Mutual Fund Liquidity Management, Stock Liquidity, and Corporate Disclosure

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Abstract

This study presents novel evidence that mutual fund liquidity management affects stock liquidity. Exploiting a proposal by the U.S. Securities and Exchange Commission (SEC) as an exogenous shock to mutual fund liquidity management, I find that mutual fund liquidity management improves stock liquidity of firms in mutual fund portfolios. This improvement is more pronounced when mutual funds have stronger incentives to improve portfolio liquidity and more resources to influence firms and when portfolio firms have lower stock liquidity prior to the SEC proposal. Consistent with mutual funds influencing portfolio firms to be more transparent, I further show that improving disclosure among portfolio firms is one mechanism through which stock liquidity is improved. Overall, the results indicate that liquidity management at the fund level has important implications for stock liquidity and information disclosure of portfolio firms.

Keywords: mutual fund liquidity management; stock liquidity; corporate disclosure.

JEL Classifications: G23; D40; M41; D82.

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“Lessons from COVID-19: Liquidity Risk Management is Central to Open-Ended Funds.”
—BlackRock (2020)

“Liquidity risk management programs (LRMPs) will be a focus area for the Division.”
—SEC (2021)

1. INTRODUCTION

Mutual funds face constant redemptions by investors. Fire sales of underlying assets in mutual fund portfolios happen when mutual funds do not have enough cash on hand or liquid securities to convert into cash to satisfy shareholder redemption requests. As Coval and Stafford (2007) document, fire sales by mutual funds adversely affect the prices of stocks held by mutual funds and the performance of those mutual funds. Therefore, mutual fund liquidity management has become increasingly important since the financial crisis in 2007–2009, during which regulators and practitioners raised concerns about whether mutual fund portfolios had enough liquidity to process fund outflows and guard against potential investor runs (i.e., widespread withdrawals) (SEC 2015). Mutual fund liquidity management has become even more salient since the COVID-19 pandemic. According to Fitch (2020), at least $62 billion of mutual funds suspended redemptions in the first half of 2020 due to liquidity mismatch. The SEC thus began focusing on mutual fund liquidity management in 2021 (SEC 2021).

To date, academic research on mutual fund liquidity management has mainly examined the ways in which mutual funds manage liquidity and the effects of this management on fund performance.¹ However, the impact of mutual fund liquidity

¹ For example, Chernenko and Sunderam (2016) examine the use of cash, Agarwal and Zhao (2019) examine the use of interfund lending, Witmer (2019) examines the use of internal money market funds, and Ren (2019) examines the use of redemptions in kind in mutual fund liquidity management. Simutin (2014) examines the effect of cash holdings on mutual fund performance.
management on portfolio firms has not received much attention. To fill this void, I examine whether mutual fund liquidity management affects the stock liquidity of portfolio firms and whether changes in the corporate disclosure of portfolio firms can help explain this effect.

In this paper, I posit that mutual funds pressure portfolio firms to improve their stock liquidity. For example, on August 2, 2019, a large investment research and consulting firm for institutional investors, Edison, stated that mutual funds requiring portfolio firms to maintain and promote stock liquidity for mutual fund liquidity management were likely winners (Edison 2019). Mutual funds can exert their influence through multiple channels such as direct intervention (e.g., shareholder votes), voting with their feet (e.g., exit), and informal communications with firms’ directors and managers (Edmans et al. 2013; Duan and Jiao 2016; McCahery et al. 2016). For example, DSP Mutual Fund mentioned in its 2019 annual report that it voted for some corporate activities to improve its portfolio firms’ stock liquidity, and BlackRock mentioned in its 2017 corporate governance report that it encouraged portfolio firms with insufficient disclosure to change their disclosure practices (BlackRock 2017; DSP Mutual Fund 2019).

In terms of empirical design, identifying the effects of mutual fund liquidity management on stock liquidity and corporate disclosure of portfolio firms can be difficult. Mutual fund liquidity management is unobservable to outsiders, and endogeneity can be an issue. For example, a positive relation between mutual fund liquidity management and stock liquidity could be driven by omitted variables that simultaneously cause funds to manage portfolio liquidity and pick firms with certain stock liquidity.\(^2\)

\(^2\) Prior studies find evidence that mutual fund preferences affect mutual funds’ portfolio choices (e.g., Falkenstein 1996; Bushee et al. 2019; Friedman 2020; Gao et al. 2021).
To overcome these empirical challenges, I explore a shock to mutual fund liquidity management and employ a difference-in-differences (DID) research design to evaluate the relation between mutual fund liquidity management and stock liquidity of portfolio firms. My identification strategy is based on an SEC proposal on September 22, 2015, to promote effective mutual fund liquidity risk management. This proposed rule requires each mutual fund to (1) establish a liquidity risk management program, (2) classify the liquidity level of each portfolio asset based on a few factors, such as bid-ask spreads, (3) disclose the liquidity of fund holdings to the public, (4) determine the minimum percentage of liquid holdings, and (5) stop acquiring illiquid assets when illiquid holdings are more than 15% of a fund’s net assets.

These proposed requirements can cause an exogenous increase in mutual fund liquidity management. For example, mutual funds need to improve portfolio liquidity to avoid fund outflows, as fund investors may be concerned when poor portfolio liquidity becomes public information. Mutual funds also need to improve portfolio liquidity to meet minimum liquid holdings and maximum illiquid holdings requirements. I expect that mutual funds will increase their liquidity management before the proposal takes effect so that they can report high levels of liquidity by the time they are required to make their public disclosure. Although the SEC proposal affects every mutual fund, the pressure on portfolio firms will vary with the level of mutual fund ownership. Thus, my treatment group consists of firms with high mutual fund ownership (i.e., above-median ownership),

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3 In addition, Zeng (2017) theoretically shows that selling illiquid assets to improve portfolio liquidity can induce shareholder runs, which can in turn distort fund liquidity management.
and my control group consists of firms with low mutual fund ownership (i.e., below-median ownership).\footnote{All my results are robust to two alternative treatment variables: (1) a continuous treatment variable (i.e., mutual fund ownership) and (2) an alternative binary treatment variable that equals 1 if mutual fund ownership exceeds 0.}

I examine the effect of mutual fund liquidity management on stock liquidity of portfolio firms using two measures of stock liquidity, the Amihud (2002) liquidity measure and the bid-ask spread, which have been widely used in the accounting and finance literatures. Moreover, the SEC directly incorporates these two measures into their proposal for liquidity requirements.\footnote{The SEC proposal uses the Amihud liquidity measure to measure stock liquidity. The SEC (2015, p. 284) states, “Liquidity for individual equity positions is calculated using the Amihud liquidity measure because it is a widely accepted liquidity measure.” The SEC proposal also uses the bid-ask spread as one of several factors that mutual funds are required to consider in the liquidity classification requirement.} Consistent with mutual fund liquidity management improving the stock liquidity of portfolio firms, I find evidence that relative to control firms, treatment firms improve their stock liquidity.\footnote{My results are robust to several alternative measures of stock liquidity, including turnover and dollar volume. Dollar volume is another factor that the SEC requires mutual funds to consider when measuring the stock liquidity of portfolio firms.} This effect is both statistically and economically significant.\footnote{For example, using the bid-ask spread, I find that stock liquidity improves by 6\% for the treatment firms.}

I also conduct several tests to analyze cross-sectional variations in the effect of mutual fund liquidity management on stock liquidity. First, mutual funds holding illiquid portfolios are expected to have stronger incentives to increase their liquidity management following the SEC proposal, compared to funds holding liquid portfolios. Consistent with this argument, I find that the effect of mutual fund liquidity management on stock liquidity of portfolio firms is stronger among mutual funds with low portfolio liquidity. This finding provides further evidence that concerns about mutual fund liquidity drive the relation between mutual fund liquidity management and stock liquidity.
Second, index funds follow specific stock indexes. Given index funds’ limited flexibility in their portfolio choices, index funds have a lower likelihood than non-index funds to be penalized by the SEC and by investors for holding too many illiquid stocks. Therefore, index funds are less concerned than non-index funds about disclosing the liquidity of each individual stock. In addition, unlike non-index funds, index funds have highly diversified holdings by design, so it is easier for them to meet the SEC proposal’s rules, such as the 15% illiquid stock threshold. Consistent with non-index funds having more incentives to improve stock liquidity, I find that the effect of the SEC proposal on stock liquidity is more pronounced among non-index funds.

Third, the ability of mutual funds to influence portfolio firms depends on their resources. Some fund families manage their funds internally, and others outsource some or all funds to external asset management companies. Fund families do not have direct control over the external resources devoted to their outsourced funds. Moreover, external asset management companies often allocate less time and fewer resources to funds outsourced to them than funds managed in-house (Chen et al. 2013; Chuprinin et al. 2015). As resources are needed to communicate with portfolio firms about liquidity concerns, managers of outsourced funds may be less able to pressure portfolio firms. Consistent with this argument, I find that the effect of mutual fund liquidity management on stock liquidity is driven by funds managed in-house.

In addition to investigating cross-sectional differences among mutual funds, I also analyze cross-sectional variations among portfolio firms. The extent to which mutual funds

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8 Engagement with portfolio firms requires substantial time and effort. For example, in 2020, BlackRock spent time meeting with portfolio firms, including over 3,000 in-depth conversations. Please see https://www.blackrock.com/corporate/literature/publication/blk-annual-stewardship-report-2020.pdf.
can improve the stock liquidity of their portfolio firms depends on the existing levels of stock liquidity of portfolio firms (i.e., the lower the initial liquidity, the more likely it is to show improvement). Consistent with this prediction, I find the effect of mutual fund liquidity management on stock liquidity of portfolio firms is more pronounced among portfolio firms with low stock liquidity prior to the regulatory proposal.

Finally, I explore a mechanism through which mutual fund liquidity management influences firm-level liquidity. Extant research documents that information asymmetry is an important factor contributing to stock illiquidity (e.g., Diamond and Verrecchia 1991; Vayanos and Wang 2013). Corporate disclosure is often viewed as a remedy for information asymmetry and relatedly, as a way to improve stock liquidity, in the capital market (e.g., Diamond 1985; Diamond and Verrecchia 1991; Bushman and Indjejikian 1995; Coller and Yohn 1997; Graham et al. 2005; Balakrishnan et al. 2014; Schoenfeld 2017). Prior studies find that institutional investors and mutual funds can affect portfolio firms’ disclosure practices (e.g., Boone and White 2015; Park 2019; Tsang et al. 2019; Abramova et al. 2020). Similar to findings in prior literature, anecdotal evidence shows that mutual funds can directly influence portfolio firms’ disclosure policies (BlackRock 2017). Anecdotal evidence also shows that an optimal response from portfolio firms when mutual funds demand more stock liquidity for liquidity management is to ensure adequate and fair disclosure to the market (Edison 2019). Therefore, I expect that some firms will increase disclosure to improve stock liquidity in response to pressure by mutual funds. Consistent with this expectation, I find that relative to control firms, treatment firms are more likely to provide management earnings forecasts and that those forecasts, on average,
are more precise. I also find that relative to control firms, treatment firms are more likely to hold conference calls, and the contents of these calls are less opaque.

This study makes at least three contributions to the literature. First, this paper adds to the mutual fund literature, particularly the small but growing literature on mutual fund liquidity management. Recent studies find that mutual funds and institutional investors can influence portfolio firms in many areas, such as corporate governance (e.g., Appel et al. 2016; Schmidt and Fahlenbrach 2017), stock liquidity (e.g., Boone and White 2015), and corporate disclosure (e.g., Boone and White 2015; Park 2019; Tsang et al. 2019; Abramova et al. 2020). This paper complements this literature by identifying an important incentive of mutual funds—fund liquidity management—to influence portfolio firms in terms of their stock liquidity and relatedly, disclosure. My results improve understanding of mutual fund liquidity management in practice, which is often unobservable to outsiders.

