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The effect of voluntary disclosure on stock liquidity: New evidence from index funds ☆

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ABSTRACT

This study tests whether voluntary disclosure affects stock liquidity. I argue that index funds fit the profile of nonstrategic traders who, according to theory, are unambiguously more likely than managers and strategic investors to prefer high stock liquidity and thus high disclosure. This suggests that I can use index funds' disclosure preferences to construct an empirical model of voluntary disclosure that abstracts away from managers' strategic disclosure motives. Accordingly, I use an index-fund setting to construct a recursive structural equation model of voluntary disclosure, index fund ownership, and liquidity. I find that when a firm joins the S&P 500 index, voluntary disclosure increases with the level of ownership assumed by index funds, and this increase in disclosure is associated with increased stock liquidity. These results imply that voluntary disclosure increases stock liquidity.

1. Introduction

Stock liquidity is central to the efficient functioning of trade in the financial markets and is determined in part by information asymmetry among traders. Since voluntary disclosure can affect information asymmetry among traders, theoretical research has shown that voluntary disclosure can affect stock liquidity (e.g., Bushman and Indjejikian, 1995). However, empirical tests of this mechanism must recognize that a manager's provision of disclosure is a product of many forces, all of which must be identified.[1] It has proved difficult to construct an empirical model of disclosure that incorporates all these forces (e.g., Joos, 2000; Leuz and Verrecchia, 2000). Index funds, by contrast, trade primarily for nonstrategic reasons, and theory suggests that such nonstrategic traders unambiguously prefer higher disclosure relative to privately

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[1] For example, as Bushman and Indjejikian (1995) note, strategic insiders have to consider the effects of disclosure on both their information advantage and the firm's stock liquidity, because both factors affect their trading profits.

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informed managers and strategic investors. This implies that I can use index funds' disclosure preferences to construct an empirical model of voluntary disclosure that abstracts away from managers' strategic disclosure motives. Accordingly, I use an index-fund setting to construct a recursive model of voluntary disclosure, index fund ownership, and stock liquidity, and demonstrate that voluntary disclosure increases stock liquidity.

The effect of index fund ownership on liquidity can arise from two mechanisms: (1) index funds' unambiguous preference for additional disclosure, and (2) index fund ownership itself (e.g., increased nonstrategic trading related to portfolio rebalancing). Separating these two mechanisms is crucial for understanding the determinants of liquidity, but it cannot be done with simple OLS or regression discontinuity (RD) techniques. For example, even if index funds elicit more disclosure from managers, instrumenting disclosure with index fund ownership does not solve the identification problem: Any effect on liquidity related to common variation in disclosure and index fund ownership could be due to either increased disclosure or index fund ownership itself (the same is true for RD designs). An appropriate empirical solution for separating these effects is to construct structural equations for disclosure and index fund ownership, and then to use recursive estimation to obtain each mechanism's liquidity effect (Greene, 2002, p. 397).[2]

Constructing the recursive model requires that index fund ownership be properly identified. To achieve this goal, I use an index-fund-inclusion setting. An important feature of this setting is that changes in the index's constituent firms are made by the index's governing body (such as S&P), and are therefore exogenous to index funds themselves. When a firm is added, index funds must take an ownership position in that firm, and this exogenous ownership position confers control rights. When index funds acquire control rights through ownership, any link between an increase in voluntary disclosure due to this control and stock liquidity can be construed as causal. By contrast, it is harder to make such claims for strategic investors (including managers) without explicitly modeling their endogenous preferences for disclosure, ownership, and liquidity. The same goes for atomistic or retail traders, who can trade at will according to their disclosure preferences and are too small to influence managers' disclosure choices.

I use inclusion in the S&P 500 index as the key economic phenomenon to test whether disclosure affects stock liquidity. At the time of a firm's index inclusion, the ownership level assumed by index funds is determined by their assets under management (AUM). Since index fund AUM varies across time and index inclusions occur throughout time, the index-fund setting generates substantial variation in index fund ownership. This setting has other benefits as well. Since firm managers can neither influence index fund AUM nor control the timing of index inclusions, the index fund ownership stake is exogenous to the firm (see Section 3.1). From the index fund perspective, prior research suggests that variation in index fund ownership is not due to strategic stock selection (see Section 2). In addition, S&P makes public their index-inclusion criteria, which I use to match each inclusion firm to a control firm (using propensity scores). Exploiting each inclusion firm's behavior pre and post inclusion relative to the matched control firm results in a difference-in-differences (D-in-D) regression setting that eliminates any time-varying effects common to both firms and differences away any firm-fixed effects. Importantly, the D-in-D design also controls for any "index-inclusion" effect common to all inclusion firms (for disclosure and liquidity).

I use a sample of 368 firms added to the S&P 500 index over the period of 1996–2010 (and 368 control firms). In my sample, 78% of index inclusions occur due to a merger or an acquisition involving an existing index firm, which frees up a spot in the index. Upon index inclusion, the ensuing index fund ownership level in my sample firms is economically meaningful, ranging from 3.9% to 10.2% of a firm's common shares outstanding.

In the first analysis, I regress several disclosure proxies on the change in index fund ownership resulting from index inclusion. I find that for a one standard deviation increase in index fund ownership, management guidance disclosures increase by approximately 19.35%, 8-K filings increase by 18.99%, supplementary financial statement filings increase by 9.49%, and press releases increase by 7.51% (relative to control firms). I also find that less entrenched managers provide more disclosure for the same amount of increase in index fund shareholdings. These results suggest that index funds are more effective at eliciting disclosure when they have a larger stake in a firm. Inclusion firms also experience an improvement in their information environment, as measured by a reduction in analyst forecast errors.[3]

In the second analysis, I demonstrate that stock liquidity, as proxied for by bid-ask spreads and the Amihud (2002) illiquidity measure, increases for inclusion firms relative to control firms in a D-in-D manner when the inclusion firm gets a larger ownership stake from index funds. However, recall that this increase in liquidity may be unrelated to the improved disclosure environment—it could occur simply because of index fund ownership by itself. I use a recursive structural equation model to separate the disclosure effect and the index fund ownership effect on liquidity, and find that the disclosure effect is significant (see Section 4.5). This result implies that disclosure increases liquidity.

This study makes several contributions to the literature. First, other studies relating disclosure to stock liquidity acknowledge identification challenges in modeling managers' strategic disclosure choices. For example, Leuz and Verrecchia (2000) rely on the voluntary adoption of IFRS by German firms to represent a commitment to increased disclosure and find that voluntary adopters experience greater liquidity. Shroff et al. (2013) find that after the passage of the 2005 Securities Offering Reform, firms increased disclosure before seasoned equity offerings, which led to higher liquidity for these firms. Balakrishnan et al. (2014) find that increases in disclosure associated with reductions to analyst coverage lead to increased

[2] The recursive model is a specific form of path analysis. See Section 4.5 for more detail.

[3] I commingle all index funds into one large fund under the assumption that all index funds share the same disclosure preference. In Section 3, I motivate the S&P 500 setting in the context of other index settings. In Section 4.3, I show econometrically that my main results cannot be attributed to changes in the holdings of non-index institutional investors. In Section 4.8, I consider the index-deletion setting.

liquidity, but they do not explicitly model the increase in disclosure. My study corroborates the prediction that disclosure increases liquidity, yet it abstracts away from any particular model of managers' strategic disclosure motives, which considerably simplifies the analysis. I also highlight an important mechanism that gives rise to disclosure.

Second, through the use of index funds, I bypass an endogeneity concern that is specific to institutional holdings. Prior studies such as Lang and Lundholm (1996) and Bushee and Noe (2000) show that disclosure is associated with institutional investor shareholdings. These studies use these associations to argue that institutional investors are attracted to firms with certain disclosure practices, and that managers adopt disclosure practices to attract such investors. However, these studies acknowledge that institutional investors may strategically invest and divest based on their unobservable investing strategy, which may ultimately affect their demand for disclosure. Index funds, by contrast, have no such leeway in choosing their portfolio firms. Instead, the funds appear to influence disclosure through ownership, an important consideration for future work on institutions and disclosure.

Third, my study differs in two important ways from that of Boone and White (2015), who argue (along lines similar to mine) that index funds prefer high disclosure because it decreases trading costs. Boone and White (2015, Tables 3 and 5) show that firms moving from the Russell 1000 to the Russell 2000 index exhibit increased disclosure, increased liquidity, and higher institutional ownership. They acknowledge that the liquidity effect could occur "via direct and indirect channels," with the former related to index fund ownership and the latter related to disclosure. But, unlike this study, theirs does not explicitly test for the two mechanisms and thus cannot address the economic question of whether disclosure and index fund ownership separately affect liquidity. Another difference is that Boone and White (2015) measure institutional ownership at the "quasi-indexer" level. Bushee and Noe (2000) find that this classification comprises not just index funds but also non-index funds that have strategic disclosure preferences. By measuring index fund ownership directly from regulatory filings, I eliminate the possibility that institutions' strategic disclosure preferences drive my results.[4]

Lastly, my focus on index funds complements the work of Brav et al. (2008), who show that other large owners, such as hedge funds, exercise their ownership power by intervening in managers' business decisions. Such intervention, which requires the investor to acquire new management skills, is not feasible on a large scale for index funds, which aim to hold a large basket of stocks in many industries at low cost. Nonetheless, as this study shows, index funds do exploit their ownership power for other purposes.

In Section 2, I motivate the hypotheses. Sections 3 and 4 describe the data and empirical results, and Section 5 concludes.

2. Hypothesis development

The index-fund industry is dominated by a few large funds with economies of scale in a highly competitive market (as of 2016, S&P's website notes that index fund holdings account for $2.2 trillion of the $17.7 trillion S&P 500 market capitalization, or 12.4%). Index funds maintain their competitive position by offering a significant cost advantage to owning a large index of stocks, and by keeping expense ratios and liquidity-related trading costs low (relative to managed funds). According to my conversations with BlackRock independent trustees, the overwhelming majority of S&P 500 index-fund trade occurs in the open secondary markets, and a significant volume of such trade arises on a daily basis (the same is true for Fidelity and Vanguard). Thus, the liquidity of the index fund and all of its associated vehicles depends on the liquidity of the underlying stocks. To reduce their liquidity-related costs, index funds can improve liquidity in the underlying stocks by eliciting more disclosure from these firms. High liquidity in these stocks lowers trading costs for clients, reduces absolute tracking error, preserves AUM, and increases the liquidity of derivative securities such as ETFs (see Appendix A). More liquidity also ensures that ETF prices do not deviate from the underlying index or become highly exposed to the risk of adverse price movements in the underlying stocks (Madhavan, 2015).[5]

Given prior evidence that neither retail nor mutual fund flows are strategic (e.g., Carhart, 1997; Fama and French, 2010; Frazzini and Lamont, 2008), I assume that index fund clients purchase and redeem index fund shares for nonstrategic (e.g., personal consumption) reasons. That is, if a client has private information about a given firm, he may wish to trade in that firm directly, not through the index. Consequently, index funds have an unambiguous preference for high disclosure, and I can use this characteristic to directly model their disclosure preferences.[6]

In theory, when index funds join a firm due to its S&P 500 index inclusion, disclosure moves to a new second-best level

[4] In related work, Bird and Karolyi (2016) conduct an RD analysis in an index setting and find a positive association between institutional ownership and disclosure. Similar to Boone and White (2015), their analysis cannot directly measure the impact of disclosure and nonstrategic trading on liquidity. Even if one eliminates the additional disclosures related to corporate activities, as Bird and Karolyi (2016) do, one must also eliminate the disclosures associated with the additional index fund ownership, because both forces can affect liquidity. In Section 4.5, I describe how the recursive model solves this identification challenge.

[5] Although index funds indicate that they rapidly settle the vast majority of their client orders through secondary-market trading, if order settlement did occur through cash or security reserves, the liquidity of index-fund derivative products might deviate from the liquidity of the underlying index stocks.

[6] Although most index funds do not legally guarantee perfect index tracking, Elton et al. (2004) find that (1) S&P 500 index fund returns trail the S&P 500 index by an amount close in magnitude to the average index fund expense ratio on average, and (2) a regression of index fund returns on index returns has an R^2 of 0.999, which suggests that index funds do not make strategic portfolio allocations. Some actively managed mutual funds track or hug an index in an attempt to beat it. My coding procedure for index funds in Section 3.3 does not consider such funds as index funds. I also do not consider enhanced and levered ETFs as index funds in my sample.

equilibrium that incorporates index funds' disclosure preferences. In practice, reaching this new equilibrium requires that managers learn index funds' disclosure preferences. Accordingly, large index funds such as BlackRock, Fidelity, and Vanguard retain teams of analysts and investor relations personnel who can check disclosure levels across an industry by examining media and financial reports, management disclosures and guidance activities, and earnings conference calls. These funds can then communicate their preference for more disclosure directly to companies through investor conferences, private meetings, and phone conversations. Index funds also clearly state their preference for more disclosure on their websites and governance materials (see Appendix B), and managers can observe and learn from the reporting practices of their new index peers (e.g., Dye and Sridhar, 1995).

