results

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

	Quoted_Spread			Effective_Spread			Market_Quality_Index
Independent Variables	NYSE/AMEX	NASDAQ	Combined	NYSE/AMEX	NASDAQ	Combined	NYSE/AMEX
Intercept	0.0190*** (26.02)	0.1021*** (18.99)	0.0632*** (25.89)	0.0135*** (22.53)	0.0691*** (16.70)	0.0434*** (24.18)	0.8100*** (6.34)
log(GOV-INDEX)	–0.0005*** (–4.29)	–0.0036*** (–5.37)	–0.0018*** (–4.05)	–0.0003*** (–3.84)	–0.0024*** (–5.02)	–0.0012*** (–3.80)	0.3074*** (11.19)
1/PRICE or log(PRICE)	0.0272*** (10.19)	0.0525*** (8.71)	0.0366*** (5.40)	0.0198*** (10.10)	0.0310*** (6.75)	0.0214*** (4.01)	–0.5077*** (–11.90)
Return_Volatility	0.0344*** (2.63)	0.2068*** (8.69)	0.2115*** (5.93)	0.0246*** (2.58)	0.1686*** (7.40)	0.1658*** (5.67)	–10.1936** (–2.13)
log(Trading_Volume)	–0.0012*** (–18.99)	–0.0054*** (–21.46)	–0.0033*** (–16.81)	–0.0008*** (–17.29)	–0.0038*** (–17.73)	–0.0023*** (–13.47)	0.5602*** (31.16)
log(ASSETS)	0.0001*** (2.71)	–0.0012*** (–4.67)	–0.0014*** (–6.79)	0.0001** (2.12)	–0.0005** (–2.32)	–0.0009*** (–5.43)	0.0470*** (4.55)
AGE	–0.0058*** (–3.69)	0.0001*** (4.87)	–0.0054 (–0.79)	–0.0041*** (–3.62)	0.0001*** (4.26)	–0.0076 (–1.50)	0.0010** (2.23)
Number_of_Analysts	0.0318*** (6.36)	0.0002*** (3.51)	0.0002*** (7.10)	0.0253*** (6.60)	0.0001*** (3.49)	0.0001*** (6.63)	0.0004 (0.30)
Institutional_Ownership (%)	–0.0017*** (–9.49)	0.0009 (0.80)	–0.0035*** (–4.93)	–0.0014*** (–9.82)	0.0015* (1.85)	–0.0021*** (–3.85)	0.0910*** (2.68)
Insider_Trading	0.0002 (0.39)	0.0045*** (3.15)	0.0010 (0.85)	0.0001 (0.45)	0.0045*** (3.60)	0.0014 (1.39)	0.1383* (1.95)
Asset_Tangibility	0.0002 (0.88)	–0.0040*** (–3.68)	0.0019** (2.51)	0.0002 (1.27)	–0.0020** (–2.51)	0.0019*** (3.32)	–0.2337*** (–3.72)
R&D_Expenditure	0.0017** (2.56)	–0.0139** (–2.04)	–0.0137** (–2.11)	0.0012** (2.52)	–0.0097** (–2.12)	–0.0102** (–2.36)	–0.1029** (–2.41)
S&P_500_Dummy_Variable	0.0011*** (13.61)	0.0087*** (8.97)	0.0067*** (21.10)	0.0008*** (12.31)	0.0063*** (8.55)	0.0045*** (19.87)	–0.0657*** (–3.34)
Adjusted R^2	0.73	0.58	0.56	0.72	0.57	0.56	0.88
No. of observations	3,758	3,559	7,317	3,758	3,559	7,317	3,758

expenditure. This result is in line with the finding of Chung, McInish, Wood, and Wyhowski (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

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

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perhaps that the role of institutional investors in corporate monitoring is much weaker on NASDAQ.[15] Consistent with our expectation, we find that both quoted and effective spreads are positively and significantly related to insider trading for NASDAQ stocks. For NYSE/AMEX stocks, however, we find that spreads are not significantly related to insider trading. The latter result may indicate that, for NYSE/AMEX stocks, the information content contained in insider trading is subsumed by other variables (e.g., GOV-INDEX, ASSETS, Number_of_Analysts, and Institutional_Ownership) included in the regression model.