Second, this study contributes to the disclosure literature and stock liquidity literature. The disclosure literature finds that corporate disclosure is affected by factors related to shareholders, directors, analysts, and managers, such as shareholder litigation (Rogers and Van Buskirk 2009; Bourveau et al. 2018) and manager style (Bamber et al. 2010). My paper extends this line of research by identifying a new determinant, mutual fund liquidity management, as an influence on corporate disclosure. This new determinant of corporate disclosure originates from mutual funds’ incentives to improve portfolio firms’ stock liquidity. My paper also identifies mutual fund liquidity management as a new determinant of stock liquidity and contributes to the liquidity literature by showing that mutual fund liquidity management can influence the stock liquidity of portfolio firms.9

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9 Please see Vayanos and Wang (2013) for a review on the liquidity literature.
Overall, my paper offers the novel insight that external parties with a vested interest in firms’ stock liquidity can influence liquidity via corporate disclosure.

Third, my results might have implications for policy making. My paper is the first to evaluate the SEC rule on regulating mutual fund liquidity and provides evidence for U.S. regulators and regulators in other countries that are considering introducing mutual fund liquidity management regulations. The evidence documented in this paper indicates that the regulation led to an improvement in the stock liquidity of portfolio firms. It also provides novel evidence of a spillover effect of regulation of mutual fund liquidity management on stock liquidity and corporate disclosure of portfolio firms, which is likely an unintended, yet important, consequence.

2. LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

2.1. Main Hypothesis

Under the Investment Company Act of 1940, a mutual fund must pay redemption proceeds to a fund investor no more than seven days after receiving a redemption request. In practice, this redemption is even more timely than that specified in the regulation. To achieve fast redemption, mutual funds often need sufficient cash or liquid securities. Otherwise, they have to sell assets—potentially at a large discount (fire sales) if their trades move prices lower—in exchange for cash to process redemption requests. Coval and Stafford (2007) investigate mutual fund fire sales and find that funds with large redemptions tend to sell existing positions at transaction prices that are substantially below

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10 For example, Britain’s Financial Conduct Authority is considering new rules to strengthen mutual fund liquidity management, especially after LF Woodford Equity Income Fund failed to meet redemption requests in June 2019.
11 Please see https://www.sec.gov/fast-answers/answersmfredemptionshtm.html.
12 Please see https://www.sec.gov/dera/staff-papers/white-papers/liquidity-white-paper-09-2015.pdf.
fundamental values. Concerns about fire sales were amplified during the financial crisis of 2007–2009, when stock liquidity greatly decreased. The SEC thus views fund liquidity as a top priority for mutual funds (Hanouna et al. 2015). As a result, regulatory, academic, and practitioner attention has focused on mutual fund liquidity management, specifically whether mutual fund portfolios have enough liquidity to process fund outflows and guard against potential investor runs.

Prior literature examines several liquidity management tools used by mutual funds, such as cash, interfund lending,\(^{13}\) internal money market funds,\(^{14}\) redemptions in kind,\(^{15}\) and credit lines. Chernenko and Sunderam (2016) find that mutual funds hold cash to accommodate investors’ redemption requests. Agarwal and Zhao (2019) study interfund lending and document that it helps to mitigate fire sales in response to extreme redemption requests. Witmer (2019) points out that some mutual funds use internal money market funds as a potential cash source of mutual fund liquidity management. Ren (2019) finds that some mutual funds use redemptions in kind. Funds also use credit lines to meet redemptions (Wermers 2000; Zeng 2017).

These tools help mutual funds manage their liquidity, but they have limitations. For example, holding cash adversely affects fund performance (e.g., Wermers 2000), and Chernenko and Sunderam (2016) find that mutual funds generally do not hold enough cash for liquidity management. Only 20% of mutual funds are allowed to use interfund lending (Agarwal and Zhao 2019). Zeng (2017) theoretically demonstrates that using credit lines only temporarily mitigates redemption problems and can induce more severe redemptions.

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\(^{13}\) Interfund lending includes borrowing between funds in a mutual fund family. The Investment Company Act of 1940 restricts interfund lending, but mutual funds can apply for exemptions for internal lending.

\(^{14}\) Internal money market funds are money market funds held by other funds in the same fund family.

\(^{15}\) Mutual funds deliver securities instead of cash to fund investors to meet their redemption requests.
in the future. Furthermore, when market liquidity is low, external financing may be infeasible if banks cannot provide promised credit lines to mutual funds (Brunnermeier 2009). Given the limitations of these tools, another way mutual funds can improve portfolio liquidity is to pressure portfolio firms to improve their stock liquidity. After all, portfolio liquidity largely depends on the average liquidity of the portfolio's constituents. This tool (i.e., pressuring portfolio firms to improve liquidity) and the others are independent but not mutually exclusive. Mutual funds may use multiple tools together to reach desired portfolio liquidity levels.

For the “pressure” strategy to work, mutual funds must have sufficient influence over portfolio firms. Prior literature provides strong evidence that mutual funds have such influence. Recent studies find that even passive mutual funds and institutional investors can influence portfolio firms’ disclosure (Boone and White 2015), governance (Appel et al. 2016; Schmidt and Fahlenbrach 2017), tax planning (Khan et al. 2017; Chen et al. 2019), dividend payout policy (Crane et al. 2016), CEO turnover (Kang et al. 2018), and financing activities (Cao et al. 2018). As large shareholders, mutual funds thus should be able to elicit other corporate changes, including stock liquidity improvements, though the effect of mutual fund liquidity management on stock liquidity may be muted. Each liquidity management tool has costs and benefits, and funds pick the best combinations of these tools, which may not include pressuring firms to improve their stock liquidity. Thus, it is an empirical question whether mutual fund liquidity management affects portfolio firms’ stock liquidity. My first hypothesis, stated in the alternative form, is as follows:

**H1:** Mutual fund liquidity management improves stock liquidity of portfolio firms.

### 2.2. Cross-Sectional Predictions
2.2.1. Fund Incentives and Resources

The effect of mutual fund liquidity management on stock liquidity may vary cross-sectionally with fund characteristics. First, a mutual fund with high portfolio liquidity is not incentivized to further improve its portfolio liquidity. As Chen et al. (2010) and Goldstein et al. (2017) show, fund liquidity is a greater concern for illiquid funds than for liquid funds. Thus, I expect the liquidity management effect to be more pronounced among mutual funds with low levels of portfolio liquidity.

Second, mutual funds may find it undesirable to publicly disclose a relatively high percentage of illiquid stocks if it reflects the managers’ poor stock picking skills. Index funds are insulated from this issue because they follow specific indexes, which means they have less flexibility in picking stocks and weak incentives to manage liquidity. Furthermore, holdings of index funds are highly diversified (Bushee and Noe 2000; SEC 2015), making it easier for index funds than non-index funds to meet the new regulation’s liquidity threshold requirements (e.g., 15% illiquid stocks). The liquidity management effect thus is expected to be weaker for index funds than for non-index funds. In summary, I expect the liquidity management effect to increase with the incentives of mutual funds. I state this hypothesis in the alternative form, as follows:

H2: The positive effect of mutual fund liquidity management on stock liquidity of portfolio firms is more pronounced for mutual funds that have stronger incentives to improve fund liquidity.

In addition to fund incentives, mutual funds need enough resources to engage with portfolio firms and influence them. These engagement activities are costly (Bebchuk et al. 2017; Pawliczek et al. 2021). For example, State Street Global Advisors (2020) mentions
that it engaged with 672 companies during 2020 via in-person meetings or conference calls, requiring substantial time and effort from mutual fund managers. In addition, mutual funds may not have the same resources. For example, in-house funds may have more resources devoted to them than funds outsourced to an external asset management company (Chen et al. 2013). Chuprinin et al. (2015) provide similar evidence that outsourced funds are treated less favorably and receive less attention, compared to in-house funds. Given that exerting pressure on portfolio firms to improve stock liquidity requires mutual funds to devote their resources and that resources vary with mutual funds, I expect the liquidity management effect to be more pronounced for funds with more resources than for funds with fewer resources. Thus, I state the hypothesis in the alternative form as follows:

**H3:** The positive effect of mutual fund liquidity management on stock liquidity of portfolio firms is stronger for mutual funds with more resources to influence portfolio firms, compared to mutual funds with fewer resources.

### 2.2.2. Pre-Treatment Stock Liquidity of Portfolio Firms

Finally, the effect of mutual fund liquidity management may vary cross-sectionally with firm characteristics. When portfolio firms have low stock liquidity, they have more room to improve stock liquidity than firms with already high stock liquidity. In addition, mutual funds may not focus on all portfolio firms due to their limited attention and resources. Thus, mutual funds may prioritize low-liquidity stocks over high-liquidity ones. The SEC argues that investing in illiquid stocks increases liquidity risk more than investing in liquid stocks (SEC 2015). Thus, I expect the liquidity management effect to be amplified for firms with low stock liquidity. This leads to the following hypothesis stated in the alternative form:
**H4:** The positive effect of mutual fund liquidity management on stock liquidity of portfolio firms is more pronounced for firms with lower stock liquidity, compared to firms with higher stock liquidity.

3. METHODOLOGY AND DATA

3.1. Identification Strategy

To examine the effect of mutual fund liquidity management on the stock liquidity of portfolio firms, I adopt the following identification strategy. On September 22, 2015, the SEC proposed a new rule to promote effective mutual fund liquidity risk management. The rule seeks to reduce the risk that mutual funds cannot meet redemption obligations, to mitigate dilution of the interests of mutual fund shareholders, and to enhance disclosure of fund liquidity.

The SEC proposal involves several major regulatory changes. First, it requires each mutual fund to establish a liquidity risk management program. Second, each mutual fund must classify each of its portfolio assets (e.g., stocks) into one of six liquidity categories based on the number of days within which the asset will be convertible to cash at a price that does not materially affect the value of that asset immediately prior to sale. Third, the proposal requires each mutual fund to disclose information regarding the liquidity of the fund’s holdings and its liquidity risk management program. Fourth, each mutual fund must determine its minimum percentage of liquid holdings and is prohibited from acquiring a less liquid asset if such acquisition would result in failing to meet its minimum percentage of liquid holdings. Finally, a mutual fund must stop acquiring illiquid assets when its illiquid holdings exceed 15% of net assets. Appendix A provides these requirements in detail.
The SEC regulatory proposal regarding mutual fund liquidity management was adopted on October 13, 2016, and became effective on January 17, 2017. The compliance date is December 1, 2018, for large mutual funds and June 1, 2019, for small mutual funds.\(^\text{16}\) I use the proposal release date (i.e., September 22, 2015) as the event date of my analysis for two reasons. First, whenever the SEC proposes a new rule, the perceived probability of its adoption is high. To the extent that improving mutual fund liquidity and establishing an effective liquidity management program take time, mutual funds have incentives to take immediate actions instead of waiting for formal adoption. For example, immediately after the proposal announcement date, State Street Global Advisors began a liquidity risk management project, which took three years to complete (State Street Global Advisors 2019). Second, except for slight adjustments in response to feedback during the comment periods, the SEC final rules are often similar enough to the proposed rules that mutual funds can take immediate actions. Using legislative proposal dates as treatment dates is also common in the literature (e.g., Cohn et al. 2016; De Simone et al. 2019; Lin et al. 2019).

This regulatory proposal constitutes an exogenous shock to mutual funds’ willingness to improve their portfolio liquidity. It induces funds to improve portfolio liquidity for two reasons: to meet the proposal’s requirements and to avoid fund investors withdrawing their investments due to liquidity concerns. Importantly, this shock is arguably exogenous to stock liquidity and corporate disclosure, thereby allowing identification of the effects of mutual fund liquidity management on portfolio firms’ stock liquidity and corporate disclosure.

