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Speculation with Information Disclosure

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Abstract

Sophisticated investors frequently choose to publicly disclose private information, a phenomenon inconsistent with most theories of speculation. We propose and test a model to bridge this gap. We show that when a speculator cares about both short-term portfolio value and long-term profit, a disclosure mixing asset fundamentals and her holdings is optimal by inducing competitive dealership to revise prices toward those holdings while alleviating adverse selection. We find that when mutual fund managers have stronger short-term incentives, the frequency of strategic non-anonymous disclosures about their stocks by market-worthy newspaper articles increases and those stocks' liquidity improves, consistent with our model.

I. Introduction

Private information is valuable. Much research in financial economics over the last three decades illustrates both its benefits to speculators and its impact on financial market quality through their trading activity. For instance, Kyle (1985) shows that speculators trade cautiously (and anonymously) with private information to minimize its disclosure to less informed market participants. Importantly, in this model and many others, since speculators' trading profits monotonically depend on their informational advantage, protecting information leakage ensures maximal extraction of the rent of being informed.

Yet in reality, we also observe speculators strategically and publicly giving away their supposedly valuable information. These disclosures may take a variety of forms. Portfolio managers share perspectives on their covered firms through

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media interviews or public commentaries; activist investors have their opinions posted through Twitter feeds or blogs; and so forth. In a recent article, Ljungqvist and Qian (2016) document an interesting phenomenon whereby some boutique hedge fund managers reveal evidence of questionable business activities by possibly overvalued firm, which they have gone through considerable trouble (and incurred great costs) to discover. Barring irrationality, this suggests that (cautious) non-anonymous disclosure of private information may indeed be optimal. For instance, Ljungqvist and Qian (2016) suggest that these hedge funds' voluntary disclosures may minimize the noise trader risk they face when taking short positions in those troubled firms (e.g., De Long, Shleifer, Summers, and Waldmann (1990), Kovbasyuk and Pagano (2022)). Intuitively, for fear that market prices may further deviate from (poor) fundamentals, therefore forcing them to liquidate prematurely, fund managers disclose some private information to expedite convergence of prices to fundamentals.[1]

The goal of this article is to shed further light on the strategic disclosure of information in financial markets. Using a model of speculative trading based on Kyle (1985), we show that if an informed speculator's objective function includes not only long-term profit but also the short-term value of her portfolio, public (i.e., non-anonymous) disclosure of private information may naturally arise. This short-term objective (Pasquariello and Vega (2009), Bhattacharyya and Nanda (2013)) captures parsimoniously a variety of forms of short-termism among sophisticated market participants: a hedge fund manager with a short position may be concerned about forced liquidation because of a sharp drop in portfolio value (as in Ljungqvist and Qian (2016)); a mutual fund manager may care about her fund's net asset value (NAV), upon which her compensation is often contingent; financial derivatives holders have their gains or losses hinge on the price movements of the underlying asset before the expiration date; liquidity constraint or risk-aversion in general can also lead to concerns over short-term asset values. A recent literature on "portfolio pumping" examines the impact of similar incentives for speculators on their trading activity and resulting market outcomes. For instance, Bhattacharyya and Nanda (2013) argue that fund managers may "pump" the short-term value of their portfolios by trading "excessively" in the direction of their initial holdings (i.e., away from what is warranted by long-term profit maximization). Consequently, equilibrium prices are distorted in the short term, the more so the larger weight the fund manager places on her short-term NAV or when she has a larger initial position. We refer to this pumping strategy—long popular with investors and scrutinized by regulators (e.g., Hu, McLean, Pontiff, and Wang (2014), Duong and Meschke (2020))—as "pumping by trading" (PBT).