Of course, managers may resist index funds' preference for greater disclosure. To overcome this obstacle, index funds must rely on both hard and soft power. Hard power arises from index funds' ownership stakes, which confer control rights such as proxy votes. These funds appear willing to use such leverage: Matvos and Ostrovsky (2010, Table 1) show that Vanguard's S&P 500 index fund withheld votes for management-proposed directors and proposals 17.2% of the time from July 2003 to June 2004 (similar magnitudes were found for other index funds). Given that many votes are decided by less than 5%, managers have a significant incentive to preserve the support of index funds (Appel et al., 2016; Gillian and Starks, 2000). Disclosing according to the preferences of these funds is one way to maintain their support.[7]

Soft power over management, by contrast, comes from a variety of sources, not least of which are informal negotiation settings. In 2013, Glenn Booraem, the Controller of Vanguard's S&P 500 index fund, noted that "while our approach of quiet diplomacy has led some to conclude that our voice is silent on many debates, we believe that our effectiveness is maximized by taking our message directly to those companies where we believe changes are needed." Booraem noted further that Vanguard has "found through hundreds of direct discussions every year that we are frequently able to accomplish as much or more through dialogue as we are through voting. Importantly, through engagement, we are able to put issues on the table for discussion that aren't on the proxy ballot" (Booraem, 2013). Likewise, in 2015, Larry Fink, the CEO of BlackRock, called for "consistent and sustained" engagement by his firm (Fink, 2015). These forms of private communication appear important not only to Vanguard and BlackRock: Matvos and Ostrovsky (2010) find that in 2003, after the SEC passed a new rule requiring disclosure of proxy votes, many index fund sponsors wrote comment letters to the SEC in which they expressed concern about being denied private communication with companies whose management the funds had voted against.

Soft power also comes from managers' and directors' concerns about their reputation and credibility. Index fund sponsors such as BlackRock and Vanguard, by virtue of their size, have considerable soft influence in the director market due to personal relationships and other connections (e.g., Cohen et al., 2008). Information sharing between large shareholders may also drive managers to comply with index funds' preferences. For instance, if managers refuse to disclose more after meeting with an index fund sponsor, that sponsor could inform other large owners that management is uncooperative. This, in turn, might cause these non-index fund owners to sell their stock or vote against management in the future. Evidence of this type of information sharing—documented in Hong et al. (2005) and the survey paper McCahery et al. (2016)—suggests that such an outcome is indeed possible. Proxy advisor firms such as ISS and Glass Lewis, who avow that their guidance arises solely from public information, and formal groups such as the Shareholder-Director Exchange further strengthen the collective influence of index funds. Soft power thus appears to be quite salient in these settings.

Lastly, companies' disclosure motivations also depend on the general market for their shares; index funds are important players in such markets. For example, Nagel (2005) and Boehmer and Kelley (2009) argue that index fund ownership increases the supply of a company's stock available for short sales, which can induce traders to act more aggressively on unfavorable information (Boehmer and Wu, 2013). Managers may want to counteract the price effect of such trade, and can do so through disclosure. Indeed, as Chen et al. (2015) and Li and Zhang (2015) find, the possibility of short selling is associated with longer 10-K disclosures and more favorable and unfavorable earnings forecasts.

I rely primarily on the index fund ownership stake to measure index funds' influence over management. The previous considerations lead to my first hypothesis:

H1: *When firms are included in the S&P 500 index, they increase disclosure more when they are more heavily owned by index funds.*

The empirical analysis takes the difference in the disclosure levels for the index-inclusion firms from pre to post inclusion. However, this difference can vary across inclusions because, for example, of shifting disclosure practices in the inclusion firm's industry. I therefore set as a baseline the change in disclosure of a comparable firm that was not included in the index. This results in a difference-in-differences or D-in-D estimation. The advantage of using D-in-D estimation is that it does not require an explicit model of disclosure and index fund ownership. To the extent that other drivers of disclosure such as proprietary costs change in the same manner across the inclusion and control firms (e.g., time-varying effects), or are constant (e.g., firm-fixed effects), the D-in-D approach eliminates these factors from the analysis (Bertrand et al., 2004). Of course, it could be that index inclusion itself affects disclosure. I can isolate this effect from that of index fund ownership: the inclusion effect is the intercept, and the index fund ownership effect is the coefficient on the index fund ownership stake.

Although index funds have power over managers, they still must exert costly effort to induce disclosure from managers, who may be reluctant to increase disclosure for several reasons. First, managers may want to preserve their private

[7] Reinforcing this view, in April 2015 the Ernst & Young Center for Board Matters published a survey of institutional investors, noting that "When companies engage with long-term institutional investors and demonstrate responsiveness to their concerns, those same investors are better positioned to support the company in an activist situation and may prove to be the company's strongest allies."

information advantage, which they partially relinquish by increasing disclosure (e.g., Bushman and Indjejikian, 1995). Second, managers may gain private benefits from withholding disclosure, as when managerial compensation is linked to stock price (e.g., Nagar, 1999; Nagar et al., 2003). Third, managers may withhold disclosure if they believe unfavorable information will soon reverse itself (e.g., Graham et al., 2005). Fourth, more disclosure may promote disclosure-related litigation (e.g., Kothari et al., 2009; Skinner, 1994, 1997). Fifth, more disclosure may induce further monitoring and scrutiny by a firm's board of directors or outside shareholders (e.g., Adams and Ferreira, 2007).

As a result, index funds' demands for more disclosure could be hindered by the extent to which managers are less sensitive to such demands. This is likely to occur when managers are entrenched. In theory, entrenched managers have more power to resist shareholders' demands and preferences—regardless of their economic substance—and thus to maintain the status quo. This idea has been validated by other studies in several empirical settings, including director demand for disclosure (e.g., Armstrong et al., 2014), managerial stock ownership (e.g., Cheng et al., 2004), blockholder governance (e.g., Bharath et al., 2013), executive compensation (e.g., Core et al., 1999), and more broadly using measures of firm value (e.g., Bebchuk et al., 2009; Claessens et al., 2002). I therefore expect that entrenched management teams will be less responsive to index funds' demands for disclosure.[8] Accordingly, I predict:

H2: *The results for H1 are stronger for firms whose managers are less entrenched.*

For H1 and H2, I assume that managers and other large investors, who have incentives to gather firm-specific information privately and then act on it either by intervention or by trading, systematically want less public disclosure than index funds do. I also assume that retail and atomistic traders are too small to influence companies' disclosure choices—they must invest in firms whose disclosures already meet their preferred level.

I next test whether disclosure affects stock liquidity. Conventional wisdom suggests that public disclosure substitutes for private information gathering, thereby making markets more liquid by reducing adverse selection that results from private information in trade in securities (e.g., Diamond and Verrecchia, 1991; Holmström and Tirole, 1993). This wisdom notwithstanding, prior literature has also suggested the possibility that public disclosure actually complements—as opposed to substitutes for—private information gathering, thereby making markets less liquid by exacerbating adverse selection (e.g., Kim and Verrecchia, 1994). Yet a third possibility is that disclosure will have no effect on liquidity in markets populated by many investors because disclosure relates primarily to idiosyncratic features of a firm, although here as well others have suggested why this logic may not apply (e.g., Taylor and Verrecchia, 2015). I also test for a concurrent liquidity effect arising from index fund ownership itself. Index fund ownership might increase the volume of uninformed loss-absorbing trade, which could serve to make markets more liquid. Similarly, index fund ownership might increase the supply of a firm's lendable shares, thereby facilitating the exposure of any unfavorable private information through informed short selling (Boehmer and Wu, 2013; Nagel, 2005). Thus, I expect to find separate effects on stock liquidity due to disclosure and index fund ownership:

H3: *When firms are included in the S&P 500 index, their stock liquidity increases more when they are more heavily owned by index funds. Both disclosure and index fund ownership contribute to this increase.*

3. Data

3.1. Sample selection: treatment and control firms

I create my S&P 500 index-inclusion (treatment) sample by starting with all 433 first-time S&P 500 additions from 1996 to 2010. This time period coincides with the availability of EDGAR filing data from the SEC. Index deletions due to acquisitions or mergers of existing index firms lead to 78% of the new inclusions in my sample. I follow Denis et al. (2003) and eliminate 45 firms added to the index because they acquired or merged with an index firm. I also require that each treatment firm be publicly traded for at least two years prior to index inclusion and remain in the index for at least two years after inclusion. The two-year window gives the index funds time to establish relationships with managers and gives managers time to adjust their disclosures. I use the $[-2$ years, $0)$ window as the pre-inclusion period and the $[0, +2$ years$]$ window as the post-inclusion period, where 0 is the date the firm was added to the S&P 500 index.[9] Imposing this requirement eliminates 20 more inclusion firms. Given the small number of eliminated firms, I assume that the survivorship or look-ahead bias is small. The final sample comprises 368 S&P 500 index-inclusion firms.

The S&P 500 index has several advantages over other indices. In terms of assets under management (AUM), it is the largest index in the world by a significant margin: total S&P 500 AUM is $2.2 trillion, far exceeding the combined AUM of the second and third largest indices, the Russell 1000 and 2000 ($155 billion as of 2016, according to Russell's website). In addition, managers are unlikely to know whether or when their firm will be included in the S&P 500 (Chen et al., 2004). By contrast, Russell 1000/2000 index inclusions are determined once per year according to relative market capitalization. This provides both a timing and a valuation target for managers seeking inclusion. As a result, managers might strategically

[8] If the empirical reality is that entrenched managers maintain their entrenchment status by gaining the favor of some large investors through disclosure, I should find no comparative results for entrenched firms.

[9] Bertrand et al. (2004) recommend this "collapsed" pre- and post-period design for D-in-D settings.

Table 1
Propensity Score Logit Regression for S&P 500 Index Inclusion from 1996–2010.

	S&P 500 Inclusion (1)
Total Institutional Investor Holdings Before Inclusion	0.094*
	(1.87)
Log of Assets	1.688***
	(25.43)
Log of Market Capitalization	0.909*
	(1.83)
ROA	0.001
	(0.40)
Future Δ ROA	0.000
	(1.03)
Capital Expenditures	0.055
	(0.80)
Research and Development	0.150
	(0.67)
Intangibles	1.854***
	(7.31)
Debt	−1.72***
	(−5.85)
Dividends	−0.600***
	(−5.56)
Business Segments	1.942***
	(2.69)
Bid-Ask Spread	−0.093*
	(1.72)
Log of Firm Age	0.055**
	(2.19)
Market to Book	0.900
	(0.98)
Analyst Following	2.399
	(1.30)
Observations	91,188
McFadden's Adjusted Pseudo R-squared	0.308

Z-statistics are in parentheses. Future Δ ROA is the firm's average yearly ROA in years [1, 2] minus the firm's average ROA in years [−2, −1], where year 0 is the firm's observation year. Bid-Ask Spread is the average daily bid-ask spread during the year preceding each firm-year observation. Other variable definitions are in Appendix D. Standard errors are clustered by year. *p < 0.1. **p < 0.05. ***p < 0.01.

disclose in order to increase or decrease firm value, inducing a disclosure bias to inclusion events. Further, because joining or exiting the Russell indices occurs only because of stock performance, a stock performance bias is inherent to firms at the index cutoff. The Russell value-based cutoff also means that high index churn occurs at relatively low levels of market capitalization, often affecting the same firms (Mullins, 2015). On the other hand, S&P 500 firms usually stay in the index for extended periods, which encourages index funds and managers to develop working relationships.

S&P can include only one firm to replace each firm that exits the index, and it selects the new firm using publicly available information. I therefore pair each S&P 500 inclusion firm with a control firm using a propensity score specification motivated by S&P's index-inclusion criteria. I create the pool of potential control firms by starting with all Compustat firm-year observations for U.S companies, including my 368 first-time inclusion treatment firms. I eliminate observations for non-treatment firms that were not publicly traded during the entire [−2 years, +2 years] window around their year of observation in Compustat and all observations for my treatment firms outside of their [−2 years, +2 years] first-time inclusion period. I then remove non-treatment firms that were either added to or dropped from the S&P 500 index at any point during the [−2 years, +2 years] period around their specific year of observation in Compustat. These firms did not meet the first-time inclusion requirement or did not remain in the index for at least two years after inclusion. This process yields a pool of 91,188 potential matches.

Using the pool of 91,188 potential matches and 368 inclusion treatment firms, I then estimate a logit model with the

inclusion firm indicator as the dependent variable and firm observables as the independent variables (see Table 1). Table 1 indicates that the propensity score model is reasonably accurate (with an adjusted McFadden's pseudo-R^2 of 0.308), reducing the likelihood of matching on correlated omitted variables. I match each treatment firm with one control firm using nearest-neighbor matching by year, Fama-French 12 industry, and closest propensity score, without replacement. The purpose of this matching procedure is to find a baseline control firm that is a reasonable substitute for the inclusion firm.[10]

Table 2, Panel A compares descriptive statistics averaged over the [−2 years, +2 years] window for the treatment and control samples. Treatment and matched control firms are similar on all dimensions except for market to book, analyst following, and log of firm age, underscoring the importance of including these covariates as controls in later tests. The differences in market to book and analyst following are consistent with prior studies that find that firm value increases for firms added to the index and that analyst following increases with institutional holdings (e.g., Morck and Yang, 2001; O'Brien and Bhushan, 1990). More importantly, disclosure levels for the treatment and control firms over the period of [−2 years, 0) are not significantly different at the 10% level. Market adjusted abnormal returns for the treatment and control firms in the two-year post periods are highly correlated (0.87; 1% level), and their difference is statistically insignificant at the 10% level. This indicates that inclusion firms do not outperform control firms, on average. The covariate balance helps validate the selection of control firms.