\(^\text{16}\) Large mutual funds have net assets of $1 billion or more, and small mutual funds have net assets of less than $1 billion.
I employ a standard difference-in-differences (DID) model. One advantage of using DID in my setting is that it does not require control firms to be comparable to treatment firms. Instead, DID requires that the changes in outcome variables are similar between treatment firms and control firms prior to the treatment. I examine the validity of this “parallel trends” assumption in the next section.\textsuperscript{17} Specifically, I estimate the following model:

\[ Y_{i,t} = \alpha + \beta_1 \text{Treat}_i + \beta_2 \text{Post}_t + \beta_3 \text{Treat}_i \times \text{Post}_t + \beta \text{Controls} + \text{FE} + \epsilon_{i,t}, \quad (1) \]

where \( Y \) is either a stock liquidity variable or a corporate disclosure variable, and \( \text{Treat} \) is an indicator variable equal to 1 if a firm’s mutual fund ownership in the last calendar quarter before September 22, 2015, exceeds the sample median and 0 otherwise.\textsuperscript{18} I expect \( \text{Treat} \) to capture possible differences in stock liquidity and corporate disclosure between the treatment and control groups prior to the SEC mutual fund liquidity management proposal. \( \text{Post} \) is an indicator variable that equals 1 if quarter \( t \) is after September 22, 2015, and 0 otherwise.\textsuperscript{19} It captures the time trend in stock liquidity and disclosure. \( \text{Treat} \times \text{Post} \) is the variable of interest that captures the effect of the SEC proposal on the treatment group. \( \text{Controls} \) is a vector of control variables, and \( \text{FE} \) indicates year-quarter fixed effects and either industry fixed effects (based on Fama-French 48 industry classification) or firm fixed effects.

Standard errors are corrected for clustering at the firm level. In some model specifications, I do not include the main effect of \( \text{Post (Treat)} \) because it is absorbed by

\textsuperscript{17} DID does not require the \textit{levels} of outcome variables to be similar between treatment firms and control firms prior to the treatment.

\textsuperscript{18} Prior studies also have used pre-treatment mutual fund ownership as a treatment variable (e.g., Agarwal et al. 2018).

\textsuperscript{19} I drop the quarter containing September 22, 2015.
year-quarter (firm) fixed effects. When I use probit regressions or ordered probit regressions, I do not include firm fixed effects due to the incidental parameter problem.\footnote{Estimating probit or ordered probit models with firm fixed effects would result in biased and inconsistent point estimates due to the incidental parameter problem (Neyman and Scott 1948; Lancaster 2000; Greene 2012).}

3.2. Parallel Trends Assumption

The key assumption underlying the DID framework is the “parallel trends” assumption, which requires that the treatment and control groups share similar trends in outcome variables during the pre-event period. In other words, there should be no differences in pre-event trends in stock liquidity between treatment and control firms. As Lemmon and Roberts (2010), Fang et al. (2014), and Luong et al. (2017) note, however, the parallel trends assumption does not require the level of outcome variables to be identical across the two groups (i.e., treatment and control groups) or across the two periods (i.e., pre-treatment and post-treatment periods). To evaluate the reasonableness of the parallel trends assumption, I include two additional indicator variables for observations in the first year and the second year prior to the proposal date and their interaction terms with \textit{Post}. The results are reported in Section 4.1.

3.3. Variables and Data

3.3.1. Stock Liquidity and Control Variables

I use the Amihud (2002) liquidity measure, which captures price impacts of trades by computing the ratio of daily absolute returns to the same-day dollar trading volume, and bid-ask spreads to measure stock liquidity. These two measures are widely adopted in the accounting and finance literatures. Furthermore, the SEC directly incorporates these two measures into its proposal. Both measures are multiplied by (-1) so that higher values
indicate higher stock liquidity. I follow Balakrishnan et al. (2014) and include market capitalization (Size), Stock Return Volatility, and Analyst Coverage as control variables for stock liquidity. Appendix B provides detailed variable definitions.

3.3.2. Disclosure Variables and Control Variables

Following prior literature, I measure corporate voluntary disclosure using management earnings guidance and conference calls. The first disclosure measure, Earnings Guidance, captures the likelihood of issuing management guidance. It is an indicator variable that equals 1 if a firm issues at least one management quarterly earnings forecast in a given fiscal quarter and 0 otherwise. Following Armstrong et al. (2014) and Chen and Vashishtha (2017), I compute the precision of management guidance, Guidance Precision, which equals 4 if the firm issues a point forecast, 3 if a range forecast, 2 if an open-ended forecast, 1 if a qualitative forecast, and 0 if no forecast. Similarly, I examine the likelihood of conference calls using Conference Call, an indicator variable that equals 1 if the firm holds at least one conference call in a given fiscal quarter and 0 otherwise. Call Clarity is the Gunning Fog index of conference call transcripts multiplied by (-1) so that larger values indicate greater clarity.

Following prior studies (e.g., Ajinkya et al. 2005; Cassell et al. 2013), I include an extensive set of control variables in the disclosure analyses. I control for Stock Return, Stock Return Volatility, B/M, Size, Earnings Volatility, R&D, Analyst Coverage, News, Loss, Analyst Dispersion, External Financing (Bradshaw et al. 2006), Litigation (firm-year ex ante litigation risk based on Kim and Skinner (2012)), and Competition (firm-year competition based on Li et al. (2013)). Please see Appendix B for variable definitions. Continuous variables are winsorized at the 1st and 99th percentiles.
3.3.3. Data and Descriptive Statistics

My sample period is from September 22, 2012, to September 22, 2018, which includes a 3-year pre-treatment period and 3-year post-treatment period. The sample used in stock liquidity analyses contains 99,772 stock-quarter observations. In the model specifications with firm fixed effects, singleton firms (i.e., firms with only one observation in the sample) are dropped to avoid underestimating standard errors and overstating statistical significance (Correia 2015; deHaan et al. 2017), leading to 99,435 observations. There are 96,852 firm-quarter observations in the disclosure analyses. The exact number of observations in each disclosure analysis varies depending on the specific unit of analysis (e.g., forecast level or conference call level) and data availability. I obtain data from CRSP, Compustat, IBES, Thomson Reuters, and EDGAR. I hand collect conference call information from Seeking Alpha and outsourced mutual fund information from the CRSP Mutual Fund database, the Thomson Mutual Fund Holdings database, and mutual funds’ SEC filings (e.g., Form ADV). Appendix B describes the data sources.

Table 1 presents the descriptive statistics for variables used in the stock liquidity and disclosure analyses. Log Amihud has a mean of -0.197, and Log Spread has a mean of -0.312. The mean value of Earnings Guidance is 0.110, indicating that the unconditional probability of management quarterly earnings forecasts in my sample is 11%. The unconditional probability of conference calls is 70.6%.

[Insert Table 1 here]

4. EMPIRICAL RESULTS

4.1. Impact of Mutual Fund Liquidity Management on Stock Liquidity (H1)
Table 2 examines the effect of mutual fund liquidity management on stock liquidity. In Columns (1) and (2), I measure stock liquidity using Log Amihud and Log Spread, respectively. The coefficients on Treat×Post in both columns are positive and statistically significant at the 1% level, indicating that the increase in stock liquidity of treatment firms exceeds that of control firms in the post-treatment period. These results support H1 that mutual fund liquidity management motivates funds to improve stock liquidity among portfolio firms. The effect is economically significant as well. For example, relative to control firms, treatment firms improve their stock liquidity (Log Spread) by 6.09% following the SEC proposal.\textsuperscript{21} Together, the finding indicates that mutual fund liquidity management, previously thought to be relevant only to mutual funds and fund investors, has a meaningful impact on the liquidity of individual portfolio stocks.

In Columns (3) and (4), I include two additional interaction terms, Treat×Pre1 and Treat×Pre2, to evaluate the parallel trends assumption, where Pre1 and Pre2 are indicator variables for observations in the first year and the second year prior to the proposal date, respectively.\textsuperscript{22} The coefficients on Treat×Post remain statistically significant at the 1% level but are statistically insignificant on both Treat×Pre1 and Treat×Pre2, satisfying the parallel trends assumption.

Treatment firms and control firms have different levels of mutual fund ownership prior to the treatment that may lead to differences in the outcome variables. This is not a concern in the DID research design because any distinctions between treatment firms and control firms are differenced out in the estimation. Nevertheless, I further include firm

\textsuperscript{21} 0.019 (coefficient) / |−0.312| (mean) = 6.09%.
\textsuperscript{22} Post, Pre1, and Pre2 are omitted from the regressions because they are absorbed by year-quarter fixed effects.
fixed effects in the regressions and report the results in Columns (5) and (6). The coefficient estimates on $Treat \times Post$ remain positive and statistically significant at the 1% level. More importantly, the effect remains economically significant even after controlling for firm fixed effects.

[Insert Table 2 here]

4.2. Additional Tests and Robustness Checks

4.2.1. Alternative Treatment Variables

As mutual fund ownership is continuous, I employ an alternative DID research design with a continuous treatment variable (Agarwal et al. 2015). The same interpretation of DID as with a binary treatment variable applies (Angrist and Pischke 2009). Columns (1) to (4) in Panel A of Table 3 present the results. The results are qualitatively similar to the results in Table 2, and the inferences remain unchanged. Specifically, all coefficients on the interaction term between the continuous treatment variable and $Post$ are positive and statistically significant at the 1% level, suggesting that fund liquidity management can improve stock liquidity.

In addition to the continuous treatment variable, I conduct another robustness test based on an alternative binary treatment variable. In my main tests, the binary treatment variable is based on median fund ownership, which is widely used in prior literature (e.g., Agarwal et al. 2018), and the control group includes control firms with mutual fund ownership below the median level, meaning that some control firms have non-zero mutual fund ownership. Here, I use an alternative binary treatment variable that limits the control firms to those with no (zero) mutual fund ownership. Specifically, I define an alternative binary treatment variable that equals 1 if the pre-treatment fund ownership exceeds 0.
Columns (5) to (8) in Panel A of Table 3 report the results. I continue to find the coefficients on $\text{Treat} \times \text{Post}$ to be positive and statistically significant at the 1% level in all specifications.

[Insert Table 3, Panel A here]

4.2.2. **Alternative Stock Liquidity Measures**

In Panel B of Table 3, I examine the robustness of my results using six alternative stock liquidity measures. I first use $\text{Amihud}$ and $\text{Spread}$ without the log transformation (Columns (1) to (4)) and continue to find robust results with these two liquidity measures ($t$-statistics ranging from 4.32 to 6.78). Next, I use $\text{Turnover}$, $\text{Dollar Volume}$, and their log transformations ($\text{Log Turnover}$ and $\text{Log Dollar Volume}$) to measure stock liquidity, because stock turnover and dollar amounts of trading volume are often used as alternative liquidity measures (e.g., Boone and White 2015). In addition, trading volume is one of the liquidity measures that the SEC liquidity management regulation requires fund managers to consider. My results (Columns (5) and (12)) remain robust to using these alternative measures ($t$-statistics ranging from 4.39 to 16.12). Furthermore, in untabulated robustness tests, I apply these alternative stock liquidity measures to the specifications using the continuous treatment variable and alternative binary treatment variable, and I continue to find robust results ($t$-statistics ranging from 4.76 to 18.61).

[Insert Table 3, Panel B here]

4.2.3. **Placebo Tests**

Following prior studies (e.g., Li and Zhang 2015) using DID research design, I perform a set of placebo tests based on a placebo event date (September 22, 2012) that is 3 years before the actual event date. I choose this date because it is closest to the real event date, but the placebo sample period (September 22, 2009, to September 21, 2015) does not include the actual SEC proposal date and thus is not affected by it. Table 3, Panel C presents
the regression results. I find the coefficients on $Treat \times Post \_Placebo$ are insignificant in all specifications ($t$-statistics ranging from -1.16 to 0.51), further confirming that my results are not driven by any specific time trends (Lechner 2011).

[Insert Table 3, Panel C here]

I also perform another set of placebo tests based on the ownership held by non-mutual fund institutions that are not affected by the SEC proposal and thus are not expected to demand more stock liquidity of portfolio firms following the SEC proposal. To measure the ownership of unaffected institutional investors, I first calculate ownership held by all institutional investors, including mutual funds and non-mutual fund institutions. Then, I subtract mutual fund ownership from the total institutional ownership to obtain unaffected ownership. I create two treatment variables $Treat \_IO$ and $Treat \_Unaffected$. $Treat \_IO$ is an indicator variable that equals 1 if total institutional ownership (including mutual fund ownership) in the quarter immediately before September 22, 2015, exceeds the median total institutional ownership and 0 otherwise. $Treat \_Unaffected$ is an indicator variable that equals 1 if unaffected ownership in the quarter immediately before September 22, 2015, exceeds the median unaffected ownership and 0 otherwise, where unaffected ownership equals total institutional ownership minus mutual fund ownership. $Treat \_Unaffected$ thus is a placebo treatment variable.