We find that stocks included in the S&P 500 index have wider quoted and effective spreads. Given the finding of GIM (2003) that firms in the S&P 500 have, on average, poorer governance, 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 2.

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 Panels A and B of Table 2, respectively.

Our hypothesis linking corporate governance to stock market liquidity is that poor governance gives rise to greater information asymmetry between the insiders (e.g., managers/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

[15] Institutional ownership and insider ownership (thus insider trading) are likely to be negatively correlated because institutional ownership must come out of those shares that are available to outside investors (i.e., non-inside ownership). For NASDAQ stocks, we find that spreads are not significantly related to institutional ownership, regardless of whether or not we include insider trading as a control variable. Hence, the insignificant relation between spreads and institutional ownership may not be due to the correlation between institutional ownership and insider trading.

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companies with higher GOV-INDEX tend to be significantly more liquid, with narrower spreads and higher market quality index, than shares of 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 covariation, 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 3. 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 IBES database is assumed to have no analyst following). We find again that quoted and effective spreads are negatively and significantly related to GOV-INDEX for both NYSE/AMEX and NASDAQ stocks, while the market quality index is positively and significantly related to GOV-INDEX for NYSE/AMEX stocks. These results provide further evidence that better corporate governance improves stock market liquidity. The regression coefficients on institutional ownership for NASDAQ are positive and significant. This result reinforces our earlier observation that institutional investors may not provide effective monitoring on NASDAQ. Why the spreads of NASDAQ stocks increase with institutional ownership is not clear. A possible explanation is that institutional ownership is positively related to the omitted variables that are positively related to the spread. The regression coefficients on other control variables are qualitatively similar to those in Table 2 with few exceptions.

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 has 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.

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TABLE 3
Regression Results from Alternative Estimation Methods

Table 3 presents the fixed-effects (Panel A) and Fuller-Battese (1974) error component model (Panel B) results of the following regression model:

$$\begin{aligned}\text{Quoted_Spread}_{i,t},\ \text{Effective_Spread}_{i,t},\ \text{or Market_Quality_Index}_{i,t} \;=\; & \beta_0 + \beta_1 \log(\text{GOV-INDEX}_{i,t}) \\ & + \beta_2(1/\text{PRICE}_{i,t}) \text{ or } \log(\text{PRICE}_{i,t}) + \beta_3 \text{Return_Volatility}_{i,t} + \beta_4 \log(\text{Trading_Volume}_{i,t}) \\ & + \beta_5 \log(\text{ASSETS}_{i,t}) + \beta_6 \text{Number_of_Analysts}_{i,t} + \beta_7 \text{Institutional_Ownership}_{i,t} \\ & + \beta_8 \text{Insider_Trading}_{i,t} + \beta_9 \text{Asset_Tangibility}_{i,t} + \beta_{10} \text{R\&D_Expenditure}_{i,t} \\ & + \beta_{11} \text{S\&P_500_Dummy_Variable} + \varepsilon_{i,t},\end{aligned}$$

where $\text{Quoted_Spread}_{i,t}$ is the time-weighted mean quoted percentage spread of stock i in year t, $\text{Effective_Spread}_{i,t}$ is the trade-weighted mean effective percentage spread, $\text{Market_Quality_Index}_{i,t}$ is the market quality index, $\text{GOV-INDEX}_{i,t}$ 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, $\text{Number_of_Analysts}_{i,t}$ is the number of analysts following firm i in year t, $\text{Institutional_Ownership}_{i,t}$ is the percentage of shares held by institutions, $\text{Insider_Trading}_{i,t}$ is the ratio of the number of shares traded by insiders to the total number of shares outstanding, $\text{Asset_Tangibility}_{i,t}$ is a measure of asset tangibility, $\text{R\&D_Expenditure}_{i,t}$ is the ratio of annual 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. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Panel A. Fixed-Effects Regression Results