3.2. Disclosure measures

I measure disclosure using management earnings guidance and three categorizations of 8-K filings: the total number of filings, the number of filings containing "financial statements and exhibits" or "results of operations and financial condition," and the number of filings containing a press release. I choose guidance and 8-Ks to measure disclosure because (Beyer et al., 2010, Table 1) find that, on average, guidance disclosures and SEC filings (including 8-Ks) explain 16% and 4% of a firm's stock return variance, respectively. Prior studies such as Lerman and Livnat (2009) also show that 8-Ks contribute to the price formation process. I use the Thomson Company Issued Guidelines (CIG) database to identify management guidance and WRDS's SEC Analytics Suite to identify 8-K disclosures and their categorizations. Each 8-K filing is matched to the inclusion and control firms using their CIK identifier and date. For each firm's pre and post observation window, I aggregate the number of quarters in which managers provide guidance, and the total number of appropriate 8-K filings.[11]

3.3. Measures of index fund shareholdings

I assume that all index funds are homogeneous in their disclosure preferences and therefore I aggregate all S&P 500 index funds into one fund. This procedure is common in the literature (e.g, Bushee and Noe, 2000). I measure the percentage of a firm's shares outstanding held by index funds in the first quarter after index inclusion using the Thomson-Reuters Mutual Fund Database. This ownership category includes index ETF stakes.[12] I obtain holdings data for non-index institutional investor ownership using the Thomson-Reuters 13F Database. As in the case of index funds, I aggregate all non-indexers into one group and measure their ownership in a given firm in terms of the funds' ownership stake. I verify that index fund ownership arises in the inclusion firms and not in the control firms, and find that this is indeed the case: index fund ownership is zero for the control firms. I also find that index fund ownership varies closely with index fund AUM, an expected outcome given that when index funds collectively have more AUM, they buy a greater percentage of each index firm's outstanding shares.[13]

3.4. Stock liquidity and information environment measures

I measure stock liquidity using the daily percentage quoted spread from TAQ and the Amihud (2002) return to dollar trading volume measure. Goyenko et al. (2009) find that the daily TAQ spread and the Amihud (2002) measure are the first- and second-best measures of stock liquidity, respectively. For percentage spreads, I follow the interpolated time method of Holden and Jacobsen (2014), which adjusts for withdrawn, crossed, and locked quotes. I also follow Chordia et al. (2000) and remove trades out of sequence, trades recorded before or after the close, and trades with special settlement conditions. I also follow Fang et al. (2009) and eliminate observations when any of the following criteria are met: quoted bid-ask spread is

[10] I choose independent variables for the Table 1 regression based on the S&P 500 index eligibility criteria (http://us.spindices.com/indices/equity/sp-500). S&P states that its index-inclusion and -deletion decisions do not reflect any private belief about the firm.

[11] The SEC describes the 8-K filing as a "current report" that contains material information that managers believe its shareholders "should know about" (http://www.sec.gov/answers/form8k.htm). As a robustness check to First Call, I use I/B/E/S guidance from 2002–2012 and parse 8-K filings using Perl to identify guidance.

[12] I manually identify index funds based on the fund's name (e.g., State Street SPDR S&P 500 ETF). I recognize that sometimes funds may buy options, but I expect this effect to be immaterial given the small size of the options market. I cross-check index fund holdings data from Thomson with two sources: Morningstar and aggregate S&P 500 index fund data from the Investment Company Institute (ICI).

[13] Note that firm value and size have no impact on the index fund ownership level at the time of inclusion: if the value of an index firm is large, its weight in the index will also be large. The ten index funds that most frequently take a stake in the treatment firms during the two years after their S&P 500 inclusion from 1996-2010 are Barclays, BlackRock Advisors, Fidelity, Merrill Lynch, Morgan Stanley, Smith Barney, State Street Fund Managers, T. Rowe Price, UBS, and Vanguard.

Table 2
Panel A: S&P 500 Index Inclusion and Control Group Comparison.

	S&P 500 Inclusion Group			Matched Control Group			T-test
	n	Mean	S.D.	n	Mean	S.D.	
Disclosure Measures (in levels)							
[– 2 years, 0) Mgmt. Guidance Issuance	368	2.25	3.97	368	2.11	4.17	
[– 2 years, 0) All 8-K Issuances	368	12.01	13.70	368	11.52	12.1	
[– 2 years, 0) Supp. Financial Stmts.	368	6.46	12.22	368	5.93	10.65	
[– 2 years, 0) Press Release	368	5.05	8.45	368	5.60	11.28	
Firm Characteristics							
Total Inst. Holdings Before Inclusion	368	0.45	0.18	368	0.43	0.25	
Log of Assets	368	8.66	1.19	368	8.54	1.64	
Log of Market Capitalization	368	8.95	0.75	368	8.74	0.82	
ROA	368	0.07	0.08	368	0.06	0.08	
Future Δ ROA	368	0.01	0.14	368	0.00	0.17	
Capital Expenditures	368	0.05	0.06	368	0.04	0.05	
Research and Development	368	0.02	0.04	368	0.02	0.04	
Intangibles	368	0.17	0.21	368	0.16	0.22	
Debt	368	0.22	0.19	368	0.21	0.19	
Business Segments	368	13.03	8.41	368	13.69	10.90	
Bid-Ask Spread	368	0.384	0.450	368	0.413	0.514	
Log of Firm Age	368	3.17	0.87	368	3.02	0.89	*
Dividends	368	0.52	0.50	368	0.49	0.50	
Market to Book	368	2.08	2.74	368	1.95	2.47	*
Analyst Following	368	9.83	6.89	368	6.98	8.15	***

**p < 0.05. Other than the disclosure measures, Total Institutional Holdings Before Inclusion, and Bid-Ask Spread, variables which are expected to change upon index inclusion, descriptive statistics are averaged over [−2 years, +2 years] relative to inclusion year. See Section 3.1 for sample selection criteria. Variable definitions are in Appendix D.

* p < 0.1.

*** p < 0.01, .

greater than $5, effective spread/quoted bid-ask spread is greater than 4.0, and quoted bid-ask spread/transaction price is greater than 0.4. These conditions pertain mainly to thinly-traded stocks (not to the firms in my sample) and help to ensure data integrity. Using all offers, I measure the daily average bid-ask spread as follows:

$$SPREAD_{id} = \frac{100}{n_{id}} \sum_{k=1}^{n} \frac{(Ask_{idk} - Bid_{idk})}{M_{idk}}, \tag{1}$$

where n is the total number of offers for firm i on day d, and for a given offer k on day d, Ask_{idk} is the ask price of firm i's stock, Bid_{idk} is the bid price of firm i's stock, and M_{idk} is the mean of Ask_{idk} and Bid_{idk}. I multiply this variable by 100 and compute separate spread values for the inclusion firm's pre-inclusion period of [−2 years, 0) and post-inclusion period of [0, +2 years] by taking the average $SPREAD_{id}$ value over all trading days within each respective period (time 0 is the firm's index-inclusion date). I also compute this measure for the control firm. I create the bid-ask spread D-in-D variable in two steps: (1) I subtract the inclusion firm's pre-inclusion average spread from its post-inclusion average spread, and (2) I subtract from (1) the control firm's post-inclusion average spread minus its pre-inclusion average spread (see Eq. (4)). This approach is similar to Bushee et al. (2010).

I measure Amihud (2002) liquidity as follows:

$$AMIHUD_{id} = 10^{8} * \frac{|RET_{id}|}{DVOLUME_{id}}, \tag{2}$$

where RET_{id} and $DVOLUME_{id}$ are daily returns and daily dollar trading volume, respectively, for firm i on day d. I compute separate Amihud illiquidity values for the inclusion firm's pre-inclusion period of [−2 years, 0) and post-inclusion period of [0, +2 years], where time 0 is the firm's index-inclusion date, by taking the average $AMIHUD_{id}$ value over all trading days within each respective observation period. I also compute this measure for the control firm. I follow the same two-step procedure used for spreads to create the Amihud illiquidity D-in-D variable. Note that a decrease in this measure signifies higher liquidity.

My proxy for a firm's information environment is analyst earnings forecast errors, computed using the I/B/E/S detail file. I create a daily mean analyst earnings forecast consensus file using quarterly EPS forecasts and take the mean consensus forecast two trading days before the earnings announcement date for the quarter being measured. I follow prior studies such as Lys and Sohn (1990) and Hope (2003) and compute quarterly percentage analyst earnings forecast errors as follows, scaling by firm i's stock price at the end of the quarter q:

$$AFE_{iq} = \frac{|Actual\ EPS_{iq} - Consensus\ Mean\ Analyst\ EPS\ Forecast_{iq}|}{Stock\ Price_{iq}}. \quad (3)$$

I compute separate analyst forecast error values for the inclusion firm's pre-inclusion period of [−2 years, 0) and post-inclusion period of [0, +2 years], where time 0 is the firm's index-inclusion date, by taking the average AFE_{iq} value for all quarters within the respective observation period. I also compute this measure for the control firm. I follow the same two-step procedure used for spreads and Amihud illiquidity to create the analyst forecast error D-in-D variable.

3.5. Control variables

In the D-in-D analysis I consider time-varying covariates that may affect disclosure and liquidity. I describe these covariates in detail in Appendix C.

4. Empirical results

4.1. Regressions

My regressions use all variables in their D-in-D form. For example, I compute and denote the D-in-D transformation for each disclosure proxy as follows:

$$\Delta Disclosure = (Disclosure_{F,T=1} - Disclosure_{F,T=0}) - (Disclosure_{C,T=1} - Disclosure_{C,T=0}). \quad (4)$$

Disclosure stands for the disclosure proxies, index *F* stands for the treatment firms, and index *C* stands for the control firms. Index *T* is the time period, where $T = 0$ is the two-year pre-inclusion period and $T = 1$ is the two-year post-inclusion period (relative to firm *F*'s index-inclusion date). I repeat this procedure for all variables. The main disclosure regression with variables in their D-in-D form is as follows (I provide the liquidity regression in Section 4.5.1):

$$\Delta Disclosure = \alpha_0 + \alpha_1 \Delta Index\% + \alpha_2 \Delta Other\% + \sum \alpha_i \Delta Control + \varepsilon. \quad (5)$$

Disclosure stands for the disclosure proxies, *Index%* stands for index fund ownership as a percentage of shares outstanding, *Other%* stands for non-index institutional ownership as a percentage of shares outstanding, and *Control* stands for the control variables defined in Appendix C. The assumptions are that firm-specific effects for the treatment firm and its control firm are fixed across time and that time-varying effects change in the same manner across time for the treatment firm and its control firm (this term can vary across the treatment-control pairs). These effects are differenced out and are not displayed.

Eq. (5) controls for an extensive set of endogeneity issues. For example, consider the concern that S&P selects high-disclosing firms for the index. It is reasonable to assume that this attribute is a firm-fixed effect that would be eliminated in the differencing procedure. Additionally, consider the concern that managers use disclosure to get their firm included in the index. To the extent that both the inclusion and control firms take similar actions to try to get in the index, the differencing procedure will control for this effect as well. However, index inclusions are typically finalized within just five days of an index deletion and are highly unpredictable, which makes it unlikely that managers can gain a spot in the index by altering their disclosure practices (e.g., Chen et al., 2004). It is also unlikely that managers can influence the timing of inclusions, since over 75% of inclusions are due to the acquisition of an existing index firm. Nonetheless, any systematic "inclusion effects" will form the intercept terms in my D-in-D regressions.

Another concern is that firms, upon being included in the index, desire greater index fund ownership and use disclosure to obtain it. But recall that the only way for managers to increase index fund ownership in their firm is to increase index fund AUM; managers' disclosure efforts must therefore attract new index-fund inflows. These new inflows would show up as a change in index fund ownership from the beginning to the end of the inclusion period for the treatment firms. I address this concern in two ways: (1) as my main regressor, I use the index fund ownership stake in the first quarter after index inclusion rather than the average index fund ownership stake over the entire post period, and (2) I check for, and do not find, a statistically significant on average change in index fund ownership from the beginning to the end of the post period for the inclusion firms (10% level). These findings suggest that my results are not attributable to management influence over index fund AUM.

Another concern is that index inclusion could lead non-index institutional investors to invest in, and influence the disclosure decisions of, the newly-included firm. Although I control for the change in non-index institutions, a correlated omitted variable bias could exist if this change is correlated with the error term and the change in index fund holdings in my regressions.[14] However, such a bias in the non-index fund estimate would not pose a problem to the index fund estimate if the non-index and index fund variables are uncorrelated, because the non-index ownership bias would not be transmitted

[14] This statement holds only if the change in non-index fund investors affects just the treatment firm. Any common change to non-index investors that affects both the treatment and control firms will not induce a bias, as this change will be eliminated in the D-in-D procedure. Unlike the change in index fund ownership, the change in non-index fund ownership is difficult to model explicitly. Accordingly, in the results section I do not attempt to interpret the coefficient on the non-index fund variable.

to the uncorrelated index fund ownership variable (assuming no measurement error). I therefore check for, but do not find, a statistically significant correlation between the index fund and non-index fund variables. This finding suggests that my results cannot be attributed to changes in the holdings of non-index institutional investors.

Furthermore, if index fund flows reflect general beliefs about macroeconomic conditions, there would have to be a strong reason these beliefs pertain only to index firms and are associated with the timing of index-inclusion events. Arbitrage considerations dictate that if such beliefs drive the dependent variables in my empirical tests, they would also impact the matched control firms and be eliminated in the differencing procedure. In any case, I acknowledge that one weakness in my research design is that it does not eliminate any unobserved on average change to disclosure unique to inclusion firms that is correlated with index fund ownership and is not captured by the control-firm-time-varying effect or by any of the time-varying control variables. However, if such an on average change is systematic across all index-inclusion firms or uncorrelated with index fund ownership, then this change will form the intercept or error terms in my regressions, respectively. The possibility of having such a correlated latent factor is a limitation of all D-in-D research designs.