I replace $Treat$ with $Treat \_IO$ in Equation (1) and report the results in Columns (1) and (2) of Panel D in Table 3. The coefficients on $Treat \_IO \times Post$ are statistically significant at the 1% level with lower magnitudes than the coefficients reported in Table 2. The coefficients are significant because the total institutional ownership contains mutual fund ownership, and the magnitudes are reduced because the total institutional ownership
contains ownership held by non-mutual fund institutions that are not affected by the SEC proposal. To differentiate mutual fund ownership and unaffected ownership, I add \(Treat_{Unaffected}\) and \(Treat_{Unaffected} \times Post\) to Equation (1). I expect the coefficients on \(Treat \times Post\) to be significantly positive and the coefficients on \(Treat_{Unaffected} \times Post\) to be insignificant. Columns (3) and (4) in Panel D of Table 3 report the results. Consistent with my prediction, the coefficients on \(Treat \times Post\) remain economically and statistically significant, and the coefficients on \(Treat_{Unaffected} \times Post\) are statistically insignificant with small magnitudes. These insignificant results provide further evidence that the improvement in stock liquidity is induced by mutual funds for the purpose of liquidity management.

[Insert Table 3, Panel D here]

4.2.4. Changes in Mutual Fund Ownership

To improve portfolio liquidity after the SEC proposal, mutual funds may sell illiquid stocks and buy liquid stocks. I note two consequences when mutual funds manage their portfolio liquidity in this way. First, the liquidity of illiquid stocks worsens because the demand of illiquid stocks decreases. Second, the liquidity of liquid stocks improves because the demand of liquid stocks increases. These two possible consequences could lead to an attenuation bias in my estimates.

To mitigate this concern, I control for concurrent mutual fund ownership as a robustness check in Panel E of Table 3. The results show that coefficients on \(Treat \times Post\) remain statistically and economically significant after controlling for concurrent mutual fund ownership (Mutual Fund Ownership). Specifically, the magnitudes of these coefficients are the same as those reported in Table 2, and the \(t\)-statistics are close to those
in Table 2. In untabulated analyses, the results are similar when I control for lagged mutual fund ownership. In summary, my results are robust to mutual funds’ rebalancing behavior.

[Insert Table 3, Panel E here]

4.3. Cross-Sectional Analyses

In this section, I examine cross-sectional variations in the effect of liquidity management across different groups of mutual funds partitioned by funds’ liquidity management incentives and resources and across subsamples of firms sorted by their levels of pre-treatment liquidity.

4.3.1. Mutual Fund Incentives to Improve Fund Liquidity (H2)

To test H2, I measure mutual funds’ portfolio liquidity to capture their incentives to improve fund liquidity. Yan (2008) and Agarwal and Zhao (2019) use the value-weighted average stock liquidity of all stocks held in a mutual fund’s portfolio to measure mutual fund portfolio liquidity. The SEC proposal uses the same method (weighted average of Amihud liquidity) to measure portfolio liquidity (SEC 2015).23 Following these prior studies and the SEC proposal, I use the value-weighted average stock liquidity of all stocks in a given mutual fund’s portfolio to proxy for mutual fund portfolio liquidity. Specifically, I take the weighted average of Amihud liquidity of all stocks held by a fund to compute this fund’s portfolio liquidity:

\[
\text{Portfolio Liquidity} = \sum \text{Weight}_i \times \text{Stock\_Liquidity}_i, \tag{2}
\]

where \(\text{Weight}_i\) is the weight of stock \(i\) in its portfolio, calculated as the dollar amount of holdings in stock \(i\) divided by the total dollar amount of the portfolio, and \(\text{Stock\_Liquidity}_i\) is measured using \(\log\text{ Amihud}\) of stock \(i\).

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23 The SEC explains in the proposal that “average liquidity of a fund’s equity positions is defined as the asset-weighted average liquidity of the individual equity positions held by the fund.”
I divide mutual funds into liquid and illiquid funds based on the median portfolio liquidity measured immediately before the treatment. I calculate each firm’s liquid fund ownership and illiquid fund ownership and create two binary treatment variables (Treat_LiquidFunds and Treat_IlliquidFunds) based on the median cut-off of liquid fund ownership and illiquid fund ownership, respectively. It is possible for a firm to be held by both liquid funds and illiquid funds at the same time, so the two separate treatment variables capture pressure from the liquid and from the illiquid funds. Columns (1) and (2) in Table 4 present the results based on these two treatment variables. The coefficients on Post×Treat_IlliquidFunds are statistically significant, but the coefficients on Post×Treat_LiquidFunds are not significant. This result further confirms that the findings documented in Table 2 are driven by funds’ liquidity concerns introduced by the proposed regulation. The finding is also consistent with the prediction that less liquid funds have greater incentives to improve portfolio liquidity, supporting H2 that the effect of mutual fund liquidity management on stock liquidity is more pronounced for mutual funds that have stronger incentives to improve fund liquidity.

H2 also predicts that the effect is more pronounced for non-index funds because non-index funds have stronger incentives to improve portfolio liquidity. To test H2, I use the index_fund_flag variable from the CRSP Mutual Funds database to identify index mutual funds and create two binary treatment variables (Treat_IndexFunds and Treat_NonIndexFunds) based on the median index fund ownership and the median non-

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24 This approach of decomposing a binary treatment variable into two binary treatment variables to capture impacts caused by two different groups of mutual funds is used in prior studies examining the effect of mutual funds on portfolio firms. For example, investigating the effect of mutual fund portfolio holding disclosures on innovations, Agarwal et al. (2018, table 7) decompose their binary treatment variable into two binary treatment variables based on the median age of mutual fund managers.
index fund ownership, respectively. As above, these variables are not mutually exclusive. The same firm can have above- or below-median ownership by both index and non-index funds. Columns (3) and (4) in Table 4 provide evidence in support of H2. The effect is more pronounced among non-index funds (t-statistic= 4.56) than index funds.

[Insert Table 4 here]

4.3.2. Mutual Fund Resources to Influence Portfolio Firms (H3)

H3 predicts that the positive effect of mutual fund liquidity management on stock liquidity of portfolio firms is stronger for mutual funds that have more resources to influence portfolio firms. To partition mutual funds based on their resources, I use outsourced funds and in-house funds. Chen et al. (2013) and Chuprinin et al. (2015) argue that outsourced funds are treated less favorably than funds managed in-house. I therefore identify funds that are outsourced to external asset management companies and funds that are managed in-house. For each firm, I calculate outsourced funds’ ownership and in-house funds’ ownership prior to the treatment. I then create a binary treatment variable (Treat_Outsourced) based on the median outsourced funds’ ownership and another binary treatment variable (Treat_In-House) based on the median in-house funds’ ownership. Consistent with H3, results in Table 5 suggest that the effect is concentrated among funds with more resources, that is, in-house funds (t-statistics= 4.61 and 3.55), relative to funds with fewer resources, that is, outsourced funds (t-statistics= -0.08 and 1.35).

[Insert Table 5 here]

4.3.3. Pre-Treatment Stock Liquidity (H4)

Table 6 examines H4 regarding the pre-treatment stock liquidity of portfolio firms. I use Log Amihud and Log Spread measured before the proposal date to proxy for the pre-
treatment stock liquidity and use the sample median to split the sample into high and low pre-treatment stock liquidity subsamples. Then, I estimate Equation (1) separately for the two subsamples and compare the coefficients on \( \text{Treat} \times \text{Post} \) between the two subsamples. Table 6 presents the regression coefficient estimates in the subsamples partitioned based on pre-treatment stock liquidity. In both low-liquidity subsamples (Columns (1) and (3)), the coefficients are statistically and economically significant. In contrast, both high-liquidity subsamples (Columns (2) and (4)) experience insignificant stock liquidity improvement. The difference between the two subsamples is statistically significant (\( p \)-value \(< 0.001 \) in both measures). Overall, the results in Table 6 support H4 that the positive effect of mutual fund liquidity management on stock liquidity of portfolio firms is more pronounced for firms with lower stock liquidity.

[Insert Table 6 here]

5. CORPORATE DISCLOSURE AS A MECHANISM

In this section, I evaluate one possible mechanism, corporate disclosure, through which funds’ liquidity management affects stock liquidity of portfolio firms. Prior theoretical and empirical studies document that information asymmetry is an important determinant of stock liquidity. One way for firms to increase liquidity is to reduce information asymmetry (e.g., Diamond and Verrecchia 1991; Vayanos and Wang 2013). Extensive literature has explored the effects of corporate disclosure on information asymmetry and stock liquidity. Theoretical research has shown that corporate disclosure can improve stock liquidity (Diamond 1985; Diamond and Verrecchia 1991; Bushman and Indjejikian 1995). Consistent with the theoretical prediction, Coller and Yohn (1997) find that managers release earnings forecasts to reduce information asymmetry and that
management earnings forecasts improve stock liquidity. More importantly, Coller and Yohn (1997) show that stock liquidity improves immediately after the management earnings forecast, and the effect can persist for some time. Brown et al. (2004) find that conference calls are negatively associated with information asymmetry.

Recent empirical studies document further evidence that corporate disclosure can affect stock liquidity and that managers actively use disclosure to improve stock liquidity. Specifically, using a natural experiment that introduces exogenous variation in the supply of public information, Balakrishnan et al. (2014) find that firm managers provide quarterly earnings guidance to improve stock liquidity. Employing a recursive structural equation model of voluntary disclosure, Schoenfeld (2017) points out the effects of management guidance and 8-K filings on stock liquidity. Finally, survey evidence indicates that a strong motivation for voluntary disclosure is to reduce information asymmetry, and firm managers confirm that voluntary disclosure effectively improves stock liquidity (Graham et al. 2005).

In addition to the prior literature and survey evidence showing the effect of disclosure on stock liquidity, anecdotal evidence also shows that mutual funds indeed ask portfolio firms to improve disclosure. For instance, BlackRock (2021, p. 6) states that “We initiate many of our engagements because a company’s disclosures do not provide the information necessary for us to assess the quality of their governance or business practices. We recommend companies review their reporting in light of their investors’ changing expectations of company disclosures … Most commonly we hold the responsible members of the board accountable when a company’s practices or disclosures fall short by voting against their re-election.” Therefore, I expect that mutual funds will focus on corporate disclosure when pressuring portfolio firms to improve stock liquidity. Following prior
studies (e.g., Jayaratne and Strahan 1996; Fang et al. 2014), I replace outcome variables (stock liquidity measures) with mechanism variables (disclosure measures) in Eq. (1).

5.1. Management Earnings Forecasts

I first estimate a probit regression to investigate whether a firm is more likely to issue quarterly earnings forecasts after the SEC proposal. The dependent variable is Earnings Guidance. Table 7, Column (1) presents the results. The coefficient on Treat×Post is 0.24 and statistically significant at the 1% level (t-statistic=3.03). The marginal effect is 3.26%, which is economically significant considering that the unconditional probability of issuing earnings guidance in this sample is 11%. This liquidity management effect is notable because firm disclosure policies tend to be sticky over time (Bushee et al. 2003; Boone and White 2015; Li and Yang 2015). Results are similar when I use a logit regression. My second test involves estimating an ordered probit model of the precision of management forecasts. Column (2) in Table 7 shows that treatment firms provide more precise forecasts than control firms after the liquidity management shock. Results are similar when I use an ordered logistic regression. These findings provide suggestive evidence that management guidance is a mechanism through which mutual fund liquidity management improves stock liquidity.