	Quoted_Spread			Effective_Spread			Market_Quality_Index
Independent Variables	NYSE/AMEX	NASDAQ	Combined	NYSE/AMEX	NASDAQ	Combined	NYSE/AMEX
Intercept	0.0239 (0.17)	0.0008 (0.21)	0.0002 (0.11)	0.0369 (0.44)	0.0005 (0.21)	0.0001 (0.12)	0.0124 (0.22)
log(GOV-INDEX)	–0.0007*** (–5.17)	–0.0079*** (–8.90)	–0.0035*** (–7.47)	–0.0005*** (–5.15)	–0.0065*** (–9.95)	–0.0029*** (–8.31)	0.5389*** (19.93)
1/PRICE or log(PRICE)	0.0212*** (6.54)	0.1676*** (14.96)	0.1141*** (14.04)	0.0180*** (8.13)	0.0963*** (9.55)	0.0666*** (9.15)	–0.4248*** (–10.91)
Return_Volatility	0.0236** (2.45)	0.1667*** (5.36)	0.1408*** (6.00)	0.0173*** (2.66)	0.1274*** (5.20)	0.1078*** (5.78)	–6.8090*** (–2.79)
log(Trading_Volume)	–0.0014*** (–13.46)	–0.0029*** (–5.73)	–0.0023*** (–6.61)	–0.0010*** (–13.12)	–0.0029*** (–4.94)	–0.0022*** (–5.33)	0.4708*** (19.33)
log(ASSETS)	–0.0001 (–0.51)	0.0061*** (8.03)	0.0029*** (6.20)	–0.0001 (–0.77)	0.0045*** (7.51)	0.0022*** (5.94)	0.1870*** (4.82)
Number_of_Analysts	–0.0082 (–1.53)	0.0002*** (2.85)	0.0001*** (3.77)	–0.0041 (–1.13)	0.0002*** (3.61)	0.0001*** (4.29)	0.0118*** (4.88)
Institutional_Ownership (%)	–0.0048*** (–10.55)	0.0075*** (3.40)	0.0029** (2.08)	–0.0032*** (–10.43)	0.0072*** (3.62)	0.0035*** (2.79)	0.9856*** (8.57)
Insider_Trading	0.0001 (0.42)	0.0052*** (3.42)	0.0028*** (3.23)	0.0001 (0.55)	0.0042*** (3.41)	0.0022*** (3.19)	0.0407 (0.71)
Asset_Tangibility	0.0216 (0.03)	0.0039 (1.59)	0.0013 (0.80)	0.0003 (0.65)	0.0045** (2.05)	0.0023 (1.61)	0.1568 (1.43)
R&D_Expenditure	0.0012*** (4.26)	–0.0289*** (–3.67)	–0.0313*** (–4.06)	0.0010*** (4.07)	–0.0178*** (–3.80)	–0.0195*** (–4.24)	0.0277 (0.48)
S&P_500_Dummy_Variable	–0.0057 (–0.22)	0.0003 (0.55)	0.0001 (0.65)	–0.0029 (–0.16)	–0.0001 (–0.12)	0.0146 (–0.15)	0.0096 (1.06)
Adjusted R^2	0.50	0.29	0.24	0.50	0.25	0.21	0.52
No. of observations	4,449	4,629	9,078	4,449	4,629	9,078	4,449

(continued on next page)

TABLE 3 (continued)
Regression Results from Alternative Estimation Methods

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

Independent Variables	Quoted_ Spread	Effective_ Spread	Market_ Quality_ Index
Intercept	0.0428*** (15.18)	0.0338*** (16.11)	2.1358*** (10.11)
log(GOV-INDEX)	–0.0012*** (–2.70)	–0.0006** (–1.97)	0.0658** (2.24)
1/PRICE or log(PRICE)	0.0335*** (8.63)	0.0125*** (4.32)	–0.5786*** (–30.82)
Return_Volatility	0.2868*** (38.46)	0.2452*** (43.62)	–17.1155*** (–22.23)
log(Trading_Volume)	–0.0030*** (–25.12)	–0.0025*** (–28.36)	0.5206*** (46.31)
log(ASSETS)	–0.0058 (–0.04)	0.0001 (1.23)	0.0707*** (6.07)
Number_of_Analysts	0.0001** (2.14)	0.0001*** (3.96)	0.0046*** (2.90)
Institutional_Ownership (%)	–0.0001 (–0.14)	0.0004 (0.88)	0.1261** (2.39)
Insider_Trading	0.0016* (1.70)	0.0011 (1.53)	0.0205 (0.36)
Asset_Tangibility	0.0023*** (3.21)	0.0019*** (3.55)	–0.2024*** (–3.34)
R&D_Expenditure	–0.0100 (–1.13)	–0.0082 (–1.07)	–0.0828 (0.30)
S&P_500_Dummy_Variable	0.0036*** (8.21)	0.0028*** (8.74)	–0.0222 (–0.73)
Adjusted R^2	0.48	0.51	0.76
No. of observations	4,480	4,480	2,580