4.2. Univariate results

Table 2, Panel B shows that the inclusion firms come from a variety of industries, which suggests that no specific sector is driving the results. Table 2, Panel C tabulates descriptive univariate changes in the treatment firms compared to changes in the control firms. Treatment firms experience an average increase of 6.54% in index fund shareholdings (significant at the 1% level) compared to the control firm change of 0.00%. The entire increase in index fund ownership occurs in the quarter immediately after index inclusion and remains stable during the two-year-post-inclusion observation period.[15]

I next assess whether the 6.54% mean increase in index fund ownership has a meaningful economic interpretation and is large enough to give index funds control. Appel et al. (2016) show that "quasi-indexer" ownership changes of just 0.5% to 3% can affect governance outcomes, and Crane et al. (2016) show that such changes in ownership can also affect payout policy. Cheng et al. (2004) find that managers value the control conferred by state anti-takeover legislation at about 1% of the value of their firms. In addition, the institutional features of my setting documented in Section 2, including comments from employees of Vanguard and BlackRock, help to further validate the index fund ownership measure. These findings support the economic significance of the index fund ownership measure.

By contrast, the net change in the ownership of non-index shareholders for inclusion firms is weaker in magnitude, suggesting, at least from a net perspective, that these shareholders' demand for disclosure is unlikely to have changed. This result also indicates that index funds likely buy out mostly atomistic traders, and it is consistent with the finding from Appel et al. (2016) that inclusion in the Russell 2000 is unrelated to strategic-investor ownership. Furthermore, non-index fund ownership is statistically uncorrelated to its corresponding increase in index fund ownership (10% level; see correlations in Table 2, Panel D).

Table 2, Panel C also provides univariate mean D-in-D changes in the disclosure measures. Upon inclusion in the S&P 500 index, treatment firms increase guidance disclosures by 14.82% and issue 26.68% more 8-Ks, 21.51% more supplementary financial statements, and 18.30% more press releases, relative to control firms (all significant at the 1% level). In levels, I find that treatment firms increase guidance disclosures by 1.99 and issue 4.68 more 8-Ks, 2.22 more supplementary financial statements, and 2.24 more press releases, relative to control firms (1% level). To contextualize these findings, Compustat firms with total assets greater than $10 M file on average 17.02 8-Ks, 10.60 supplementary financial statements, and 3.71 press releases per two-year period over my sample period of 1994-2012. The disclosure magnitudes I find thus appear economically meaningful. Lastly, treatment firms experience an on average reduction in percentage bid-ask spreads, Amihud (2002) illiquidity, and percentage analyst earnings forecast errors of 0.056, 0.014, and 0.0058, respectively, after S&P 500 index inclusion (relative to control firms).

Table 2, Panel C provides univariate statistics on the control variables as well (in the D-in-D form). Almost all of the control variables have means near zero, which indicates that neither the treatment nor the control firms changed much relative to each other during the pre and post time periods, except in index fund ownership. The only variables with a noticeable difference are analyst following and market to book, which increase by about 3 and 0.14 for the treatment firms, respectively (in Section 4.3, I control for these changes). These findings are consistent with prior studies relating institutional investors to analyst following (e.g., Table 3 of Bhushan, 1989; Tables 6 and 7 of O'Brien and Bhushan, 1990) and market to book to index inclusion (e.g., Morck and Yang, 2001). Contemporaneous changes in other firm characteristics, such as total assets, remain close to zero. I next turn to multivariate analyses.

4.3. Test of H1: Index fund ownership and disclosure

H1 predicts that the index fund ownership stake upon index inclusion is positively associated with disclosure. Table 3, Panel A indicates that for an approximately one standard deviation increase in index fund shareholdings, management guidance disclosures increase by 19.35% (significant at the 5% level), 8-K filings increase by 18.99% (10% level), supplementary financial statements increase by 9.49% (1% level), and press release filings increase by 7.51% (1% level).[16] These

[15] I consider index fund ownership to be the primary motive for control as opposed to a firm's index weighting because index funds must consistently rebalance all stocks in their portfolios (when AUM changes). The 6.54% change is similar in magnitude to findings of recent studies examining the change in institutional holdings around S&P 500 inclusion. For example, Wurgler (2011) estimates that in 2009, S&P 500 index funds held approximately 8.7% of each index firm's outstanding stock (I find an average of 8.1% for 2009).

[16] These results are robust to the monotonic transformation of $sign(\%change) * \ln(1 + |\%change|)$. This transformation attenuates the magnitude of large

Table 2
Panel B: Industry and Year Profile for S&P 500 Index-Inclusion Firms from 1996–2010.

Inclusion Year Industry Breakdown			**Year of Index Inclusion**			
Industry	Freq.	Percent	Year	Freq.	Year	Freq.
Consumer Non Durables	20	5.43%	1994	–	2007	29
Consumer Durables	6	1.63%	1995	–	2008	31
Manufacturing	14	3.80%	1996	17	2009	26
Energy	25	6.79%	1997	24	2010	12
Chemicals and Allied Products	4	1.09%	1998	27	2011	–
Business Equipment	83	22.55%	1999	33	2012	–
Communications	19	5.16%	2000	50	**Total**	368
Utilities	17	4.62%	2001	28		
Retail	31	8.42%	2002	22		
Healthcare	27	7.34%	2003	9		
Finance	82	22.28%	2004	17		
Other	40	10.87%	2005	16		
Total	368	100.00%	2006	27		

results are comparable in magnitude to those of recent studies. For example, Shroff et al. (2013) show that firms issuing new equity increase their guidance by 36% and their press releases by 17% during the pre-seasoned-equity-offering period following the 2005 Securities Offering Reform. Table 3, Panel B shows that all of my results hold for disclosure levels. For a one standard deviation increase in index fund shareholdings, management guidance disclosures increase by 1.90 (5% level), 8-K filings increase by 6.57 (5% level), supplementary financial statements increase by 4.98 (5% level), and press release filings increase by 2.23 (5% level). I find no evidence of an on average change in disclosure due to S&P 500 index inclusion (intercept terms are statistically insignificant at the 10% level). These results are consistent with H1.

Recall from Section 4.1 that one concern with interpreting the disclosure coefficient on index fund ownership is that non-index fund ownership could be correlated with an unobserved determinant of disclosure, resulting in a biased index fund coefficient. However, the index fund coefficient is an unbiased estimator even if non-index fund variable is correlated with the error term, as long as the index fund and non-index fund variables are measured without error and uncorrelated. The intuition is that the variance-covariance matrix is diagonal, so biases in one estimate are not transmitted to the other estimate. I find that the correlations between the index fund and non-index fund variables are statistically insignificant at the 10% level, and I therefore interpret the index fund coefficient without any corrections (see Table 2, Panel D). Accordingly, I do not interpret the coefficient of the non-index fund ownership.

I use prior studies to estimate the capital markets consequences of the additional disclosures associated with index fund ownership. The literature has established that management guidance disclosures contribute to the price formation process (see reviews by Beyer et al., 2010; Healy and Palepu, 2001; Leuz and Wysocki, 2016). Specifically, Beyer et al. (2010, Table 1) report that, on average, guidance disclosures explain 16% of a firm's stock return variance. As for 8-Ks, Lerman and Livnat (2009, Table 3) show that 8-K filings categorized as Financial Statements and Exhibits, which account for about 75% of 8-K filings from 1994-2007 and encompass my measure of supplementary financial statement filings, have absolute excess returns of 0.17% and abnormal trading volume relative to non-disclosure periods. I use this 0.17% on average effect to compute that the average absolute excess return for the additional 6.17 supplementary financial statement 8-Ks associated with index fund ownership is approximately 1.05%. My disclosure results are therefore not just statistically significant, but also economically meaningful.[17]

The sensitivity of disclosure to index fund ownership also suggests that even my broadest measure of disclosure, the overall number of 8-K filings, likely contains a significant voluntary component, because mandatory 8-K filings are warranted only if the company undergoes substantial operational changes.[18] Although I do not expect index fund ownership to be associated with such operational changes, I explicitly check for this relation by (1) directly measuring how many of the total 8-K filings result from voluntary disclosures, and (2) checking compulsory index fund sponsor 13D and 13G filings.[19] For (1), 96% of the 8-K filings in my setting relate to voluntary supplementary financial statements and press releases. For (2), in untabulated tests I find that for compulsory Schedule 13 filings, index fund sponsors commit to a passive investing approach as evidenced by their 13G filings. These

(*footnote continued*)
changes while preserving the sign of the change (Cheng et al., 2004, Table 9).

[17] Carter and Soo (1999) also look at market returns for 8-K filings and find that the information contained within 8-Ks is informative for timely 8-K filings. They find evidence that voluntary disclosure filings, which include supplementary financial statements, are the timeliest filings.

[18] Triggers for mandatory 8-K disclosures can be found on the SEC's website (http://www.sec.gov/answers/form8k.htm). These triggers include, for example, change in auditor and change in shell company status.

[19] Mutual fund sponsors must file a Schedule 13 form with the SEC when their aggregate ownership (across all their funds) in a firm reaches 5% or more. The filing of a 13G would suggest that these funds intend to be passive investors, whereas the filing of a 13D would suggest that these funds intend to be actively involved in management. Companies and shareholders can sue mutual fund sponsors if they file a 13G and try to be active investors.

Table 2
Panel C: Descriptive Statistics for 368 S&P 500 Index-Inclusion Firms and 368 Propensity-Matched Control Firm Difference-in-Differences Measures from 1996–2010.

D-in-D Variable		n	Mean	S.D.	25th %	Median	75th %
Ownership Measures							
[1]	Index Fund Holdings (as a %)	368	6.54***	1.61	4.95	5.28	8.14
[2]	Non-Index Fund Holdings (as a %)	368	0.78***	0.53	0.34	0.85	1.40
Disclosure Measures (as percentage change)							
[3]	% Management Guidance	368	14.82***	9.59	4.11	11.96	27.38
[4]	% All 8-K Filings	368	26.68***	21.00	11.57	29.68	53.50
[5]	% Supplementary Financial Statements	368	21.51***	25.32	0.00	25.25	61.22
[6]	% Press Releases	368	18.30***	10.79	6.76	18.20	34.59
[7]	Disclosure Factor	368	−0.01	0.54	−0.39	0.12	0.46
Disclosure Measures (as level change)							
[8]	Management Guidance	368	1.99***	2.18	0.00	1.00	3.00
[9]	All 8-K Filings	368	4.68**	6.92	−4.00	2.00	9.00
[10]	Supplementary Financial Statements	368	2.22***	5.43	−3.00	0.00	6.00
[11]	Press Releases	368	2.24***	3.01	−1.00	0.00	4.00
Information Asymmetry Measures							
[12]	Bid-Ask Spread	368					−0.056***
	0.126		−0.148			−0.080	0.002
[13]	Amihud Illiquidity	368					−0.014***
	0.048		−0.035		−0.014		−0.004
[14]	Analyst Forecast Errors	368					−0.006***
	0.007		−0.013			−0.005	0.003
Governance Measure							
[15]	Entrenchment Index$_F$	368	1.11***	0.96	0.00	1.00	2.00
Control Variables							
[16]	Total Assets	368	0.11	0.62	−0.10	0.16	0.43
[17]	ROA	368	0.01	0.16	−0.05	0.00	0.02
[18]	Capital Expenditures	368	0.01	0.04	−0.02	0.00	0.01
[19]	Research and Development	368	0.00	0.04	0.00	0.00	0.00
[20]	Intangibles	368	0.02	0.16	−0.05	0.00	0.06
[21]	Debt	368	0.01	0.15	−0.06	0.00	0.09
[22]	Business Segments	368	−0.73	4.25	−2.00	0.00	2.50
[23]	Dividends	368	0.03	0.39	0.00	0.00	0.00
[24]	Market to Book	368	0.14**	0.69	−0.46	0.03	0.55
[25]	Analyst Following	368	2.86***	5.80	−1.25	1.75	6.00
[26]	M&A	368	0.11	0.89	0.00	0.00	1.00
[27]	CEO Change	368	0.01	0.60	0.00	0.00	0.00
Blockholder Filing Measures							
[28]	13G Filings	368	0.23***	0.12	0.00	0.00	0.00
[29]	13D Filings	368	0.00	0.04	0.00	0.00	0.00

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. D-in-D refers to the procedure shown in Eq. (4). Percents are computed by taking the number of disclosures in [0, +2 years] post-period divided by the number of disclosures in [− 2 years, 0) pre-period minus one. If there were disclosures made in [0, +2 years] and no disclosures made in [− 2 years, 0), the variable is set to 1; if there were no disclosures in either period, the variable is set to 0. Variable definitions are in Appendix D.

results reduce the likelihood that my disclosure measures capture mandatory 8-K filings or operational changes resulting from index fund intervention.

I also measure an improvement in the firm's information environment through a reduction in analyst forecast errors. I replicate the D-in-D regression using analyst forecast error instead of disclosure as the dependent variable. In Table 3, I find that for a one standard deviation increase in index fund ownership, percentage analyst forecast error decreases by.0045 (5% level), controlling for any change in analyst following.[20] The similarity between the analyst earnings forecast error result and the disclosure result is consistent with several prior studies. Waymire (1986) finds that analyst earnings forecast accuracy increases after managers provide voluntary disclosures to the capital markets, and Baginski and Hassell (1990) and Jennings (1987) observe that management disclosures trigger analyst earnings forecast revisions. Hope (2003) also shows that more transparent firms have lower analyst forecast errors. This phenomenon appears to occur in my setting as well.

[20] I find similar results for percentage analyst forecast errors based on median consensus values.

Table 2
Panel D: Selected Pearson Correlations for Difference-in-Differences Measures from 1996–2010.