5.2. Conference Calls

Panel A of Table 8 reports probit regression results of estimating the likelihood of holding conference calls. The coefficient on Treat×Post is both statistically and

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25 Because of the sticky disclosure policies, Boone and White (2015) include a lagged dependent variable in their 2SLS regressions. I do not include a lagged dependent variable because my estimation is a DID estimator, which is not required to control for a lagged outcome variable (Lechner 2011).
economically significant, with treatment firms being 6.88% more likely than control firms to hold conference calls after the proposal announcement. Results are similar if I use a logit regression. Panel B in Table 8 presents results on the clarity of conference call presentations and managers’ answers during Q&A sessions (Columns (1) and (2)), presentations only (Columns (3) and (4)), and managers’ answers only (Columns (5) and (6)). In all specifications, the coefficients on $Treat \times Post$ are positive (more understandable) and statistically significant at the 1% level ($t$-statistics ranging from 3.23 to 10.59). Panel B indicates that managers in treatment firms provide presentations and answers that are easier for market participants to understand, compared to those provided by managers in control firms, after the fund liquidity management regulation is proposed. Together, Table 8 provides suggestive evidence in support of the disclosure mechanism.

[Insert Table 8 here]

In summary, the results in this subsection and Section 5.1 suggest that mutual funds pressure portfolio firms to improve corporate disclosure, which ultimately helps improve stock liquidity. As such, the results provide empirical support for the disclosure mechanism and show an unintended consequence that mutual fund liquidity management increases the frequency of voluntary disclosure and improves the quality of voluntary disclosure among portfolio firms.

5.3. Validation of Corporate Disclosure Mechanism

In this section, I validate the disclosure mechanism through which portfolio firms increase their stock liquidity. Specifically, I examine whether stock liquidity improvement is driven by disclosure improvement around the SEC proposal using four individual measures of disclosure improvement: earnings guidance likelihood, guidance precision,
conference call likelihood, and call clarity. In Table 9, I use an indicator variable \( (Improved\_Disclosure) \) that equals 1 if a specific dimension of a treatment firm’s disclosure improves during the post-treatment period, relative to the pre-treatment period, and 0 otherwise. I replace \( Treat \) in Equation (1) with \( Improved\_Disclosure \) and estimate the modified regressions.\(^{26}\) I do not include \( Post \ (Improved\_Disclosure) \) because it is absorbed by year-quarter (firm) fixed effects. As shown in Table 9, the coefficients on \( Improved\_Disclosure \times Post \) are significantly positive in all columns, indicating that liquidity improvement is at least partially driven by improved corporate disclosure. In summary, these results show that after the SEC proposal, portfolio firms with improved disclosure also experience improved stock liquidity, suggesting that disclosure is a possible mechanism through which liquidity management at the fund level affects stock liquidity at the firm level.

[Insert Table 9 here]

6. CONCLUSION

In this paper, I use a quasi-natural experiment created by the SEC mutual fund liquidity management proposal to examine a new and unresolved question of whether mutual funds, for the purpose of liquidity management, influence their portfolio firms’ stock liquidity and disclosure activities. My results provide evidence that mutual fund liquidity management improves the stock liquidity of portfolio firms. Further analyses find that this improvement is more pronounced among funds with stronger incentives to increase liquidity and with more resources to influence portfolio firms. My findings are

\(^{26}\) Replacing a treatment variable with a non-treatment variable in a DID setting is often used for supplementary analyses in the literature. For example, Agarwal et al. (2018, Table IA13) replace their treatment variable with performance measures.
stronger for firms with lower pre-treatment stock liquidity, compared to firms with higher pre-treatment stock liquidity. I also document that mutual funds improve stock liquidity of portfolio firms by enhancing these firms’ corporate disclosure.

This paper is the first to evaluate the effects of mutual fund liquidity management regulation on public firms. The results should be of interest to regulators, researchers, and practitioners. For regulators, the results reveal potential consequences of mutual fund liquidity management regulations and their spillover effects on portfolio firms. For researchers in accounting and finance, both stock liquidity and disclosure are central to capital market research, and mutual fund liquidity management is an increasingly important research topic. For practitioners, my paper suggests that mutual fund liquidity management can play an important role in portfolio management. Requesting that portfolio firms improve disclosure and liquidity is an effective method of fund liquidity management. I show that fund liquidity management can benefit firms in terms of improving their stock liquidity. However, my study does not shed light on the costs of implementing liquidity management and increasing firm disclosure.
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Appendix A
Details of the SEC Proposal

Panel A. Timeline of Rules

| Date               | Event                                                                 |
|--------------------|----------------------------------------------------------------------|
| September 22, 2015 | The SEC proposes mutual fund liquidity management rules.              |
| October 13, 2016   | The SEC adopts proposed rules with minor changes.                     |
| January 17, 2017   | The mutual fund liquidity management rules become effective.          |
| December 1, 2018   | Mutual funds with net assets of $1 billion or more begin compliance.  |
| June 1, 2019       | Mutual funds with net assets of less than $1 billion begin compliance. |

Panel B. Regulatory Requirements

1. Each mutual fund is required to establish a liquidity risk management program.

2. Each mutual fund is required to classify each of its portfolio assets into one of six liquidity categories based on the number of days within which the asset will be convertible to cash at a price that does not materially affect the value of that asset immediately prior to sale. The six liquidity categories include (1) 1 business day; (2) 2–3 business days; (3) 4–7 calendar days; (4) 8–15 calendar days; (5) 16–30 calendar days; and (6) more than 30 calendar days. In addition, each mutual fund must consider the following factors when classifying the liquidity of each stock position (this appendix covers only factors related to stocks): (1) bid-ask spreads; (2) daily trading volume and frequency of trades or quotes; (3) number, diversity, and quality of market participants; (4) volatility of trading prices; (5) ratio of fund’s holding size of the stock to the daily trading volume of the stock and the ratio of the fund’s holding shares of the stock to the shares outstanding of the stock; and (6) relationship of the stock to another asset in the fund’s portfolio.

3. Each mutual fund is required to disclose information regarding the liquidity of the fund’s holdings and its liquidity risk management program.

4. Each mutual fund is required to determine the fund’s minimum percentage of net assets to be invested in 3-day liquid assets, including a written record of how the minimum is determined. The 3-day liquid asset is defined as any cash or asset held by a fund that can be convertible into cash within 3 business days at a price that does not materially affect the value of that asset immediately prior to sale. A fund would be prohibited from acquiring a less liquid asset if, immediately after the acquisition, the fund would have invested less than this minimum.
5. A fund is prohibited from acquiring any 15% standard asset if, immediately after the acquisition, the fund would have invested more than 15% of its net assets in the 15% standard assets. A 15% standard asset is any asset that may not be sold or disposed of within 7 calendar days at approximately the value ascribed to it by the fund.
Appendix B
Variable Definitions

1. Stock Liquidity Measures

*Amihud* is the quarterly average of a stock’s daily stock liquidity, developed in Amihud (2002). Following Amihud (2002), I use daily CRSP data to calculate the daily stock liquidity as \((-1) \times \frac{\text{Return} \times 10^6}{\text{Price} \times \text{Volume}}\) for each day in a fiscal quarter, where *Return* is the daily stock return, *Price* is the daily closing price, and *Volume* is the daily total number of shares sold. I then average the daily stock liquidity over the fiscal quarter. (Data source: CRSP)

*Log Amihud* is the natural logarithm of 1 plus quarterly Amihud for each fiscal quarter.

*Spread* is the quarterly average of a stock’s daily bid-ask spread. I use daily CRSP data to calculate the daily bid-ask spread as \((-1) \times \frac{100 \times (\text{Ask} - \text{Bid})}{(\text{Ask} + \text{Bid})/2}\), where *Ask* is the daily closing ask price and *Bid* is the daily closing bid price. I then average the daily bid-ask spread over the fiscal quarter. (Data source: CRSP)

*Log Spread* is the natural logarithm of 1 plus quarterly Spread for each fiscal quarter.

*Turnover* is the quarterly average of a stock’s daily turnover. I use daily CRSP data to calculate the daily turnover as \(\frac{\text{Volume}}{\text{Shares}}\), where *Volume* is the daily total number of shares sold and *Shares* is the daily total number of shares outstanding. I then average the daily turnover over the fiscal quarter. (Data source: CRSP)

*Log Turnover* is the natural logarithm of 1 plus quarterly Turnover for each fiscal quarter.

*Dollar Volume* is the quarterly average of a stock’s daily dollar volume. I use daily CRSP data to calculate the daily dollar volume as \(\text{Volume} \times \text{Price}\), where *Volume* is the daily total number of shares sold and *Price* is the daily closing price. I then average the daily dollar volume over the fiscal quarter. (Data source: CRSP)

*Log Dollar Volume* is the natural logarithm of 1 plus quarterly Dollar Volume for each fiscal quarter.

2. Control Variables for Stock Liquidity (following Balakrishnan et al. 2014, p. 2249-2250)

*Size* is the natural logarithm of market capitalization at the end of the fiscal quarter. (Data source: Compustat)

*Stock Return Volatility* is the standard deviation of daily stock returns in the fiscal quarter. (Data source: CRSP)

*Analyst Coverage* is the number of analysts covering the firm in the fiscal quarter. (Data source: IBES)

3. Mutual Fund Variables (identified immediately before September 22, 2015)

*IlliquidFunds* is a group of mutual funds whose portfolio liquidity is below the median portfolio liquidity. Portfolio liquidity is measured as the value-weighted liquidity of stocks in the portfolio (i.e., \(\sum \text{Weight}_i \times \text{Stock Liquidity}_i\)), where *Weight* is the portfolio weight on stock *i* and *Stock Liquidity* is *Log Amihud* of stock *i*. This portfolio liquidity measure is the same as the one used by the SEC in the proposal. (Data source: CRSP and Thomson Reuters)
**LiquidFunds** is a group of mutual funds whose portfolio liquidity exceeds the median portfolio liquidity. (Data source: CRSP and Thomson Reuters)

**Outsourced** is a group of mutual funds that are outsourced. Following Chen et al. (2013) and Chuprinin et al. (2015), I identify a mutual fund as an outsourced mutual fund if the name of this mutual fund’s advisor is different from the name of the mutual fund family complex and the advisor is not affiliated. (Data source: hand-collection)

**In-House** is a group of mutual funds that are managed within the mutual fund family complex. (Data source: hand-collection)

**IndexFunds** is a group of index mutual funds. I use a variable (index_fund_flag) in the CRSP Mutual Funds database to identify index mutual funds. A mutual fund is identified as an index fund if index_fund_flag is equal to B, D, or E. (Data source: CRSP)

**NonIndexFunds** is a group of mutual funds that are not index funds. (Data source: CRSP)

4. **Pre-Treatment Stock Liquidity Variables**

   **Pre-Treatment Log Amihud** is the natural logarithm of 1 plus quarterly Amihud for the fiscal quarter immediately before September 22, 2015. (Data source: CRSP)

   **Pre-Treatment Log Spread** is the natural logarithm of 1 plus quarterly Spread for the fiscal quarter immediately before September 22, 2015. (Data source: CRSP)

5. **Information Disclosure Variables**

   **Earnings Guidance** is an indicator variable that equals 1 if the firm issues at least one management quarterly earnings forecast in the fiscal quarter and 0 otherwise. (Data source: IBES)

   **Guidance Precision** measures the precision of management quarterly earnings forecasts issued in the fiscal quarter. It equals 4 if the forecast is a point forecast, 3 if the forecast is a range forecast, 2 if the forecast is an open-ended forecast, 1 if the forecast is a qualitative forecast, and 0 if there is no forecast in the fiscal quarter. (Data source: IBES)

   **Conference Call** is an indicator variable that equals 1 if the firm holds at least one conference call in the fiscal quarter and 0 otherwise. (Data source: Seeking Alpha)

   **Call Clarity** is the Gunning Fog index of the conference call transcripts, multiplied by (-1). (Data source: Seeking Alpha)

   **Improved_Disclosure** is an indicator variable that equals 1 if a specific dimension of a treatment firm’s disclosure (earnings guidance likelihood, guidance precision, conference call likelihood, or call clarity) improves in the post-treatment period relative to the pre-treatment period, and 0 otherwise.