Because the Fuller-Battese model requires that the number of time-series observations be identical across all cross-sectional units (i.e., companies), we include only those companies with complete data during the entire 4-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 separately from each market are similar.

Panel B of Table 3 reports the results of the Fuller-Battese (1974) 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 2 and Panel A of Table 3.

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

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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.[16] 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 Panel B of Table 3, we report the results from the combined sample of NYSE/AMEX and NASDAQ stocks.

The results (see Table 4) 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 0 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 (0.0736) on the previous year's change in GOV-INDEX is much smaller than the corresponding figure (0.2469) 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 5 presents the OLS results, and Panel B presents 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 those listed on NASDAQ.

[16] 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.

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TABLE 4

Regression Results with Changes in the Variables

Table 4 presents the ordinary least squares (OLS) results of the following regression model:

$$\Delta\text{Quoted_Spread}_{i,t},\ \Delta\text{Effective_Spread}_{i,t},\ \text{or}\ \Delta\text{Market_Quality_Index}_{i,t} = \beta_0 + \beta_1 \Delta \log(\text{GOV-INDEX}_{i,t}) + \beta_2 \Delta \log(\text{GOV-INDEX}_{i,t-1}) + \beta_3 \Delta(1/\text{PRICE}_{i,t})\ \text{or}\ \Delta \log(\text{PRICE}_{i,t}) + \beta_4 \Delta\text{Return_Volatility}_{i,t} + \beta_5 \Delta \log(\text{Trading_Volume}_{i,t}) + \beta_6 \Delta \log(\text{ASSETS}_{i,t}) + \beta_7 \Delta\text{Number_of_Analysts}_{i,t} + \beta_8 \Delta\text{Institutional_Ownership}_{i,t} + \beta_9 \text{Insider_Trading}_{i,t} + \beta_{10} \Delta\text{Asset_Tangibility}_{i,t} + \beta_{11} \Delta\text{R\&D_Expenditure}_{i,t} + \varepsilon_{i,t},$$

where $\text{Quoted_Spread}_{i,t}$ is the time-weighted mean quoted percentage spread of stock i in year t, $\text{Effective_Spread}_{i,t}$ is the trade-weighted mean effective percentage spread, $\text{Market_Quality_Index}_{i,t}$ is the market quality index, $\text{GOV-INDEX}_{i,t}$ 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, $\text{Number_of_Analysts}_{i,t}$ is the number of analysts following firm i in year t, $\text{Institutional_Ownership}_{i,t}$ is the percentage of shares held by institutions, $\text{Insider_Trading}_{i,t}$ is the ratio of the number of shares traded by insiders to the total number of shares outstanding, $\text{Asset_Tangibility}_{i,t}$ is a measure of asset tangibility, $\text{R\&D_Expenditure}_{i,t}$ is the ratio of annual 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. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Independent Variables	Quoted_ Spread	Effective_ Spread	Market_ Quality_ Index
Intercept	0.0021***	0.0017***	0.1988***
	(7.23)	(7.50)	(16.93)
Δlog(GOV-INDEX)	–0.0103***	–0.0076***	0.2469***
	(–11.88)	(–11.49)	(7.55)
$\Delta\log(\text{GOV-INDEX})_{t-1}$	0.0009	0.0007	0.0736*
	(0.84)	(0.90)	(1.92)
Δ1/PRICE or Δlog(PRICE)	0.1290***	0.0653***	–0.2566***
	(6.30)	(3.74)	(–5.99)
ΔReturn_Volatility	0.2939***	0.2749***	–4.9517***
	(9.15)	(9.04)	(–4.83)
Δlog(Trading_Volume)	–0.0020***	–0.0024***	0.4177***
	(–2.67)	(–2.76)	(14.22)
Δlog(ASSETS)	0.0023*	0.0020**	–0.1008**
	(1.95)	(2.16)	(–2.28)
ΔNumber_of_Analysts	0.0193	0.0432	0.0019
	(0.50)	(1.29)	(1.02)
ΔInstitutional_Ownership (%)	–0.0027	–0.0005	0.8065***
	(–0.85)	(–0.18)	(5.86)
ΔInsider_Trading	0.0023	0.0017	–0.0936
	(1.48)	(1.33)	(–1.25)
ΔAsset_Tangibility	0.0036	0.0030	–0.2766*
	(0.90)	(0.98)	(–1.66)
ΔR&D_Expenditure	–0.0499**	–0.0285	–0.3463
	(–2.30)	(–1.63)	(–0.89)
Adjusted R^2	0.36	0.40	0.27
No. of observations	2,756	2,756	1,614