Var. #	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]	[14]
[1]														
[2]	0.07													
[3]	**0.15**	0.03												
[4]	**0.11**	0.05	**0.20**											
[5]	**0.15**	0.03	**0.25**	**0.19**										
[6]	**0.14**	0.00	**0.23**	**0.26**	**0.11**									
[7]	**0.21**	0.04	**0.39**	**0.91**	**0.91**	**0.70**								
[8]	**0.11**	0.02	**0.24**	**0.25**	**0.15**	**0.18**	**0.19**							
[9]	**0.10**	0.01	**0.32**	**0.21**	**0.41**	**0.16**	**0.42**	**0.12**						
[10]	**0.09**	0.05	**0.10**	−0.06	−0.09	−0.02	**0.46**	−0.01	−0.02					
[11]	**0.12**	0.06	0.01	0.02	0.00	0.05	**0.35**	0.01	0.05	−0.06				
[12]	**−0.14**	−0.01	**−0.16**	**−0.12**	0.03	**−0.11**	**−0.14**	**−0.15**	**−0.10**	0.06	−0.04			
[13]	**−0.15**	−0.03	**−0.11**	**−0.11**	−0.06	**−0.17**	**−0.15**	**−0.19**	**−0.13**	0.01	−0.06	**0.32**		
[14]	**−0.12**	**−0.11**	0.05	**−0.13**	0.04	0.05	**−0.10**	−0.06	−0.06	−0.05	0.02	**0.10**	0.07	

Bolded correlations indicate statistical significance at the 5% level.

The results are also consistent with evidence in Tables 3 and 4 of Bushee and Noe (2000) and Tables 3 and 6 of Boone and White (2015), all of which document a positive association between "quasi-indexer" institutional investors and disclosure. Bushee and Noe (2000) view this association as a strategic preference for these funds to join firms whose management provides more disclosure; Boone and White (2015) argue that "quasi-indexer" investors prefer more disclosure in order to reduce trading costs. The "quasi-indexer" measure, however, includes not just index funds, but also many non-index funds that strategically select stocks (Bushee and Noe, 2000). Since index funds do not have such strategic motives, the added value of my analysis is that it provides a causal explanation for the observed association between institutional ownership (specifically index funds) and disclosure.

As noted in Section 2, an index fund will not want the firm to overdisclose and lose its competitive advantage (Verrecchia, 1983). In untabulated analyses, I check for signs of overdisclosure by examining the association between disclosure and firm value after index inclusion. I fail to find a statistically significant association between disclosure and firm value in either direction (this insignificant association could occur because of low power). To the extent that disclosure increases stock liquidity without offsetting increases in proprietary costs, I expect that firm value will increase, as Fang et al. (2009) and Balakrishnan et al. (2014) find a positive relation between stock liquidity and firm value. Thus, index funds' preference for more disclosure is not inconsistent with value creation.

Finally, unlike the index fund ownership measure, no control variables consistently explain the variation in disclosure across the different specifications.[21] This non-result speaks to the accuracy of the control firm selection method. As the descriptive statistics for the control variables in Table 2, Panel C indicate, treatment firms change very little after S&P 500 inclusion relative to control firms, other than the exogenous change in index fund ownership. In addition, the inclusion effect (i.e., the intercept term) is insignificant. This result suggests that it is not inclusion itself but the level of index fund ownership upon inclusion that drives disclosure changes at the firm.

4.4. Test of H2: management entrenchment

H2 predicts that the results for H1 are stronger for firms whose managers are less entrenched. Managers who are more entrenched are less likely to respond favorably to the preferences of index funds, which would decrease the funds' ability to elicit disclosure. Following Bebchuk et al. (2009), I measure entrenchment for the inclusion firm using the entrenchment index (E-index). The E-index increases by one for each of the following corporate governance features: a staggered board, limits to shareholder bylaw amendments, poison pill/shareholder rights plan, golden parachute, and a supermajority requirement for mergers and for charter amendments. Since this measure is constructed on an annual basis, I use the E-index closest to the index-inclusion date, manually recreating the measure using RiskMetrics when data are missing. The purpose of this test is to help validate that the index fund preference for more disclosure is driving the main results in Table 3. This analysis also helps translate the mechanisms discussed in Section 2 into testable empirical conjectures, because these mechanisms depend in part on the willingness of companies to cater to outside shareholders.[22]

[21] One exception to this is the M&A indicator variable. Firms typically file an 8-K to announce an M&A.

[22] A criticism of this measure is that it labels certain governance provisions as unconditionally good or bad for firm performance (Armstrong et al., 2010; Brickley and Zimmerman, 2010). However, the E-index appears appropriate in my setting because I am specifically interested in finding a proxy for management's likelihood of responding to external shareholders, and not for summary measures like firm performance. The difference in the E-index from pre to post inclusion is not statistically significant at the 10% level for my sample of index-inclusion firms, which validates this test as an appropriate comparative static.

Table 3
Panel A: The Effect of Index Fund Ownership on Disclosure for S&P 500 Index-Inclusion Firms Relative to Propensity-Matched Control Firms from 1996-2010.

D-in-D Variable	D-in-D Percentage Change Disclosure Measures			
	Mgmt. Guidance **(1)**	8-K Filings **(2)**	Supp. Fin. Stmts. **(3)**	Press Releases **(4)**
Index Fund Holdings	**12.020****	**11.795***	**5.897*****	**4.677*****
	(2.25)	**(1.73)**	**(2.76)**	**(2.98)**
Non-Index Fund Holdings	1.153	2.045	4.889	2.213
	(0.95)	(1.01)	(1.04)	(0.83)
Total Assets	0.002	−0.001	0.002	0.003
	(0.10)	−(0.40)	(0.75)	(1.16)
ROA	220.082	470.069	661.081	189.023
	(0.45)	(0.98)	(1.24)	(0.99)
Capital Expenditures	−985.135	−1209.511	−1187.966	−249.552
	−(1.03)	−(1.04)	−(1.28)	−(0.89)
Research and Development	845.315	1457.402	1389.041	957.015
	(0.82)	(0.92)	(1.10)	(1.01)
Intangibles	305.114	248.133	406.102	357.312
	(0.84)	(0.61)	(1.25)	(0.89)
Debt	416.649	346.100	176.599	113.563
	(1.01)	(0.95)	(0.61)	(0.85)
Business Segments	4.961	3.766	2.323	5.122
	(0.50)	(0.66)	(0.51)	(0.25)
Dividends	3.318	6.315	−3.194	1.253
	(0.25)	(0.42)	−(0.32)	(0.52)
Market to Book	0.584	0.244	0.648	0.326
	(0.54)	(0.28)	(0.93)	(0.38)
Analyst Following	3.143	4.551	3.346	1.086
	(1.03)	(0.55)	(0.50)	(0.25)
M&A Indicator	0.994	4.950*	1.975*	10.204***
	(0.14)	(1.71)	(1.71)	(3.98)
New CEO Indicator	2.341	−8.747	−4.012	6.418
	(0.98)	−(1.44)	−(0.81)	(1.35)
Intercept	0.044	−2.025	−2.147	0.335
	(0.58)	−(0.18)	−(0.74)	(0.53)
Observations	368	368	368	368
Adjusted R-squared	0.073	0.087	0.118	0.091

D-in-D refers to the procedure shown in Eq. (4). T-statistics are in parentheses. Standard errors are clustered by inclusion year. Variable definitions are in Appendix D.
* $p < 0.1$.
** $p < 0.05$.
*** $p < 0.01$.

H2 holds in Table 4, Panel A, where I recompute my models from Table 3 with an interaction term for the change in index fund ownership with a firm's E-index. The interaction term coefficients are negative and statistically significant across all of the percentage change in disclosure tests, except for press releases: −1.232%, −1.944%, and −1.378% for management guidance, 8-K filings, and supplementary financial statements, respectively. Similar results obtain for disclosure level changes in Table 4, Panel B. These results suggest that index funds are less successful at eliciting disclosure from firms with more entrenched managers.

4.5. Test of H3: Disclosure's effect on stock liquidity

4.5.1. Recursive structural equation model

H3 predicts that: (1) the disclosures elicited by index funds increase liquidity (the indirect effect), and (2) index fund

Table 3
Panel B: The Effect of Index Fund Ownership on Disclosure for S&P 500 Index-Inclusion Firms Relative to Propensity-Matched Control Firms from 1996–2010.

D-in-D Variable	D-in-D Level Change Disclosure Measures				
	Mgmt. Guidance **(5)**	8-K Filings **(6)**	Supp. Fin. Stmts. **(7)**	Press Releases **(8)**	Analyst Forecast Errors **(9)**
Index Fund Holdings	**1.182****	**4.083****	**3.091****	**1.385****	**−0.003****
	(2.54)	**(2.50)**	**(2.45)**	**(2.16)**	**−(2.29)**
Non-Index Fund Holdings	0.914	0.091	0.064	0.131	0.008
	(0.12)	(1.33)	(1.03)	(0.35)	(0.65)
Total Assets	0.006	0.000	−0.000	−0.001	−0.003
	(1.43)	(0.34)	−(0.40)	−(0.23)	−(0.11)
ROA	95.099	3.895	10.932	1.443	0.212
	(0.88)	(0.36)	(1.11)	(0.94)	(0.58)
Capital Expenditures	−122.837	−26.478	−28.476	−11.393	−2.328
	−(0.66)	−(1.00)	−(1.18)	−(0.53)	−(0.45)
Research and Development	103.717	2.538	60.701*	50.136	12.981
	(0.55)	(0.07)	(1.85)	(1.06)	(0.78)
Intangibles	355.012	12.895	13.846	10.331	14.011
	(1.21)	(1.39)	(1.65)	(1.43)	(1.00)
Debt	106.12	0.754	5.814	19.231	7.455
	(1.00)	(0.09)	(0.77)	(0.05)	(0.27)
Business Segments	3.566	0.169	0.051	0.341	0.124
	(0.71)	(1.31)	(0.44)	(0.25)	(0.75)
Dividends	1.001	0.057	−1.686	−0.356	−0.704
	(0.95)	(0.02)	−(0.53)	−(0.14)	−(0.67)
Market to Book	0.209	−0.000	0.006	0.105	0.612
	(0.41)	−(0.00)	(0.36)	(0.20)	(1.32)
Analyst Following	3.553	0.047	−0.054	0.318	0.099
	(0.48)	(0.25)	−(0.32)	(0.41)	(0.73)
M&A Indicator	1.114*	2.123**	2.227	1.09***	0.57
	(1.81)	(2.05)	(1.37)	(2.82)	(1.33)
New CEO Indicator	0.935	−0.099	0.590	0.615	0.011
	(1.01)	−(0.06)	(0.42)	(1.16)	(0.87)
Intercept	0.263	−0.438	−0.134	0.039	−0.002***
	(0.60)	−(0.66)	−(0.26)	(0.65)	−(2.69)
Observations	368	368	368	368	368
Adjusted R-squared	0.104	0.040	0.042	0.038	0.088

D-in-D refers to the procedure shown in Eq. (4). T-statistics are in parentheses. Standard errors are clustered by inclusion year. Variable definitions are in Appendix D.
* $p < 0.1$.
** $p < 0.05$.
*** $p < 0.01$.

ownership itself increases liquidity (the direct effect). To separate and measure these two effects, I construct a recursive structural equation model of disclosure, index fund ownership, and stock liquidity (Bhattacharya et al., 2012; Core et al., 2015; Greene, 2002, p. 397; Mayew et al., 2015). The recursive model is a specific form of path analysis that, in my setting, assumes that liquidity is driven by index fund ownership and disclosure, and not vice versa (see the exclusion restriction below). Accordingly, I estimate the main liquidity regression using all variables in their D-in-D form (see Eq. (4)):

$$\Delta Liquidity = \beta_0 + \beta_1 \Delta Index\% + \beta_2 \Delta Disclosure + \beta_3 \Delta Other\% + \sum \beta_i \Delta Control + \nu. \quad (6)$$

Liquidity stands for the stock liquidity proxies, *Index%* stands for index fund ownership as a percentage of shares outstanding, *Other%* stands for non-index institutional ownership as a percentage of shares outstanding, and *Control* stands for the control variables defined in Appendix C (as in Eq. (5)). *Disclosure* represents a summary D-in-D disclosure factor variable (see Section 4.5.2). Firm-specific effects and time-varying effects are differenced out and are not displayed. The exclusion

Table 4
Panel A: The Effect of Index Fund Ownership on Disclosure for S&P 500 Index-Inclusion Firms Relative to Propensity-Matched Control Firms from 1996–2010: The Case of Entrenched Managers.

D-in-D Variable	D-in-D Percentage Change Disclosure Measures			
	Mgmt. Guidance **(1)**	8-K Filings **(2)**	Supp. Fin. Stmts. **(3)**	Press Releases **(4)**
Index Fund Holdings	10.817**	11.165***	4.991***	3.744**
	(2.03)	(3.29)	(3.53)	(2.21)
Index Fund Holdings* E-index	**−0.183****	**−0.239****	**−0.215****	**−0.335**
	−(2.31)	**−(2.43)**	**−(2.08)**	**−(1.40)**
E-index	−0.010	−0.573	−0.580	−0.652
	−(0.09)	−(0.85)	−(0.57)	−(0.20)
Controls from Table 3	Y	Y	Y	Y
Observations	368	368	368	368
Adjusted R-Squared	0.140	0.110	0.132	0.122

D-in-D refers to the procedure shown in Eq. (4). T-statistics are in parentheses. Standard errors are clustered by inclusion year. Variable definitions are in Appendix D. *p < 0.1. **p < 0.05. ***p < 0.01.

Table 4
Panel B: The Effect of Index Fund Ownership on Disclosure for S&P 500 Index-Inclusion Firms Relative to Propensity-Matched Control Firms from 1996–2010: The Case of Entrenched Managers.