6. **Control Variables for Information Disclosure**

   **Stock Return** is the cumulative stock return in the fiscal quarter. (Data source: CRSP)

   **Stock Return Volatility** is the standard deviation of daily stock returns in the fiscal quarter. (Data source: CRSP)

   **B/M** is the book value of equity divided by the market value of equity at the beginning of the fiscal quarter. (Data source: Compustat)

   **Size** is the natural logarithm of market capitalization at the end of the fiscal quarter. (Data source: Compustat)

   **Earnings Volatility** is the standard deviation of quarterly net income in the past 12 quarters with a minimum of three quarters of data. (Data source: Compustat)
**R&D** is an indicator variable that equals 1 if research and development expense in the fiscal quarter exceeds 0 and 0 otherwise. (Data source: Compustat)

**Analyst Coverage** is the number of analysts covering the firm in the fiscal quarter. (Data source: IBES).

**News** is an indicator variable that equals 1 if the EPS of current fiscal quarter \( t \) is greater than or equal to the EPS of fiscal quarter \( t-4 \) and 0 otherwise. (Data source: Compustat)

**Loss** is an indicator variable that equals 1 if the EPS in the fiscal quarter is less than 0 and 0 otherwise. (Data source: Compustat)

**Analyst Dispersion** is standard deviation of analysts' earnings forecasts divided by the stock price at the beginning of the fiscal quarter. (Data source: IBES)

**External Financing** is an indicator variable that equals 1 if the fiscal year’s external financing exceeds 0 and 0 otherwise, where the external financing is measured following Bradshaw et al. (2006). (Data source: Compustat)

**Litigation** is firm-year ex ante litigation risk, estimated using the coefficient estimates from model (3) in Kim and Skinner (2012). (Data source: Compustat)

**Competition** is a firm-year measure of competition developed in Li et al. (2013) and is calculated as \( 1000 \times \frac{\text{number of competition-related words}}{\text{total number of words}} \) in the current year’s 10-K filing. Competition-related words include “competition,” “competitor,” “competitive,” “compete,” “competing,” and any variations with an “s” appended. Following Li et al. (2013), I omit cases where “not,” “less,” “few,” or “limited” precedes the competition-related word by three or fewer words. (Data source: EDGAR)

### 7. Treatment-Related Variables

**Post** is an indicator variable that equals 1 if the observation is in the post-treatment period (i.e., from September 22, 2015, to September 22, 2018) and 0 otherwise.

**Treat** is an indicator variable that equals 1 if mutual fund ownership in the quarter immediately before September 22, 2015, exceeds the median mutual fund ownership and 0 otherwise.

**Pre1** is an indicator variable that equals 1 if the observation is in the first year prior to the SEC proposal date (i.e., from September 22, 2014, to September 22, 2015) and 0 otherwise.

**Pre2** is an indicator variable that equals 1 if the observation is in the second year prior to the SEC proposal date (i.e., from September 22, 2013, to September 22, 2014) and 0 otherwise.

**Treat_Altarnative** is an indicator variable that equals 1 if mutual fund ownership in the quarter immediately before September 22, 2015, exceeds 0 and 0 otherwise.

**Treat_Continuous** is the mutual fund ownership in the quarter immediately before September 22, 2015.

**Treat_IlliquidFunds** is an indicator variable that equals 1 if ownership held by IlliquidFunds exceeds the median ownership held by IlliquidFunds and 0 otherwise.

**Treat_LiquidFunds** is an indicator variable that equals 1 if ownership held by LiquidFunds exceeds the median ownership held by LiquidFunds and 0 otherwise.

**Treat_Outsourced** is an indicator variable that equals 1 if ownership held by Outsourced exceeds the median ownership held by Outsourced and 0 otherwise.
Treat_In-House is an indicator variable that equals 1 if ownership held by In-House exceeds the median ownership held by In-House and 0 otherwise.

Treat_IndexFunds is an indicator variable that equals 1 if ownership held by IndexFunds exceeds the median ownership held by IndexFunds and 0 otherwise.

Treat_NonIndexFunds is an indicator variable that equals 1 if ownership held by NonIndexFunds exceeds the median ownership held by NonIndexFunds and 0 otherwise.

Post Placebo is an indicator variable that equals 1 if the observation is in the placebo post-treatment period (i.e., from September 22, 2012, to September 21, 2015) and 0 otherwise.

Treat_IO is an indicator variable that equals 1 if total institutional ownership (including mutual fund ownership) in the quarter immediately before September 22, 2015, exceeds the median total institutional ownership and 0 otherwise.

Treat_Unaffected is an indicator variable that equals 1 if unaffected ownership in the quarter immediately before September 22, 2015, exceeds the median unaffected ownership and 0 otherwise, where unaffected ownership equals total institutional ownership minus mutual fund ownership.

Mutual Fund Ownership is the ownership held by mutual funds in the concurrent quarter.
### Table 1
**Descriptive Statistics**

| Variable                          | N    | Mean  | SD    | P25  | Median | P75  |
|-----------------------------------|------|-------|-------|------|--------|------|
| **Dependent Variables in Stock Liquidity Analyses:** |      |       |       |      |        |      |
| Amihud                           | 99,772 | -0.994 | 5.260 | -0.050 | -0.005 | -0.001 |
| Log Amihud                       | 99,772 | -0.197 | 0.607 | -0.049 | -0.005 | -0.001 |
| Spread                           | 99,772 | -0.530 | 0.988 | -0.457 | -0.140 | -0.054 |
| Log Spread                       | 99,772 | -0.312 | 0.414 | -0.376 | -0.131 | -0.052 |
| **Main Treatment Variable:**     |      |       |       |      |        |      |
| Treat                            | 99,772 | 0.504  | 0.500 | 0.000  | 1.000  | 1.000  |
| **Control Variables in Stock Liquidity Analyses:** |      |       |       |      |        |      |
| Size                             | 99,772 | 6.249  | 2.200 | 4.706  | 6.209  | 7.756  |
| Stock Return Volatility          | 99,772 | 0.022  | 0.017 | 0.011  | 0.017  | 0.028  |
| Analyst Coverage                 | 99,772 | 4.636  | 6.609 | 0.000  | 2.000  | 7.000  |
| **Dependent Variables in Disclosure Analyses:** |      |       |       |      |        |      |
| Earnings Guidance                | 95,693 | 0.110  | 0.313 | 0.000  | 0.000  | 0.000  |
| Guidance Precision               | 98,405 | 0.383  | 1.029 | 0.000  | 0.000  | 0.000  |
| Conference Call                  | 96,852 | 0.706  | 0.456 | 0.000  | 1.000  | 1.000  |
| Call Clarity (all)               | 71,884 | -34.830 | 8.308 | -39.154 | -33.282 | -28.918 |
| **Additional Control Variables (at the firm-quarter level):** |      |       |       |      |        |      |
| Stock Return                     | 96,852 | 0.057  | 0.243 | -0.071 | 0.045  | 0.166  |
| B/M                              | 96,852 | 0.602  | 0.776 | 0.244  | 0.479  | 0.818  |
| Earnings Volatility              | 96,852 | 0.039  | 0.231 | 0.005  | 0.012  | 0.031  |
| R&D                              | 96,852 | 0.348  | 0.476 | 0.000  | 0.000  | 1.000  |
| News                             | 96,852 | 0.549  | 0.498 | 0.000  | 1.000  | 1.000  |
| Loss                             | 96,852 | 0.335  | 0.472 | 0.000  | 0.000  | 1.000  |
| Analyst Dispersion               | 96,852 | 0.003  | 0.007 | 0.000  | 0.001  | 0.002  |
| External Financing               | 96,852 | 0.395  | 0.489 | 0.000  | 0.000  | 1.000  |
| Litigation                       | 96,852 | 0.133  | 0.137 | 0.010  | 0.079  | 0.246  |
| Competition                      | 96,852 | 0.641  | 0.447 | 0.334  | 0.616  | 0.932  |

*Notes:* This table reports descriptive statistics for the main variables used in stock liquidity and disclosure analyses. Appendix B contains variable definitions. The sample period is 2012 – 2018.
Table 2
Effect of Mutual Fund Liquidity Management on Stock Liquidity of Portfolio Firms (H1)

| Dependent Variables: | Baseline Model | Parallel Trends | Firm Fixed Effects |
|----------------------|----------------|-----------------|--------------------|
|                      | Log Amihud     | Log Spread      | Log Amihud         | Log Spread         | Log Amihud          | Log Spread          |
| Treat×Post           | 0.049***       | 0.190***        | 0.063***           | 0.027***           | 0.058***            | 0.027***            |
|                      | (5.49)         | (4.22)          | (3.79)             | (3.54)             | (7.95)              | (7.25)              |
| Treat                | 0.208***       | 0.140***        | 0.020              | 0.009              | 0.027***            | 0.027***            |
|                      | (14.10)        | (16.85)         | (0.85)             | (0.86)             |                     |                     |
| Treat×Pre2           | -0.018         | -0.001          | (-1.25)            | (-0.11)            |                     |                     |
| Treat×Pre1           | 0.006          | 0.008           |                     |                     |                     |                     |
|                      | (0.37)         | (1.01)          |                     |                     |                     |                     |
| Size                 | 0.107***       | 0.101***        | 0.112***           | 0.104***           | 0.123***            | 0.112***            |
|                      | (33.36)        | (53.69)         | (32.08)            | (52.45)            | (23.96)             | (39.31)             |
| Stock Return Volatility | -4.785***     | -5.506***       | -5.412***          | -5.913***          | -1.208***           | -2.480***           |
|                      | (-10.78)       | (-24.04)        | (-11.91)           | (-25.30)           | (-4.22)             | (-16.78)            |
| Analyst Coverage     | -0.003***      | 0.004***        | 0.0003             | 0.006***           | 0.001               | 0.006***            |
|                      | (-4.59)        | (6.84)          | (0.52)             | (10.97)            | (1.50)              | (15.31)             |
| Year-Quarter FE      | Yes            | Yes             | Yes                | Yes                | Yes                 | Yes                 |
| Industry FE          | Yes            | Yes             | Yes                | Yes                | No                  | No                  |
| Firm FE              | No             | No              | No                 | No                 | Yes                 | Yes                 |
| Firm Clustered SE    | Yes            | Yes             | Yes                | Yes                | Yes                 | Yes                 |
| # of Observations    | 99,772         | 99,772          | 99,772             | 99,772             | 99,435              | 99,435              |
| Adj. R-Squared       | 0.283          | 0.570           | 0.263              | 0.552              | 0.734               | 0.888               |

Notes: This table reports results on the effect of mutual fund liquidity management on stock liquidity. Log Amihud is the natural logarithm of 1 plus quarterly Amihud for each fiscal quarter, where Amihud is the quarterly average of a stock’s daily stock liquidity developed in Amihud (2002). Log Spread is the natural logarithm of 1 plus quarterly Spread for each fiscal quarter, where Spread is the quarterly average of a stock’s daily bid-ask spread. Columns (1) and (2) report the main effect, Columns (3) and (4) validate the assumption of parallel trends, and Columns (5) and (6) estimate a firm fixed effects specification. In the firm fixed effects specification, singleton firms are dropped to avoid underestimating standard errors and overstating statistical significance (Correia 2015; deHaan et al. 2017). The t-statistics reported in parentheses are based on standard errors clustered by firm. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively, using two-tailed tests. Appendix B contains variable definitions.
Table 3  
Effect of Mutual Fund Liquidity Management on Stock Liquidity of Portfolio Firms (H1): Robustness Checks and Placebo Tests

Panel A. Alternative Treatment Variables

| Dependent Variables: | Continuous Treatment Variable | Alternative Binary Treatment Variable |
|----------------------|-------------------------------|--------------------------------------|
|                      | Log Amihud                    | Log Spread                           |
|                      | (1)                           | (2)                                  |
| Treat_Continuous×Post| 0.121***                      | 0.139***                             |
|                      | (5.90)                        | (8.68)                               |
| Treat_Continuous     | 0.397***                      | 0.456***                             |
|                      | (14.34)                       | (23.96)                              |
| Treat_Alternative×Post| 0.068***                     | 0.061***                             |
|                      | (7.00)                        | (8.01)                               |
| Treat_Alternative    | 0.015                         | 0.012                                |
|                      | (0.79)                        | (1.28)                               |
| Control Variables    | Included                      | Included                             |
| Year-Quarter FE      | Yes                           | Yes                                  |
| Industry FE          | Yes                           | No                                   |
| Firm FE              | No                            | Yes                                  |
| Firm Clustered SE    | Yes                           | Yes                                  |
| # of Observations    | 99,772                        | 99,435                               |
| Adj. R-Squared       | 0.271                         | 0.733                                |
Table 3 (continued)