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 PIN on GOV-INDEX and the same control variables used previously. Panel A of Table 5 presents the OLS results, and Panel B presents the results of the fixed-effects regression. Both the OLS and fixed-effects regression results indicate that PIN is negatively related to GOV-INDEX for both NYSE/AMEX and NASDAQ stocks and that the relation is statistically significant only for the NASDAQ sample. These results are consistent with the

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TABLE 5

Regression Results for Price Impact and PIN

Table 5 presents the ordinary least square (OLS) results (Panel A) and fixed-effects results (Panel B) of the following regression model:

$$\begin{aligned}\text{Price_Impact}_{i,t} \text{ or } \text{PIN}_{i,t} \quad = \quad & \beta_0 + \beta_1 \log(\text{GOV-INDEX}_{i,t}) + \beta_2 \log(\text{PRICE}_{i,t}) + \beta_3 \text{Return_Volatility}_{i,t} \\ & + \beta_4 \log(\text{Trading_Volume}_{i,t}) + \beta_5 \log(\text{ASSETS}_{i,t}) + \beta_6 \text{AGE}_{i,t} + \beta_7 \text{Number_of_Analysts}_{i,t} \\ & + \beta_8 \text{Institutional_Ownership}_{i,t} + \beta_9 \text{Insider_Trading}_{i,t} + \beta_{10} \text{Asset_Tangibility}_{i,t} \\ & + \beta_{11} \text{R\&D_Expenditure}_{i,t} + \beta_{12} \text{S\&P_500_Dummy_Variable} + \varepsilon_{i,t},\end{aligned}$$

where $\text{Price_Impact}_{i,t}$ is the mean price impact of firm i in year t, $\text{PIN}_{i,t}$ 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, $\text{Insider_Trading}_{i,t}$ is the ratio of the number of shares traded by insiders to the total number of shares outstanding, $\text{Asset_Tangibility}_{i,t}$ is a measure of asset tangibility, $\text{R\&D_Expenditure}_{i,t}$ is the ratio of annual 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. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