D-in-D Variable	D-in-D Level Change Disclosure Measures			
	Mgmt. Guidance **(5)**	8-K Filings **(6)**	Supp. Fin. Stmts. **(7)**	Press Releases **(8)**
Index Fund Holdings	1.203**	3.993**	3.204**	1.453**
	(2.40)	(2.55)	(2.38)	(2.27)
Index Fund Holdings* E-index	**−0.738*****	**−0.504***	**−0.506***	**−0.499**
	−(2.91)	**−(1.95)**	**−(1.91)**	**−(1.18)**
E-index	−0.105	0.116	0.110	0.214
	−(0.23)	(0.17)	(0.18)	(0.59)
Controls from Table 3	Y	Y	Y	Y
Observations	368	368	368	368
Adjusted R-Squared	0.110	0.048	0.054	0.064

D-in-D refers to the procedure shown in Eq. (4). T-statistics are in parentheses. Standard errors are clustered by inclusion year. Variable definitions are in Appendix D. *p < 0.1. **p < 0.05. ***p < 0.01.

restriction is that the error terms in Eqs. (5) and (6) are uncorrelated, which implies that there is no factor that affects both disclosure and liquidity that is not accounted for by the time-varying control variables, firm-fixed effects, or the control-firm-time-varying effect. These conditions are the same as asserting the appropriateness of an instrumental variable (I cannot test them). I can therefore use Eq. (6) to compute both the indirect (disclosure) effect and direct effect of index fund ownership on liquidity. I provide the results from this procedure next.

4.5.2. Empirical results

In Table 5, Column 1, I first estimate a D-in-D disclosure model by regressing disclosure on index fund ownership and control variables (as in Eq. (5)). To measure disclosure, I construct a D-in-D disclosure factor using the D-in-D percentage changes in management guidance, 8-K filings, supplementary financial statements, and press releases. The factor process yields a one-dimensional disclosure variable, which considerably simplifies the analysis. I create my disclosure factor using a maximum likelihood procedure with varimax rotated factors (Bushman et al., 2004). I retain all four D-in-D disclosure measures because they all proxy for the same underlying construct, as suggested by the positive correlations between the measures (Table 2, Panel D).[23] As expected, the coefficient on index fund holdings is positive and statistically significant

[23] The associated factor loadings for the D-in-D percentage change in disclosure measures are 0.36 for management guidance, 0.83 for 8-K filings, 0.84 for supplementary financial statement filings, and 0.64 for press releases.

Table 5
Recursive Model of Disclosure, Index Fund Ownership, and Stock Liquidity for S&P 500 Index-Inclusion Firms Relative to Propensity-Matched Control Firms from 1996–2010.

		D-in-D Liquidity Measures	
D-in-D Variable	Disclosure Factor **(1)**	Bid-Ask Spread **(2)**	Amihud Illiquidity **(2)**
Index Fund Holdings	**0.259*****	**−0.031****	**−0.012****
	(7.99)	**−(2.43)**	**−(2.31)**
Disclosure Factor		**−0.106*****	**−0.025****
		−(2.82)	**−(2.26)**
Non-Index Fund Holdings	0.009	0.003	0.001
	(0.03)	(0.10)	(0.29)
Intercept	0.000	−0.002***	−0.005**
	(0.12)	−(2.89)	−(2.22)
Controls from Table 3	Y	Y	Y
Observations	368	368	368
Adjusted R-squared	0.318	0.047	0.058

*p < 0.1. D-in-D refers to the procedure shown in Eq. (4). T-statistics are in parentheses. The recursive model is described in Section 4.5.1 and in Eq. (6). I first estimate a reduced form D-in-D disclosure model by regressing the disclosure factor on index fund ownership and control variables in Column 1. I then estimate the bid-ask spread and Amihud illiquidity models in Columns 2 and 3 by regressing the D-in-D bid-ask spread measure and the D-in-D Amihud illiquidity measure on the index fund ownership level, the D-in-D disclosure factor, and the D-in-D control variables. I compute the effect of disclosure on the bid-ask spreads and the Amihud illiquidity measures by multiplying the disclosure factor coefficient in Columns 2 and 3 by the index fund holdings coefficient in Column 1. I describe the results in Section 4.5.2. As discussed in Section 4.5.2, I construct the one-dimensional D-in-D disclosure factor using the pre-period to post-period D-in-D percentage changes in management guidance, 8-K filings, supplementary financial statements, and press releases (see Table 2, Panel C). Standard errors are clustered by inclusion year and variable definitions are in Appendix D.
**p < 0.05.
***p < 0.01.

(coefficient of 0.259; 1% level), corroborating the findings in Table 3.

In Table 5, Columns 2 and 3, I then estimate the liquidity models by regressing the D-in-D bid-ask spread and the D-in-D Amihud illiquidity measure on the index fund ownership level, the D-in-D disclosure factor, and the D-in-D control variables (as in Eq. (6)). To compute the indirect effect of index fund ownership (through disclosure) on liquidity, I multiply the disclosure factor coefficients in Columns 2 and 3 (β_2 from Eq. (6)) by the index fund holdings coefficient in Column 1 (α_1 from Eq. (5)). The resulting negative products of –0.027 for spreads (–0.106*0.259; 5% level) and –0.006 for Amihud illiquidity (–0.025*0.259; 5% level) signify that the indirect effect is present in my sample, as predicted in H3.[24] For a one standard deviation increase in index fund ownership, the indirect effect decreases percentage spreads by 0.0435 (5% level) and Amihud illiquidity by 0.0104 (5% level). These results are close in magnitude to those of recent studies. For example, Bushee et al. (2010, Table 3) find that percentage bid-ask spreads decrease by 0.11 for a one standard deviation increase in their abnormal press coverage measure.[25]

[24] Because multiplication introduces non-linearities, I use the delta method (or the linear Taylor expansion) to compute standard errors (Krull and MacKinnon, 2001; Sobel, 1987). I follow MacKinnon et al. (2007) and Preacher and Hayes (2008) and do not standardize the coefficients because I do not use categorical variables. As a robustness check, I use spreads and Amihud illiquidity from just the first two quarters and last two quarters of the pre and post periods and find similar results. This test confirms that differences in these measures persist throughout the post period for the treatment firms and are not temporary effects.

[25] If I insert the disclosure proxies one-by-one in place of the factor variable in Table 5, Columns 1–3, the indirect disclosure effect (after multiplication) has the same sign as the factor variable and is statistically significant (at the 10% level or lower) for spreads with management guidance, 8-K filings, and supplementary financial statement filings; and for Amihud illiquidity with management guidance and supplementary financial statement filings. The magnitudes of these effects decline relative to the factor variable.

4.6. Test of H3: Index fund ownership and stock liquidity

In Table 5, Columns 2 and 3, I also find that index fund ownership (β_1 from Eq. (6)) directly reduces bid-ask spreads (coefficient of −0.031; 5% level) and Amihud illiquidity (−0.012; 5% level), as predicted by H3. The ratio of the indirect (disclosure) effect to the direct effect is 87% (−0.027/−0.031) for spreads and 50% (−0.006/−0.012) for Amihud illiquidity. As discussed in Section 2, one explanation for the direct effect is that index funds, in rebalancing their portfolios, increase the supply of uninformed liquidity traders in the market for a firm's shares. This finding builds on prior studies such as Beneish and Whaley (1996); Hegde and McDermott (2003), and Boone and White (2015), which find that a firm's index inclusion is followed by a decrease in bid-ask spreads for that firm's stock. These studies conjecture that uninformed index fund trading contributes to this decrease, but, unlike in my analysis, they do not test for this effect. This study is the first to document that disclosure, index fund ownership, and index inclusion combine to affect liquidity in the index setting.

4.7. Alternative specifications

In this section, I conduct two sets of additional analyses to help rule out alternative explanations for my main results. For the first set of analyses, I re-estimate the main tests from Tables 3 and 5 using the following alternative specifications: (1) removing the control firm as a baseline, and (2) including a time trend and splitting the sample by index-inclusion dates in 1996–2001 and 2002–2010. I also (3) check for an existing disclosure time trend using a falsification window of [−4 years, −2 years). Test (1) checks for whether my results are attributable to systematic changes in the control firms. This test produces results similar to those in Tables 3, 4, and 5. For test (2), including the time trend reduces the economic significance of the guidance result in Table 3, but not the liquidity results in Table 5. In addition, I do not find a statistically significant difference in the results for years 1996–2001 and 2002–2010. These findings indicate that the disclosure effect is not due to unmeasured time-varying factors. For test (3), I find no evidence of an existing trend in disclosure for the inclusion firms: the disclosure level from [−4 years, −2 years) is comparable to the disclosure level from [−2 years, 0) (insignificant difference at the 10% level).

For the second set of analyses, I select a second set of control firms from a pool of already-included S&P 500 firms. The intuition is that if there is a time-trending unmeasured factor that leads to more disclosure and is correlated with index fund ownership, such an effect would not be eliminated with non-index control firms (e.g., increasing scrutiny of index firms relative to non-index firms over my sample period). After selecting new control firms, I find that, like the initial set of control firms, these firms do not change much from the pre to the post period. I rerun the tests for H1 and H3 from Tables 3 and 5, respectively, and find that the H1 disclosure results are similar in magnitude and statistical significance to those in Table 3. The effect of disclosure on liquidity from H3 is stronger by a magnitude of 4% than the result in Table 5. These results provide confidence that it is index funds' preference for more disclosure that drives my results, not the selection of control firms or S&P 500 index inclusion itself.

4.8. S&P 500 index deletions

A natural extension of index inclusion is to look at index deletions, as index additions and deletions always come in pairs. However, deletions from the S&P 500 index happen mainly because index firms get acquired, and not because the firms performed poorly. Acquisitions cause about 78% of index deletions in my sample from 1996-2010, which creates a sample selection bias in the small number of remaining firms. The sample selection bias is due to the following: (1) 78% of deleted firms are omitted from the sample because they are no longer publicly traded, and (2) the remaining deleted firms could attract a specific type of owner when index funds leave. Without explicitly modeling the disclosure preferences of the new owners, it is hard to predict their effect on the disclosure practices of these firms. But if one assumes that the new owners are not systematically different from other strategic owners, then the arguments in Section 2 suggest that the managers of these firms will reduce their disclosure levels. With these caveats in mind, I therefore repeat the same set of tests for 82 deleted and closely-matched control firms (untabulated). The index and non-index ownership measures are once again uncorrelated, and the 8-K count, supplementary financial statement, and press release disclosure measures drop with the drop in index fund ownership measure (but not guidance); the magnitudes of these results are smaller than those of the index-inclusion tests. These results are consistent with the reversal of H1. Due to power limitations imposed by the small sample, I do not test for H2 and H3 in the deletion setting.

5. Conclusion

Capital markets theory argues that disclosure affects information asymmetry and thus stock liquidity. Empirically, however, it has been difficult to test this theory due to the complexity of modeling the disclosure preferences of managers and strategic investors (e.g., Joos, 2000). This study abstracts away from any particular model of strategic disclosure motives by using an index-fund setting. Drawing on various institutional and empirical findings, I argue that index funds fit the profile of non-strategic traders, who, according to theory, are unambiguously more likely than managers and strategic investors to prefer high stock liquidity and therefore high disclosure. I find that when a firm joins the S&P 500 index, the ownership level assumed by

index funds is determined by index fund assets under management at that time and is thus plausibly exogenous to managers' disclosure choices. This ownership level gives index funds some degree of control over management. Accordingly, I find that voluntary disclosure increases with the level of index fund ownership, and this increase in disclosure is associated with increased stock liquidity. These results imply that voluntary disclosure increases stock liquidity.

The index setting provides a unique opportunity to conduct a relatively clean test of the effect of voluntary disclosure on stock liquidity. However, any effect on liquidity in this setting could be due to disclosure or to index fund ownership itself. This means that standard instrumental variable and regression discontinuity research designs cannot separate the liquidity effect of each mechanism. An appropriate empirical solution to separate the two effects is to construct a recursive structural equation model. My recursive model analysis suggests that the disclosure effect and the index fund ownership effect are distinct phenomena in my sample. These findings contribute to the ongoing research on large and influential nonstrategic investors such as index funds. Future research can continue to explore the incentives and preferences of nonstrategic investors.

Appendix A. Index ETF creation

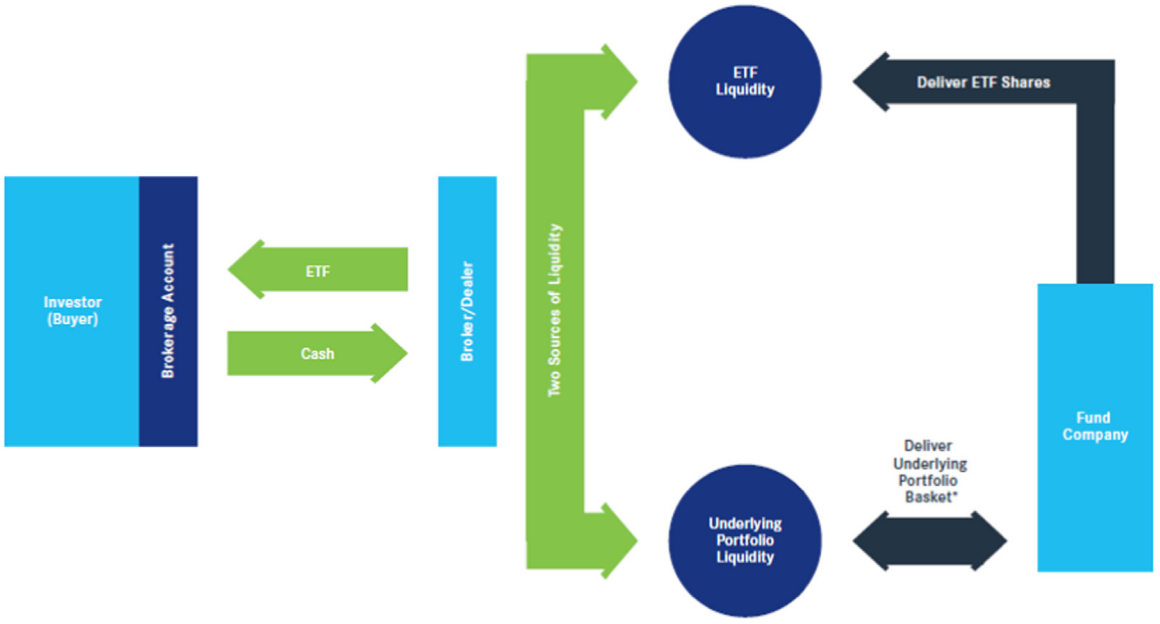
BlackRock's iShares ETF Mechanism

This graphic depicts BlackRock's ETF creation and redemption process. Note that the liquidity of the index fund depends on the liquidity of the underlying index stocks (BlackRock Inc., 2014b).