Panel B. Alternative Stock Liquidity Measures

| Dependent Variables: | (1) | (2) | (3) | (4) | (5) | (6) |
|----------------------|-----|-----|-----|-----|-----|-----|
| Treat\times Post    | 0.400*** | 0.431*** | 0.055*** | 0.071*** | 0.001*** | 0.002*** |
|                      | (4.71) | (5.85) | (4.32) | (6.78) | (4.93) | (8.42) |
| Treat                | 1.335*** | 0.340*** | -0.004*** |       |       |       |
|                      | (11.37) | (15.80) | (-9.24) |       |       |       |
| Control Variables    | Included | Included | Included | Included | Included | Included |
| Year-Quarter FE      | Yes   | Yes    | Yes    | Yes    | Yes    | Yes    |
| Industry FE          | Yes   | No     | Yes    | No     | Yes    | No     |
| Firm FE              | No    | Yes    | No     | Yes    | No     | Yes    |
| Firm Clustered SE   | Yes   | Yes    | Yes    | Yes    | Yes    | Yes    |
| # of Observations    | 99,772 | 99,435 | 99,772 | 99,435 | 99,772 | 99,435 |
| Adj. R-Squared       | 0.133 | 0.531 | 0.446 | 0.826 | 0.146 | 0.714 |

| Dependent Variables: | (7) | (8) | (9) | (10) | (11) | (12) |
|----------------------|-----|-----|-----|------|------|------|
| Treat\times Post    | 0.001*** | 0.002*** | 4.683*** | 3.796*** | 0.171*** | 0.202*** |
|                      | (5.14) | (8.70) | (5.53) | (5.91) | (10.99) | (16.12) |
| Treat                | -0.003*** | -21.627*** | 0.286*** |       |       |       |
|                      | (-9.28) | (-13.42) | (9.40) |       |       |       |
| Control Variables    | Included | Included | Included | Included | Included | Included |
| Year-Quarter FE      | Yes   | Yes    | Yes    | Yes    | Yes    | Yes    |
| Industry FE          | Yes   | No     | Yes    | No     | Yes    | No     |
| Firm FE              | No    | Yes    | No     | Yes    | No     | Yes    |
| Firm Clustered SE   | Yes   | Yes    | Yes    | Yes    | Yes    | Yes    |
| # of Observations    | 99,772 | 99,435 | 99,772 | 99,435 | 99,772 | 99,435 |
| Adj. R-Squared       | 0.149 | 0.716 | 0.426 | 0.932 | 0.839 | 0.957 |

Panel C. Placebo Date

| Dependent Variables: | Log Amihud | Log Spread |
|----------------------|------------|------------|
|                      | (1) | (2) | (3) | (4) |
| Treat\times Placebo  | -0.017 | 0.007 | 0.002 | -0.001 |
|                      | (-1.16) | (0.51) | (0.25) | (-0.15) |
| Treat                | 0.180*** | 0.110*** |      |      |
|                      | (11.04) | (12.74) |      |      |
| Control Variables    | Included | Included | Included | Included |
| Year-Quarter FE      | Yes   | Yes    | Yes    | Yes    |
| Industry FE          | Yes   | No     | Yes    | No     |
| Firm FE              | No    | Yes    | No     | Yes    |
| Firm Clustered SE   | Yes   | Yes    | Yes    | Yes    |
| # of Observations    | 93,775 | 93,521 | 93,775 | 93,521 |
| Adj. R-Squared       | 0.336 | 0.762 | 0.608 | 0.902 |
Table 3 (continued)

Panel D. Unaffected Institutional Investors

| Dependent Variables: | Log Amihud | Log Spread | Log Amihud | Log Spread |
|----------------------|------------|------------|------------|------------|
|                      | (1)        | (2)        | (3)        | (4)        |
| Treat_IO×Post        | 0.030***   | 0.016***   | 0.061***   | 0.028***   |
|                      | (4.14)     | (4.13)     | (7.46)     | (6.63)     |
| Treat×Post           |            |            |            |            |
|                      | 0.061***   | 0.028***   |            |            |
|                      | (7.46)     | (6.63)     |            |            |
| Treat_Unaffected×Post|            |            |            |            |
|                      | -0.007     | -0.003     |            |            |
|                      | (-0.85)    | (-0.67)    |            |            |
| Control Variables    | Included   | Included   | Included   | Included   |
| Year-Quarter FE      | Yes        | Yes        | Yes        | Yes        |
| Firm FE              | Yes        | Yes        | Yes        | Yes        |
| Firm Clustered SE    | Yes        | Yes        | Yes        | Yes        |
| # of Observations    | 99,435     | 99,435     | 99,435     | 99,435     |
| Adj. R-Squared       | 0.733      | 0.888      | 0.734      | 0.888      |

Panel E. Controlling for Concurrent Mutual Fund Ownership

| Dependent Variables: | Log Amihud | Log Spread | Log Amihud | Log Spread |
|----------------------|------------|------------|------------|------------|
|                      | (1)        | (2)        | (3)        | (4)        |
| Treat×Post           | 0.049***   | 0.058***   | 0.019***   | 0.027***   |
|                      | (5.48)     | (7.95)     | (4.13)     | (7.24)     |
| Treat                | 0.206***   | 0.133***   |            |            |
|                      | (13.70)    | (12.82)    |            |            |
| Mutual Fund Ownership| 0.010      | -0.0001    | 0.036      | 0.004      |
|                      | (1.27)     | (-0.26)    | (1.14)     | (1.09)     |
| Control Variables    | Yes        | Yes        | Yes        | Yes        |
| Year-Quarter FE      | Yes        | Yes        | Yes        | Yes        |
| Industry FE          | Yes        | No         | Yes        | No         |
| Firm FE              | No         | Yes        | No         | Yes        |
| Firm Clustered SE    | Yes        | Yes        | Yes        | Yes        |
| # of Observations    | 99,772     | 99,435     | 99,772     | 99,435     |
| Adj. R-Squared       | 0.283      | 0.734      | 0.571      | 0.888      |

Notes: This table reports results from the robustness tests and placebo tests. Panel A reports results based on alternative treatment variables. Panel B reports results based on alternative stock liquidity measures. Panel C reports results from the first set of placebo tests based on a placebo date of September 22, 2012, and a sample period from September 22, 2009, to September 21, 2015. Panel D reports results from the second set of placebo tests based on ownership unaffected by the SEC proposal. Panel E reports results from robustness tests with concurrent mutual fund ownership as an additional control variable. Post_Placebo is an indicator variable that equals 1 if the observation is in the placebo post-treatment period (September 22, 2009, to September 21, 2015) and 0 otherwise. Treat_IO is an indicator variable that equals 1 if total institutional ownership (including mutual fund ownership) in the quarter immediately before September 22, 2015, exceeds the median total institutional ownership and 0 otherwise. Treat_Unaffected is an indicator variable that equals 1 if unaffected ownership in the quarter immediately before September 22, 2015, exceeds the median unaffected ownership and 0 otherwise, where unaffected ownership equals total institutional ownership minus mutual fund ownership. Mutual Fund Ownership is the ownership held by mutual funds in the concurrent quarter. In the firm fixed effects specification, singleton firms are dropped to avoid underestimating standard errors and overstating statistical significance (Correia 2015; deHaan et al. 2017). The t-statistics reported in parentheses are based on standard errors clustered by firm. Appendix B contains variable definitions.
# Table 4
The Moderating Effect of Mutual Funds’ Incentives to Improve Fund Liquidity (H2)

| Dependent Variables: | Pre-Treatment Portfolio Liquidity | Index Funds and Non-Index Funds |
|----------------------|----------------------------------|---------------------------------|
|                      | Log Amihud | Log Spread | Log Amihud | Log Spread |
|                      | (1)        | (2)        | (3)        | (4)        |
| Treat_IlliquidFunds×Post | 0.036**   | 0.018**    |            |            |
|                      | (2.42)     | (2.39)     |            |            |
| Treat_LiquidFunds×Post | 0.021      | 0.004      | 0.054***   | 0.026***   |
|                      | (1.45)     | (0.54)     | (4.56)     | (4.56)     |
| Treat_NonIndexFunds×Post |          |            |            |            |
| Treat_IndexFunds×Post |            |            |            |            |
| Control Variables    | Included   | Included   | Included   | Included   |
| Year-Quarter FE      | Yes        | Yes        | Yes        | Yes        |
| Firm FE              | Yes        | Yes        | Yes        | Yes        |
| Firm Clustered SE    | Yes        | Yes        | Yes        | Yes        |
| # of Observations    | 99,435     | 99,435     | 99,435     | 99,435     |
| Adj. R-Squared       | 0.734      | 0.888      | 0.734      | 0.888      |

Notes: This table presents evidence on cross-sectional variations of the effect of mutual fund liquidity management on stock liquidity across different groups of mutual funds partitioned on mutual funds’ incentives to improve fund liquidity. In the firm fixed effects specification, singleton firms are dropped to avoid underestimating standard errors and overstating statistical significance (Correia 2015; deHaan et al. 2017). The t-statistics reported in parentheses are based on standard errors clustered by firm. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively, using two-tailed tests. Appendix B contains variable definitions.
Table 5
The Moderating Effect of Mutual Funds’ Resources to Influence Portfolio Firms (H3)

| Dependent Variables: | Log Amihud | Log Spread |
|----------------------|------------|------------|
|                      | (1)        | (2)        |
| **Treat_In-House×Post** | **0.058*** | **0.022*** |
|                      | (4.61)     | (3.55)     |
| **Treat_Outsourced×Post** | -0.001     | 0.008      |
|                      | (-0.08)    | (1.35)     |
| Control Variables    | Included   | Included   |
| Year-Quarter FE      | Yes        | Yes        |
| Firm FE              | Yes        | Yes        |
| Firm Clustered SE    | Yes        | Yes        |
| # of Observations    | 99,435     | 99,435     |
| Adj. R-Squared       | 0.734      | 0.888      |

Notes: This table presents evidence on cross-sectional variations of the effect of mutual fund liquidity management on stock liquidity across different groups of mutual funds partitioned on mutual funds’ resources to influence portfolio firms. In the firm fixed effects specification, singleton firms are dropped to avoid underestimating standard errors and overstating statistical significance (Correia 2015; deHaan et al. 2017). The t-statistics reported in parentheses are based on standard errors clustered by firm. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively, using two-tailed tests. Appendix B contains variable definitions.
Table 6
The Moderating Effect of Pre-Treatment Stock Liquidity (H4)

| Dependent Variables: | Log Amihud | | Log Spread | |
|----------------------|------------|----------|------------|----------|
|                      | (1)        | (2)      | (3)        | (4)      |
| Pre-Treatment Log Amihud | | | | |
| Low Liquidity        | +0.0799*** | -0.0002  | +0.0435*** | 0.0006   |
| High Liquidity       | (6.06)     | (-0.50)  | (5.91)     | (0.36)   |
|                      | Included    | Included  | Included    | Included  |
| Pre-Treatment Log Spread | | | | |
| Low Liquidity        |             |          |             |          |
| High Liquidity       |             |          |             |          |
|                      |             |          |             |          |
| Predicted Sign       | +          |          | +          |          |
| Control Variables    | Yes        | Yes      | Yes        | Yes      |
| Year-Quarter FE      | Yes        | Yes      | Yes        | Yes      |
| Firm FE              | Yes        | Yes      | Yes        | Yes      |
| Firm Clustered SE    | Yes        | Yes      | Yes        | Yes      |
| # of Observations    | 48,472     | 47,967   | 48,411     | 48,046   |
| Adj. R-Squared       | 0.713      | 0.187    | 0.848      | 0.557    |