	Price_Impact			PIN		
Independent Variables	NYSE/ AMEX	NASDAQ	Combined	NYSE/ AMEX	NASDAQ	Combined
Panel A. OLS Results						
Intercept	1.1863***	1.6850***	1.4119***	0.3029***	0.5216***	0.4441***
	(44.43)	(21.04)	(32.19)	(14.64)	(11.62)	(18.45)
log(GOV-INDEX)	–0.0092*	–0.0581***	–0.0393***	–0.0045	–0.0095*	–0.0048
	(–1.70)	(–6.91)	(–7.08)	(–0.94)	(–1.76)	(–1.29)
log(PRICE)	–0.0252***	–0.0161***	–0.0304***	0.0036	0.0049	0.0068***
	(–5.22)	(–3.16)	(–8.74)	(1.30)	(1.63)	(3.33)
Return_Volatility	4.0574***	0.3668**	1.7720***	0.4225***	–0.1405*	–0.0872
	(9.84)	(2.03)	(6.94)	(3.14)	(–1.74)	(–1.22)
log(Trading_Volume)	–0.0625***	–0.0660***	–0.0599***	–0.0092***	–0.0237***	–0.0217***
	(–23.37)	(–20.27)	(–26.50)	(–5.29)	(–14.66)	(–18.97)
log(ASSETS)	–0.0005	–0.0135***	–0.0124***	0.0002	0.0036**	0.0077***
	(–0.22)	(–3.78)	(–5.88)	(0.14)	(1.99)	(7.00)
AGE	–0.0001	–0.0025***	–0.0011***	–0.0002**	–0.0005***	–0.0438
	(–1.13)	(–7.77)	(–11.00)	(–2.12)	(–2.69)	(–0.63)
Number_of_Analysts	0.0018***	–0.0035***	–0.0993	–0.0003	–0.0015***	–0.0009***
	(8.28)	(–5.54)	(–0.32)	(–1.21)	(–4.50)	(–4.35)
Institutional_Ownership (%)	–0.1061***	–0.1729***	–0.1621***	0.0053	0.0082	0.0115**
	(–12.98)	(–11.12)	(–15.68)	(0.73)	(1.10)	(2.14)
Insider_Trading	0.0036	0.0397**	0.0210	0.0492***	0.0356***	0.0456***
	(0.27)	(2.15)	(1.44)	(3.70)	(3.62)	(5.55)
Asset_Tangibility	0.0166*	–0.0136	0.0875***	–0.0096	–0.0092	–0.0181***
	(1.70)	(–0.88)	(9.46)	(–1.17)	(–1.11)	(–3.21)
R&D_Expenditure	0.1115***	–0.0001*	–0.1600*	0.0174	–0.0001	–0.0001
	(2.75)	(–1.85)	(–1.91)	(0.87)	(–1.13)	(–1.19)
S&P_500_Dummy_Variable	0.0679***	0.0648***	0.0825***	–0.0027	–0.0247***	0.0120***
	(17.31)	(5.04)	(18.93)	(–0.65)	(–3.81)	(3.30)
Adjusted R^2	0.73	0.65	0.70	0.07	0.29	0.17
No. of observations	4,257	4,128	8,385	4,258	4,128	8,386

(continued on next page)

TABLE 5 (continued)
Regression Results for Price Impact and PIN

Independent Variables	Price_Impact			PIN		
	NYSE/ AMEX	NASDAQ	Combined	NYSE/ AMEX	NASDAQ	Combined
Panel B. Fixed-Effects Regression Results						
Intercept	0.0065	0.0001	0.0033	–0.0075	–0.0002	–0.0041
	(0.74)	(0.00)	(0.11)	(–1.13)	(–0.00)	(–0.34)
log(GOV-INDEX)	–0.0079	–0.1270***	–0.0596***	–0.0059	–0.0243***	–0.0107**
	(–1.49)	(–12.22)	(–9.79)	(–0.85)	(–3.32)	(–2.13)
log(PRICE)	–0.0201***	0.0089	–0.0274***	–0.0066	0.0373***	0.0150***
	(–2.90)	(0.63)	(–3.02)	(–1.01)	(5.44)	(3.09)
Return_Volatility	1.9478***	0.1402	0.4825***	0.0723	0.0099	0.0441
	(5.03)	(0.83)	(3.08)	(0.57)	(0.12)	(0.60)
log(Trading_Volume)	–0.0525***	–0.0385***	–0.0313***	–0.0031	–0.0315***	–0.0198***
	(–11.16)	(–4.09)	(–4.69)	(–0.78)	(–7.74)	(–6.74)
log(ASSETS)	–0.0118	–0.1482	–0.0896***	–0.0206***	–0.0340***	–0.0272***
	(–1.52)	(–13.09)***	(–12.30)	(–3.24)	(–6.29)	(–6.49)
Number_of_Analysts	–0.0009***	–0.0002	–0.0011***	–0.0005	–0.0012***	–0.0007**
	(–3.69)	(–0.21)	(–3.13)	(–1.17)	(–2.62)	(–2.45)
Institutional_Ownership (%)	–0.1540***	–0.6668***	–0.4497***	0.0170	–0.1070***	–0.0366***
	(–7.55)	(–21.02)	(–20.25)	(0.89)	(–6.51)	(–2.86)
Insider_Trading	0.0060	–0.0156	–0.0070	0.0598***	0.0075	0.0351***
	(0.54)	(–0.73)	(–0.51)	(3.69)	(0.68)	(3.27)
Asset_Tangibility	0.0545**	0.0504	0.1030***	0.0366	0.0317*	0.0421***
	(2.04)	(1.54)	(4.34)	(1.39)	(1.93)	(3.02)
R&D_Expenditure	–0.0575	–0.0002	–0.0002*	0.0801	0.0001	0.0001
	(–0.83)	(–1.29)	(–1.72)	(1.52)	(0.81)	(0.58)
S&P_500_Dummy_Variable	–0.3690	–0.0450	–0.0017	–0.0012	–0.0001	–0.0010
	(–0.29)	(–0.01)	(–1.08)	(–0.59)	(–0.02)	(–0.58)
Adjusted R^2	0.34	0.42	0.34	0.01	0.09	0.04
No. of observations	4,257	4,128	8,385	4,258	4,128	8,386