The mechanics of an ETF structure

- As Figure 2 illustrates, an investor buys an ETF through an advisor or a brokerage account, and places a buy order. In contrast to the mutual fund structure, the order is directed to the exchange instead of the fund.
- After exchanging the shares of the ETF for cash with the client's broker/dealer, the market makers or Authorized Participants (AP) can create or redeem shares directly with the fund. The ability to readily create ETF shares is a unique feature that single stocks do not have.
- Transactions are usually made through an in-kind mechanism. The in-kind process starts with the APs creating ETF units in the primary market by delivering a basket of securities to the fund equal to the current holdings of the ETF. In return, they receive a large block of ETF shares (typically 50,000), which are then available for trading in the secondary market.
- To facilitate all of this, ETF advisors such as BlackRock Fund Advisors are producing portfolio composition files (or PCFs) for each of their funds on a daily basis. These files list the exact stocks in their representative percentages. As market makers take in cash and hand out ETFs, they are aware of which stocks they must buy.
- To build a creation unit, market makers take cash, go to the capital markets, and buy the stocks as listed and defined in the PCF. Market makers then deliver these securities "in-kind" to the fund which issues the appropriate ETF's creation unit.
- Redemptions are the reverse: a block of ETF shares is delivered to the ETF manager by an AP in return for the underlying securities through an in-kind transfer between an AP and the fund.

Figure 2: Creation process (redemption process in reverse)



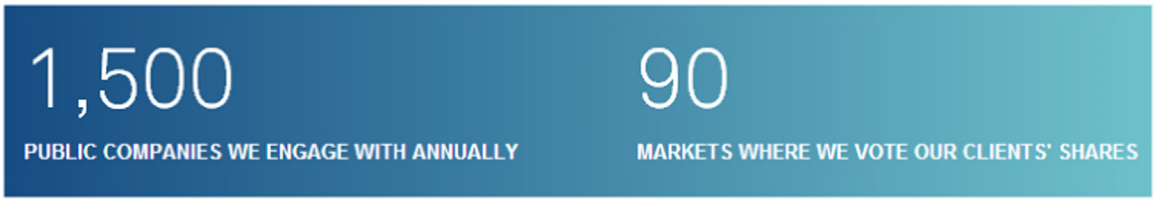
Appendix B. Industry practice and disclosure

B.1 BlackRock's engagement principles

> "Where company reporting and disclosure is inadequate or the approach taken is inconsistent with our view of what is in the best interests of shareholders, we will engage with the company and/or use our vote to encourage better practice. In making voting decisions, we take into account research from external proxy advisors, other internal and external research and academic articles, information published by the company or provided through engagement and the views of our equity portfolio managers."

"BlackRock believes that shareholders have a right to timely and detailed information on the financial performance and situation of the companies in which they invest. In addition, companies should also publish information on the governance structures in place and the rights of shareholders to influence these. The reporting and disclosure provided by companies forms the basis on which shareholders can assess the extent to which the economic interests of shareholders have been protected and enhanced and the quality of the board's oversight of management. BlackRock considers as fundamental, shareholders' rights to vote, including on changes to governance mechanisms, to submit proposals to the shareholders' meeting and to call special meetings of shareholders." (BlackRock Inc., 2014a).

B.2 Blackrock's 2012 engagements



ENGAGEMENT AND PROXY VOTING

Engagement—direct communication with a portfolio company—is a fundamental part of BlackRock's responsible investment effort. We believe the key to engagement is constructive and private communication. Engagement lets us share our philosophy and approach to investment and corporate governance with portfolio companies and enhance their understanding of our objectives. Equally, we believe it gives us an opportunity to improve our understanding of investee companies and their governance structures and to better inform our voting and investment decisions.

We engage in a constructive manner—our aim is to build mutual understanding, not to tell companies what to do. We meet with executives and board directors; we communicate with the company's advisors; and we engage with other shareholders where appropriate.

(BlackRock Inc., 2016).

B.3 Glass lewis "proxy talks"

> "From time to time, Glass Lewis will host 'Proxy Talk' conference calls to discuss a meeting, proposal or issue in depth. Glass Lewis' clients are able to listen to the call and submit questions to the speakers, with representatives from Glass Lewis' research team serving as moderators. Proxy Talks are held prior to the publishing of our research in order to glean additional information that we (and our clients) consider as part of our analysis. Typically calls are held to provide the participants (e.g., company representatives, dissidents, shareholder proposal proponents) an open forum to provide further color on specific issues. We believe this is an effective way for companies to reach our client base directly, empowering our clients and fostering improved disclosure of the relevant facts."

(Glass Lewis, 2016a).

B.4 Glass lewis on disclosure

> "As a general framework, our evaluation of board responsiveness involves a review of publicly available disclosures (e.g. the proxy statement, annual report, 8-Ks, company website, etc.) released following the date of the company's last annual meeting up through the publication date of our most current Proxy Paper. Depending on the specific issue, our focus typically includes, but is not limited to, the following:

- At the board level, any changes in directorships, committee memberships, disclosure of related party transactions, meeting attendance, or other responsibilities.
- Any revisions made to the company's articles of incorporation, bylaws or other governance documents.
- Any press or news releases indicating changes in, or the adoption of, new company policies, business practices or special reports.
- Any modifications made to the design and structure of the company's compensation program."

(Glass Lewis, 2016a).

"When rendering advice on audit committee members and the appointment of auditors, Glass Lewis pays careful attention to the transparency and history of financial statements."

"Glass Lewis believes that comprehensive, timely and transparent disclosure of executive pay is critical to allowing shareholders to evaluate the extent to which the pay is keeping pace with company performance. When reviewing proxy materials, Glass Lewis examines whether the company discloses the performance metrics used to determine executive compensation. We recognize performance metrics must necessarily vary depending on the company and industry, among other factors, and may include items such as total shareholder return, earnings per share growth, return on equity, returns on assets and revenue growth. However, we believe companies should disclose why the specific performance metrics were selected and how the actions they are designed to incentivize will lead to better corporate performance."

(Glass Lewis, 2016b).

B.5 Disclosure initiatives in the institutional shareholder services (ISS) 2013 proxy season report

ISS's 2013 U.S. Proxy Season Review, a document that summarizes important management and shareholder proposals from January to June of 2013, lists 42 disclosure related initiatives. A sampling of these include: executive pay clawback policies, executive compensation policies, more detailed financial statements for overseas operations, a breakdown of political contributions, a breakdown of lobbying payments, and additional sustainability and environmental disclosures.

(Institutional Shareholder Services, 2016).

B.6 Vanguard's views on corporate governance website states:

"We have found, through hundreds of meetings and discussions annually, that we can often accomplish more through dialogue than through the ballot."

"…companies' required disclosures of their pay practices are more useful and create more accountability if they focus as much on 'why' as they do on 'how much'."

(The Vanguard Group, Inc., 2016).

B.7 Fidelity group's corporate governance guidelines

"…the specific proxy voting policies that are summarized below to maximize the value of investments in its clients' accounts, which it believes will be furthered through (1) accountability of a company's management and directors to its shareholders, (2) alignment of the interests of management with those of shareholders (including through compensation, benefit and equity ownership programs), and (3) increased disclosure of a company's business and operations."

(Fidelity Management and Research LLC, 2016).

Appendix C: Control variables

Construct	Description and Proxy	Source
Size and Complexity	Larger firms and firms with more complex operations may inherently have more information to disclose. I control for this effect using total assets, the number of business and geographical segments, and the amount of intangibles.	Compustat
Profitability	Prior research documents a relationship between profitability and disclosure (e.g., Lang and Lundholm, 1993; Miller, 2002). I measure profitability using net income before extraordinary items scaled by total assets (ROA).	Compustat
Growth	A firm may want to disclose its growth options or its current state of growth, a factor I measure using market to book ratio.	Compustat, CRSP

Analysts	Prior research documents that analysts prefer firms with better disclosure practices. Hence, changes in analyst following can help control for a firm's potentially unobservable disclosure practices. I measure change in analyst following using the average number of outstanding EPS forecasts from the pre to post period.	I/B/E/S
Operations	More active firms are likely to disclose information related to their activities. I therefore measure capital expenditures, research and development costs, debt, an indicator for acquisitions, and an indicator for CEO changes.	Compustat, SDC, Execucomp
Dividends	Prior research documents that some institutional investors prefer dividend paying firms. Dividends may also relate to a change in a firm's operations. I employ an indicator equal to 1 if a firm pays a dividend, and 0 otherwise.	Compustat
Systematic Changes	Managers could systematically change their firm's disclosure policy for reasons related to S&P 500 inclusion alone. This inclusion effect forms the intercept term in my regressions.	N/A
Idiosyncratic Changes	Any idiosyncratic changes in disclosure form the error terms in my regressions.	N/A

Appendix D: Variable definitions for S&P 500 inclusion and propensity-matched control firms

This Appendix describes each variable used in this study and its source.

Variable	Definition	Source
Institutional Investor Holdings Measures		
Index Fund Holdings$_{f,T}$	Percentage of outstanding shares held by index funds measured on the first calendar quarter end after the included firm's index inclusion.	Thomson Mutual Fund Database
Non-Index Fund Holdings$_{f,T}$	Percentage of outstanding shares held by non-index fund institutional shareholders averaged over observation period T measured at calendar quarter end dates.	Thomson 13F Database
Disclosure Measures		
Management Guidance$_{f,T}$	Number of quarters in observation period T for which management issued EPS guidance.	I/B/E/S
8-K Filings$_{f,T}$	Total number of 8-K filings during observation period T.	WRDS SEC Analytics Suite
Suppl. Financial Statements$_{f,T}$	8-K filings categorized as financial statements and exhibits and/or results of operations and financial condition during observation period T.	WRDS SEC Analytics Suite
Press Releases$_{f,T}$	Press release 8-K filings during observation period T.	WRDS SEC Analytics Suite
Disclosure Factor$_{f,T}$	This variable is a summary disclosure factor based on the pre-period to post-period (T=0 to T=1) D-in-D percentage change in management guidance, 8-K filings, supplementary financial statements, and press releases. I use a maximum likelihood procedure with varimax rotated factors (see Section 4.5.2 for factor weightings).	I/B/E/S, WRDS SEC Analytics Suite
Stock Liquidity and Information Asymmetry Measures		
Bid-Ask Spread$_{f,T}$	See Section 3.4 for the bid-ask spread D-in-D computation procedure.	TAQ
Amihud Illiquidity$_{f,T}$	See Section 3.4 for the Amihud illiquidity D-in-D computation procedure.	CRSP
Analyst Forecast Error$_{f,T}$	See Section 3.4 for the analyst forecast error D-in-D computation procedure.	I/B/E/S
Governance Measure		
E − index$_{f,T}$	Entrenchment index closest to index-inclusion date.	Bebchuk et al. (2009); RiskMetrics
Control Variables (computed using annual data)		
Total Assets$_{f,T}$	Log of total assets averaged over observation period T.	Compustat
ROA$_{f,T}$	Income before extraordinary items divided by total assets averaged over observation period T.	Compustat
Capital Expenditures$_{f,T}$	Capital expenditures divided by total assets averaged over observation period T.	Compustat
Research and Development$_{f,T}$	Research and development expense divided by total assets averaged over observation period T.	Compustat
Intangibles$_{f,T}$	Intangible assets divided by total assets averaged over observation period T.	Compustat
Debt$_{f,T}$	(Current debt plus long term debt) divided by total assets averaged over observation period T.	Compustat
Business Segments$_{f,T}$	Number of business segments plus geographic segments averaged over observation period T.	Compustat
Dividends$_{f,T}$	1 if firm paid a dividend in observation period T, 0 otherwise.	Compustat

Market to Book$_{f,T}$	Market value divided by book value of assets averaged over observation period T.	Compustat
M&A Indicator$_{f,T}$	1 if firm made an acquisition during the observation period, 0 otherwise.	SDC Platinum
New CEO Indicator$_{f,T}$	1 if firm replaced CEO during the observation period, 0 otherwise.	Execucomp
Analyst Following$_{f,T}$	Number of analysts with outstanding EPS forecasts averaged over observation period T.	I/B/E/S
13G Filings$_{f,T}$	Passive investor 13G blockholder filings in observation period T.	WRDS SEC Analytics Suite
13D Filings$_{f,T}$	Active investor 13D blockholder filings in observation period T.	WRDS SEC Analytics Suite

f=F for index-inclusion (treatment) firm, C for propensity-matched control firm, T=0 for the two year pre-period ending the day before the inclusion date, 1 for the two year post-period beginning on the inclusion date. All variables except the E-index are computed as D-in-D as shown in Eq. (4).