Test of difference in Treat×Post coefficients:

| Difference | p-value   |
|------------|-----------|
| 0.080***   | <0.001    |
| 0.043***   | <0.001    |

Notes: This table presents evidence on cross-sectional variations of the effect of mutual fund liquidity management on stock liquidity across subsamples of firms sorted by pre-treatment stock liquidity. In the firm fixed effects specification, singleton firms are dropped to avoid underestimating standard errors and overstating statistical significance (Correia 2015; deHaan et al. 2017). The t-statistics reported in parentheses are based on standard errors clustered by firm. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively, using two-tailed tests. Appendix B contains variable definitions.
| Dependent Variables: | Earnings Guidance | Guidance Precision |
|---------------------|-------------------|--------------------|
| Treat x Post        | **0.240***        | **0.223***         |
|                     | (3.03)            | (2.69)             |
| Treat               | 0.174**           | 0.199***           |
|                     | (2.33)            | (2.72)             |
| Stock Return        | -0.069*           | -0.108***          |
|                     | (-1.94)           | (-3.09)            |
| Stock Return Volatility | **-7.140***    | **-6.047***        |
|                     | (-5.33)           | (-4.72)            |
| B/M                 | 0.005             | -0.009             |
|                     | (0.13)            | (-0.22)            |
| Size                | 0.067***          | 0.068***           |
|                     | (3.98)            | (4.23)             |
| Earnings Volatility | **-1.907***       | **-1.883***        |
|                     | (-3.26)           | (-3.31)            |
| R&D                 | **0.281***        | **0.272***         |
|                     | (4.28)            | (4.46)             |
| Analyst Coverage    | 0.033***          | 0.031***           |
|                     | (8.12)            | (8.59)             |
| News                | **-0.063***       | **-0.059***        |
|                     | (-3.73)           | (-3.40)            |
| Loss                | -0.059            | -0.045             |
|                     | (-1.62)           | (-1.25)            |
| Analyst Dispersion  | **-36.145***      | **-37.380***       |
|                     | (-5.67)           | (-5.99)            |
| External Financing  | 0.035             | 0.027              |
|                     | (1.09)            | (0.87)             |
| Litigation          | 0.258**           | 0.219              |
|                     | (2.11)            | (1.85)             |
| Competition         | **0.455***        | **0.409***         |
|                     | (8.80)            | (8.13)             |
| Year-Quarter FE     | Yes               | Yes                |
| Industry FE         | Yes               | Yes                |
| Firm Clustered SE   | Yes               | Yes                |
| # of Observations   | 95,693            | 98,405             |
| Pseudo R-Squared    | 0.283             | 0.249              |

Notes: This table presents evidence on the effect of mutual fund liquidity management on management forecasts. Earnings Guidance is an indicator variable that equals 1 if the firm issues at least one management quarterly earnings forecast in the fiscal quarter and 0 otherwise. Guidance Precision measures the precision of management quarterly earnings forecasts issued in the fiscal quarter. Guidance Precision equals 4 if the forecast is a point forecast, 3 if a range forecast, 2 if an open-ended forecast, 1 if a qualitative forecast, and 0 if there is no forecast in the fiscal quarter. Firm fixed effects in the probit model (Column (1)) and the ordered probit model (Column (2)) are not included to avoid the incidental parameter problem. The t-statistics reported in parentheses are based on standard errors clustered by firm. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively, using two-tailed tests. Appendix B contains variable definitions.
Table 8
Disclosure Mechanism: Conference Calls

Panel A. Indicator of Conference Calls
Dependent Variable: Conference Call

| Variable               | Estimate | Std. Error | t-Value |
|------------------------|----------|------------|---------|
| Treat×Post             | 0.280*** | (5.92)     |         |
| Treat                  | 0.162*** | (3.57)     |         |
| Stock Return           | -0.013   | (-0.50)    |         |
| Stock Return Volatility| -2.344***| (-4.74)    |         |
| B/M                    | -0.000   | (-0.02)    |         |
| Size                   | 0.149*** | (11.34)    |         |
| Earnings Volatility    | -0.269***| (-4.28)    |         |
| R&D                    | 0.194*** | (4.06)     |         |
| Analyst Coverage       | 0.067*** | (9.77)     |         |
| News                   | 0.033**  | (2.49)     |         |
| Loss                   | 0.061**  | (2.30)     |         |
| Analyst Dispersion     | 15.586***| (7.21)     |         |
| External Financing     | 0.015    | (0.65)     |         |
| Litigation             | 0.985*** | (10.54)    |         |
| Competition            | 0.245*** | (6.28)     |         |

Year-Quarter FE Yes
Industry FE Yes
Firm Clustered SE Yes
# of Observations 96,852
Pseudo R-Squared 0.292
### Table 8 (continued)

**Panel B. Clarity of Conference Calls**

| Dependent Variable: Call Clarity | Presentation + Answers | Presentation Only | Answers Only |
|----------------------------------|------------------------|-------------------|-------------|
| **Treat×Post**                   | 1.832***               | 1.462***          | 0.602***    | 0.449***    | 3.255*** | 2.657*** |
|                                  | (10.59)                | (8.09)            | (4.58)      | (3.23)      | (10.24)  | (8.27)   |
| Treat                            | -0.561***              | -0.094            | -1.413***   |             |          |          |
|                                  | (-3.29)                | (-0.80)           | (-4.15)     |             |          |          |
| Stock Return                     | 0.568***               | 0.236             | 0.408***    | 0.283**     | 0.924*** | 0.480**  |
|                                  | (4.02)                 | (1.63)            | (3.32)      | (2.15)      | (3.76)   | (2.02)   |
| Stock Return Volatility          | -10.337***             | -3.067            | -6.715***   | -5.473**    | -4.805   | 0.105    |
|                                  | (-3.31)                | (-1.00)           | (-2.59)     | (-2.09)     | (-0.83)  | (0.02)   |
| B/M                              | 0.478***               | -0.101            | 0.272***    | -0.175      | 1.030*** | -0.269   |
|                                  | (4.24)                 | (-0.61)           | (3.09)      | (-1.32)     | (4.88)   | (-0.98)  |
| Size                             | -0.515***              | -0.255**          | -0.197***   | -0.211**    | -1.053*** | -0.760*** |
|                                  | (-9.79)                | (-2.12)           | (-5.10)     | (-2.22)     | (-10.99) | (-3.52)  |
| Earnings Volatility              | -3.707***              | 2.767             | -3.896***   | -0.517      | -3.768   | 6.098**  |
|                                  | (-2.62)                | (1.53)            | (-3.60)     | (-0.34)     | (-1.36)  | (2.04)   |
| R&D                              | -0.042                 | -0.199            | 0.203       | -0.087      | -0.329   | -0.252   |
|                                  | (-0.24)                | (-0.98)           | (1.58)      | (-0.47)     | (-0.98)  | (-0.77)  |
| Analyst Coverage                 | -0.071***              | -0.046**          | 0.001       | 0.014       | -0.132***| -0.135***|
|                                  | (-6.01)                | (-2.56)           | (0.11)      | (0.98)      | (-6.13)  | (-4.40)  |
| News                             | 0.019                  | 0.04              | 0.051       | 0.052       | 0.084    | 0.105    |
|                                  | (0.27)                 | (0.62)            | (0.83)      | (0.87)      | (0.69)   | (1.02)   |
| Loss                             | -0.627***              | 0.027             | -0.376***   | 0.067       | -0.932***| 0.021    |
|                                  | (-5.70)                | (0.27)            | (-4.31)     | (0.74)      | (-4.57)  | (0.13)   |
| Analyst Dispersion               | -5.789                 | 5.605             | 0.071       | 6.194       | -38.679***| -11.53   |
|                                  | (-0.95)                | (0.91)            | (0.01)      | (1.04)      | (-3.65)  | (-1.12)  |
| External Financing               | 0.057                  | -0.122            | -0.02       | -0.104      | 0.072    | -0.161   |
|                                  | (0.61)                 | (-1.32)           | (-0.27)     | (-1.33)     | (0.42)   | (-1.02)  |
| Litigation                       | -1.568***              | -0.622*           | -0.588**    | -0.008      | -2.922***| -1.697***|
|                                  | (-4.29)                | (-1.74)           | (-2.16)     | (-0.03)     | (-4.32)  | (-2.89)  |
| Competition                      | -0.142                 | -0.167            | -0.027      | 0.043       | -0.272   | -0.379   |
|                                  | (-1.02)                | (-0.79)           | (-0.27)     | (0.24)      | (-1.04)  | (-1.03)  |
| Year-Quarter FE                  | Yes                    | Yes               | Yes         | Yes         | Yes      | Yes      |
| Industry FE                      | Yes                    | No                | Yes         | No          | Yes      | No       |
| Firm FE                          | No                     | Yes               | No          | Yes         | No       | Yes      |
| Firm Clustered SE               | Yes                    | Yes               | Yes         | Yes         | Yes      | Yes      |
| # of Observations               | 71,884                 | 71,706            | 71,884      | 71,706      | 71,884   | 71,706   |
| Adj. R-Squared                  | 0.081                  | 0.228             | 0.019       | 0.101       | 0.119    | 0.327    |

Notes: This table presents evidence on the effect of mutual fund liquidity management on conference calls. Conference Call is an indicator variable that equals 1 if the firm holds at least one conference call in the fiscal quarter and 0 otherwise. Call Clarity is the Gunning Fog index of the conference call transcripts, multiplied by (-1). Firm fixed effects are not included in the probit model (Panel A) to avoid the incidental parameter problem. In the firm fixed effects specification, singleton firms are dropped to avoid underestimating standard errors and overstating statistical significance (Correa 2015; deHaan et al. 2017). The t-statistics reported in parentheses are based on standard errors clustered by firm. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively, using two-tailed tests. Appendix B contains variable definitions.
Table 9  
Effect of Mutual Fund Liquidity Management on Stock Liquidity with Actual Disclosure Improvement

| Disclosure: | \( \text{Log Amihud} \) | \( \text{Log Spread} \) |
|-------------|-----------------|-----------------|
|             | (1)             | (2)             | (3)             | (4)             | (5)             | (6)             | (7)             | (8)             |
| \( \text{Improved\_Disclosure} \times \text{Post} \) | 0.029***        | 0.026***        | 0.034***        | 0.037***        | 0.011**         | 0.009*          | 0.026***        | 0.010***        |
|             | 5.14            | 4.66            | 5.03            | 6.56            | 2.27            | 1.90            | 2.84            |
| Control Variables | Yes             | Yes             | Yes             | Yes             | Yes             | Yes             | Yes             | Yes             |
| Year-Quarter FE | Yes             | Yes             | Yes             | Yes             | Yes             | Yes             | Yes             | Yes             |
| Firm FE      | Yes             | Yes             | Yes             | Yes             | Yes             | Yes             | Yes             | Yes             |
| Firm Clustered SE | Yes             | Yes             | Yes             | Yes             | Yes             | Yes             | Yes             | Yes             |
| # of Observations | 99,435          | 99,435          | 99,435          | 99,435          | 99,435          | 99,435          | 99,435          | 99,435          |
| Adj. R-Squared | 0.733           | 0.733           | 0.733           | 0.733           | 0.888           | 0.888           | 0.888           | 0.888           |

Notes: This table examines whether the stock liquidity improvement is driven by disclosure improvement around the SEC proposal. \( \text{Improved\_Disclosure} \) is an indicator variable that equals 1 if a specific dimension of a treatment firm’s disclosure (earnings guidance likelihood, guidance precision, conference call likelihood, or call clarity) improves in the post-treatment period relative to the pre-treatment period, and 0 otherwise. In the firm fixed effects specification, singleton firms are dropped to avoid underestimating standard errors and overstating statistical significance (Correia 2015; deHaan et al. 2017). The \( t \)-statistics reported in parentheses are based on standard errors clustered by firm. ****, ***, and * indicate significance at the 1%, 5%, and 10% levels, respectively, using two-tailed tests. Appendix B contains variable definitions.