above result that companies with better governance structure exhibit smaller price impacts.

IV. Summary and Concluding Remarks

Companies with good corporate governance are likely to have liquid secondary markets for their shares because good governance improves financial and operational transparency, which ultimately 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. 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 financial and operational transparency 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

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of information-based trading (PIN). We also find that changes in our liquidity measures are significantly related to changes in the 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 to different measures of liquidity.

Prior research suggests that companies with poor governance structure have lower market values because poorly protected shareholder rights result in smaller cash flows to shareholders. For instance, Gompers, Ishii, and Metrick (GIM) (2003) show that firms with poorer shareholder rights exhibit lower net profit margins and slower sales growth. Our finding of a positive relation between stock market liquidity and corporate governance quality provides another reason why firms with poor governance structure have lower market values. Our study suggests that governance affects firm value through the cost of equity capital: Poor corporate governance leads to lower stock market liquidity, which increases the expected (required) return of shareholders, resulting in higher cost of equity capital.[17] Hence, governance structure affects both the numerator (i.e., cash flows) and denominator (the cost of capital) of the standard discounted cash flow model of firm valuation. By establishing a clear empirical link between corporate governance and liquidity, our results provide additional evidence that firm value may increase as the firm adopts corporate governance standards that improve financial and 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 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.[18]

Although the results of our study suggest that good governance could enhance firm value through its effect on stock market liquidity, whether companies choose to adopt additional governance standards remains a question. As suggested by Aggarwal, Erel, Stulz, and Williamson (2009), governance standards may be selected by the controlling shareholder to maximize his private value of the firm. The controlling shareholder's decision of whether to adopt additional governance

[17]The effect of liquidity on the cost of equity is documented in, for example, Amihud and Mendelson (1986), Eleswarapu (1997), Brennan and Subrahmanyam (1996), Brennan, Chordia, and Subrahmanyam (1998), and Pastor and Stambaugh (2003). Habib, Johnson, and Naik (1997) establish a theoretical link between transparency and the cost of capital.

[18]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 fundamentally changed 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.

standards therefore involves weighing the benefits of greater liquidity and lower cost of equity capital against the cost associated with, for example, the diminished ability of the controlling shareholder to expropriate firm value.

Appendix A. Governance Categories and Factors Used by the Institutional Shareholder Services

Table A1 reports the 24 governance standards related to financial and operational transparency that comprise our index. The standards are drawn from data compiled by the Institutional Shareholder Services (ISS). Where appropriate, the associated category and variable in Gompers, Ishii, and Metrick (GIM) (2003) are 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 antitakeover provisions in a firm's charter, bylaws, and state law.

TABLE A1
Governance Variables

	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 not 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 antitakeover provisions.	State

Appendix B. Calculation of the Probability of Information-Based Trading

The Easley, Kiefer, O'Hara, and Paperman (EKOP) (1996) model of the trade process for firm i over trading day j is represented by the following likelihood function:

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

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, 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:

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

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

$$
\mathrm{PIN}_i = \frac{\hat{\alpha}_i\hat{\mu}_i}{\hat{\alpha}_i\hat{\mu}_i + 2\hat{\varepsilon}_i}.
$$

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