References

Adams, R., Ferreira, D., 2007. A Theory of Friendly Boards. J. Financ. 62, 217–250.
Amihud, Y., 2002. Illiquidity and stock returns: cross-section and time-series effects. J. Financ. Mark. 5, 31–56.
Appel, I., Gormley, T., Keim, D., 2016. Passive investors, not passive owners. J. Financ. Econ. 121, 111–141.
Armstrong, C., Core, J., Guay, W., 2014. Do independent directors cause improvements in firm transparency? J. Financ. Econ. 113, 383–403.
Armstrong, C., Guay, W., Weber, J., 2010. The role of information and financial reporting in corporate governance and debt contracting. J. Account. Econ. 50, 179–234.
Baginski, S., Hassell, J., 1990. The market interpretation of management earnings forecasts as a predictor of subsequent financial analyst forecast revision. Account. Rev. 65, 175–190.
Balakrishnan, K., Billings, M., Kelly, B., Ljungqvist, A., 2014. Shaping liquidity: on the causal effects of disclosure and liquidity. J. Financ. 69, 2237–2278.
Bebchuk, L., Cohen, A., Ferrell, A., 2009. What matters in corporate governance? Rev. Financ. Stud. 22, 783–827.
Beneish, M., Whaley, R., 1996. An anatomy of the "S&P game": the effects of changing the rules. J. Financ. 51, 1909–1930.
Bertrand, M., Duflo, E., Mullainathan, S., 2004. How much should we trust differences-in-differences estimates? Q. J. Econ. 119, 249–275.
Beyer, A., Cohen, D., Lys, T., Walther, B., 2010. The financial reporting environment: review of the recent literature. J. Account. Econ. 50, 296–343.
Bharath, S., Jayaraman, S., Nagar, V., 2013. Exit as governance: an empirical analysis. J. Financ 68, 2515–2547.
Bhattacharya, N., Ecker, F., Olsson, P., Schipper, K., 2012. Direct and mediated associations among earnings quality, information asymmetry, and the cost of equity. Account. Rev. 87, 449–482.
Bhushan, R., 1989. Firm characteristics and analyst following. J. Account. Econ. 11, 255–274.
Bird, A., Karolyi, S., 2016. Do Institutional Investors Demand Public Disclosure? Rev. Financ. Stud., Forthcoming.
BlackRock Inc., 2014a. Global corporate governance & engagement principles. ⟨http://www.blackrock.com/corporate/en-us/literature/fact-sheet/blk-responsible-investment-1engprinciples-global-122011.pdf⟩(accessed 16.08.15).
BlackRock Inc., 2014b. The mechanics of an ETF structure. ⟨http://us.ishares.com/content/en_us/repository/resource/innovative_mechanism.pdf⟩(accessed 16.08.15).
BlackRock Inc., 2016. Guidelines, reports and position papers. ⟨https://www.blackrock.com/corporate/en-br/about-us/investment-stewardship/voting-guidelines-reports-position-papers⟩(accessed 16.08.15).
Boehmer, E., Kelley, E., 2009. Institutional investors and the informational efficiency of prices. Rev. Financ. Stud. 22, 3563–3594.
Boehmer, E., Wu, J., 2013. Short selling and the price discovery process. Rev. Financ. Stud. 26, 287–322.
Boone, A., White, J., 2015. The effect of institutional ownership on firm transparency and information production. J. Financ. Econ. 117, 508–533.
Booraem, G., 2013. Passive Investors, Not Passive Owners. ⟨https://corpgov.law.harvard.edu/2013/05/10/passive-investors-not-passive-owners/ (accessed 16.08.15).
Brav, A., Jiang, W., Partnoy, F., Thomas, R., 2008. Hedge fund activism, corporate governance, and firm performance. J. Financ. 63, 1729–1775.
Brickley, J., Zimmerman, J., 2010. Corporate governance myths: comments on armstrong, guay, and weber. J. Account. Econ. 50, 235–245.
Bushee, B., Core, J., Guay, W., Hamm, S., 2010. The role of the business press as an information intermediary. J. Account. Res. 48, 1–19.
Bushee, B., Noe, C., 2000. Corporate disclosure practices, institutional investors, and stock return volatility. J. Account. Res. 38, 171–202.
Bushman, R., Indjejikian, R., 1995. Voluntary disclosures and the trading behavior of corporate insiders. J. Account. Res. 33, 293–316.
Bushman, R., Piotroski, J., Smith, A., 2004. What determines corporate transparency? J. Account. Res. 42, 207–252.
Carhart, M., 1997. On persistence in mutual fund performance. J. Financ. 52, 57–82.
Carter, M., Soo, B., 1999. The relevance of form 8-K reports. J. Account. Res. 37, 119–132.
Chen, H., Noronha, G., Singal, V., 2004. The price response to S&P 500 index additions and deletions: evidence of asymmetry and a new explanation. J. Financ. 59, 1901–1929.
Chen, X., Cheng, Q., Luo, T., Yue, H., 2015. Short sellers and corporate disclosures. Work. Paper.
Cheng, S., Nagar, V., Rajan, M., 2004. Identifying control motives in managerial ownership: evidence from antitakeover legislation. Rev. Financ. Stud. 18, 637–672.
Chordia, T., Roll, R., Subrahmanyam, A., 2000. Commonality in liquidity. J. Financ. Econ. 56, 3–28.
Claessens, S., Djankov, S., Fan, J., Lang, L., 2002. Disentangling the incentive and entrenchment effects of large shareholdings. J. Financ. 57, 2741–2771.
Cohen, L., Frazzini, A., Malloy, C., 2008. The small world of investing: board connections and mutual fund returns. J. Polit. Econ. 116, 951–979.
Core, J., Hail, L., Verdi, R., 2015. Mandatory disclosure quality, inside ownership, and cost of capital. Eur. Account. Rev. 24, 1–29.
Core, J., Holthausen, R., Larcker, D., 1999. Corporate governance, chief executive officer compensation, and firm performance. J. Financ. Econ. 51, 371–406.
Crane, A., Michenaud, S., Weston, J., 2016. The effect of institutional ownership on payout policy: evidence from index thresholds. Rev. Financ. Stud. 29, 1377–1408.
Denis, D., McConnell, J., Ovtchinnikov, A., Yu, Y., 2003. S&P 500 index additions and earnings expectations. J. Financ. 58, 1821–1840.
Diamond, D., Verrecchia, R., 1991. Disclosure, liquidity, and the cost of capital. J. Financ. 46, 1325–1359.
Dye, R., Sridhar, S., 1995. Industry-wide disclosure dynamics. J. Account. Res. 33, 157–174.
Elton, E., Gruber, M., Busse, J., 2004. Are investors rational? Choices among Index Funds. J. Financ. 59, 261–288.
Fama, E., French, K.R., 2010. Luck versus skill in the cross-section of mutual fund returns. J. Financ. 65, 1915–1947.
Fang, V., Noe, T., Tice, S., 2009. Stock market liquidity and firm value. J. Financ. Econ. 94, 150–169.
Fidelity Management and Research LLC, 2016. Corporate Governance and Proxy Guidelines. ⟨https://www.fidelity.com/about-fidelity/fidelity-by-numbers/fmr/proxy-guidelines⟩(accessed 16.08.15).
Fink, L., 2015. Text of letter sent to Chairmen/CEOs asking them to focus on delivering long-term value. ⟨http://www.blackrock.com/corporate/en-at/

literature/publication/long-term-value-letter-041415.pdf⟩(accessed 16.08.15).
Frazzini, A., Lamont, O., 2008. Dumb money: mutual fund flows and the cross-section of stock returns. J. Financ. Econ. 88, 299–322.
Gillian, S., Starks, L., 2000. Corporate governance proposals and shareholder activism: the role of institutional investors. J. Financ. Econ. 57, 275–305.
Glass Lewis, 2016a. Glass Lewis Engagement Procedures. ⟨http://www.glasslewis.com/engagement-policy/⟩(accessed 16.08.15).
Glass Lewis, 2016b. Proxy Research. ⟨http://www.glasslewis.com/proxy-research-3/ (accessed 16.08.15).
Goyenko, R., Holden, C., Trzcinka, C., 2009. Do liquidity measures measure liquidity? J. Financ. Econ. 92, 153–181.
Graham, J., Harvey, C., Rajgopal, S., 2005. The economic implications of corporate financial reporting. J. Account. Econ. 40, 3–73.
Greene, W., 2002. Econometric Analysis, Fifth EditionPearson Education, Inc., Upper Saddle River, NJ.
Healy, P., Palepu, K., 2001. Information asymmetry, corporate disclosure, and the capital markets: a review of the empirical disclosure literature. J. Account. Econ. 31, 405–440.
Hegde, S., McDermott, J., 2003. The liquidity effects of revisions to the S&P 500 index: an empirical analysis. J. Financ. Mark. 6, 413–459.
Holden, C., Jacobsen, S., 2014. Liquidity measurement problems in fast, competitive markets: expensive and cheap solutions. J. Financ. 69, 1747–1785.
Holmström, B., Tirole, J., 1993. Market liquidity and performance monitoring. J. Polit. Econ. 101, 678–709.
Hong, H., Kubik, J., Stein, J., 2005. Thy neighbor's portfolio: word-of-mouth effects in the holdings and trades of money managers. J. Financ. 60, 2801–2824.
Hope, O., 2003. Accounting policy disclosures and analysts' forecasts. Contemp. Account. Res. 20, 295–321.
Institutional Shareholder Services, 2016. ISS Governance. ⟨https://www.issgovernance.com/ (accessed 16.08.15).
Jennings, R., 1987. Unsystematic security price movements, management earnings forecasts, and revisions in consensus analyst earnings forecasts. J. Account. Res. 25, 90–110.
Joos, P., 2000. Discussion of the economic consequences of increased disclosure. J. Account. Res. 38, 125–136.
Kim, O., Verrecchia, R., 1994. Market liquidity and volume around earnings announcements. J. Account. Econ. 17, 41–67.
Kothari, S.P., Shu, S., Wysocki, P., 2009. Do managers withhold bad news? J. Account. Res. 47, 241–276.
Krull, J., MacKinnon, D., 2001. Multilevel modeling of individual and group level mediated effects. Multivar. Behav. Res. 36, 249–277.
Lang, M., Lundholm, R., 1993. Cross-sectional determinants of analyst ratings of corporate disclosures. J. Account. Res. 31, 246–271.
Lang, M., Lundholm, R., 1996. Corporate disclosure policy and analyst behavior. Account. Rev. 71, 467–492.
Lerman, A., Livnat, J., 2009. The new Form 8-K disclosures. Rev. Account. Stud. 15, 752–778.
Leuz, C., Verrecchia, R., 2000. The economic consequences of increased disclosure. J. Account. Res. 38, 91–124.
Leuz, C., Wysocki, P., 2016. The economics of disclosure and financial reporting regulation: evidence and suggestions for future research. J. Account. Res. 54, 525–622.
Li, Y., Zhang, L., 2015. Short selling pressure, stock price behavior, and management forecast precision: evidence from a natural experiment. J. Account. Res. 53, 79–117.
Lys, T., Sohn, S., 1990. The association between revisions of financial analysts' earnings forecasts and security-price changes. J. Account. Econ. 13, 341–363.
MacKinnon, D., Fairchild, A., Fritz, M., 2007. Mediation Analysis. Annu. Rev. Psychol. 58, 593–614.
Madhavan, A., 2015. Exchange-traded funds: an overview of institutions, trading, and impacts. Annu. Rev. Financ. Econ. 6, 311–341.
Matvos, G., Ostrovsky, M., 2010. Heterogeneity and peer effects in mutual fund proxy voting. J. Financ. Econ. 98, 90–112.
Mayew, W., Sethuraman, M., Venkatachalam, M., 2015. MD&A disclosure and the firm's ability to continue as a going concern. Account. Rev. 90, 1621–1651.
McCahery, J., Sautner, Z., Starks, L., 2016. Behind the Scenes: The Corporate Governance Preferences of Institutional Investors. J. Financ., http://onlinelibrary.wiley.com/doi/10.1111/jofi.12393/full.
Miller, G., 2002. Earnings performance and discretionary disclosure. J. Account. Res. 40, 173–204.
Morck, R., Yang, F., 2001. The Mysterious Growing Value of S&P 500 Membership. NBER Work. Paper Ser.
Mullins, W., 2015. The Governance Impact of Indexing: Evidence from Regression Discontinuity. Work. Paper.
Nagar, V., 1999. The role of the manager's human capital in discretionary disclosure. J. Account. Res. 37, 167–181.
Nagar, V., Nanda, D., Wysocki, P., 2003. Discretionary disclosure and stock-based incentives. J. Account. Econ. 34, 283–309.
Nagel, S., 2005. Short sales, institutional investors and the cross-section of stock returns. J. Financ. Econ. 78, 277–309.
O'Brien, P., Bhushan, R., 1990. Analyst following and institutional ownership. J. Account. Res. 28, 55–76.
Preacher, K., Hayes, A., 2008. Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models. Behav. Res. Methods 40, 879–891.
Shroff, N., Sun, A., White, H., Zhang, W., 2013. Voluntary disclosure and information asymmetry: evidence from the 2005 securities offering reform. J. Account. Res. 51, 1299–1345.
Skinner, D., 1994. Why firms voluntarily disclose bad news. J. Account. Res. 32, 38–60.
Skinner, D., 1997. Earnings disclosures and stockholder lawsuits. J. Account. Econ. 23, 249–282.
Sobel, M., 1987. Direct and indirect effects in linear structural equation models. Sociol. Method. Res. 16, 155–176.
Taylor, D., Verrecchia, R., 2015. Delegated trade and the pricing of public and private information. J. Account. Econ. 60, 8–32.
The Vanguard Group, Inc., 2016. Our governance and executive compensation principles. ⟨https://about.vanguard.com/vanguard-proxy-voting/corporate-governance/⟩(accessed 16.08.15).
Verrecchia, R., 1983. Discretionary disclosure. J. Account. Econ. 5, 179–194.
Waymire, G., 1986. Additional evidence on the accuracy of analyst forecasts before and after voluntary management earnings forecasts. Account. Rev. 61, 129–142.
Wurgler, J., 2011. On the Economic Consequences of Index-Linked Investing. NBER Work. Paper Ser.