In our model, we show that strategic public disclosure of private information (in the spirit of Admati and Pfleiderer (1988), Kamenica and Gentzkow (2011)) is an additional tool to achieve portfolio pumping. A sophisticated speculator may optimally reveal private information about her holdings and asset fundamentals at the same time, but in a mixed fashion. Unable to distinguish between the two,

[1]Consistently, Crawford, Gray, and Kern (2017) find that some small hedge fund managers with limited access to capital *privately* share and discuss their trades on a members-only web platform to induce other investors to invest similarly and so accelerate the price-discovery process.

uninformed market participants (market-makers) may revise their priors about asset fundamentals in response to such disclosures when clearing the market. Accordingly, short-term equilibrium prices are pumped in the direction of the speculator's holdings. We refer to this pumping strategy as "pumping by disclosing" (PBD).

PBT hurts the speculator's long-term profit as she deviates from her long-term profit-maximizing strategy. When available, PBD reduces the adverse effects of PBT by limiting the equilibrium extent of "excessive" trading. Disclosure, however, is also costly, as it compromises the speculator's informational advantage, which in turn deteriorates the speculator's long-term profits. Nonetheless, we show that, in equilibrium, the benefits from alleviating PBT and boosting the speculator's short-term value always outweigh the costs of compromising her informational advantage. Strategic disclosure, therefore, optimally arises in our model.

PBD has important, original implications for our understanding of the determinants of financial market quality. Disclosure has two opposite effects on market liquidity. On the one hand, as more private information is revealed, market-makers face less adverse selection risk and so lower the price impact of order flow, increasing market depth. On the other hand, as speculators refrain from PBT, a larger fraction of the aggregate order flow is driven by information-based trading, decreasing market depth. We show that when disclosure is optimal, the former effect dominates the latter such that PBD improves market liquidity.

Our empirical analysis provides support for the model's implications. Our model suggests that strategic disclosure may be commonplace: Given a reasonably low cost, any partly short-term-oriented speculator should find it optimal to disclose. Anecdotal evidence broadly supports this implication. For instance, portfolio managers "talk their book," that is, discuss their positions in order to create positive or negative interest and therefore promote buying or selling of the securities.[2] Yet, with the noteworthy exception of Ljungqvist and Qian (2016), empirical evidence on this issue remains scarce. To that end, we focus on strategic non-anonymous disclosures made by mutual fund families through three major newspapers: the Wall Street Journal (WSJ), the Financial Times (FT), and the New York Times (NYT) between 2005 and 2014. We first establish that these disclosures are accompanied by nontrivial stock price fluctuations within days of their first print publication, consistent with the notion that market participants are paying attention to their release. We then show that three novel composite indices of stronger short-term incentives of U.S. equity mutual fund managers (based on several extant such proxies in the literature) are associated with an increased occurrence of strategic disclosures and greater stock market liquidity for the disclosure targets, especially when those targets are firms more suitable to such strategic disclosures by virtue of their greater fundamental uncertainty, consistent with our model.

Overall, our novel insights on the determinants and nontrivial externalities of strategic disclosure contribute to a recent theoretical literature on the disclosure

[2]This phenomenon has received ample coverage in the media. See, for instance, "Everybody Talks Their Book, Everybody" on Abnormal Returns, available at http://abnormalreturns.com/2010/02/18/everybody-talks-their-book-everybody/, or "New Investing Strategy: Talk Your Book" on Bloomberg-View, available at https://www.bloomberg.com/view/articles/2014-03-07/new-investing-strategy-talk-your-book. See also Appel and Fos (2022) and references therein.

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activity of sophisticated market participants. Kovbasyuk and Pagano (2022) argue that when uninformed investors have limited attention, *price-taking* arbitrageurs in several undervalued assets may optimally choose to overweight and advertise their private payoff information about only one such asset to expedite convergence to fundamentals. When studying bilateral transactions with imperfect competition, Glode, Opp, and Zhang (2018) also show that a privately informed agent facing a counterparty endowed with market power may find it optimal to voluntarily disclose his ex post verifiable information in order to mitigate the counterparty's inefficient screening, leading to socially efficient trade. However, Han and Yang (2013) postulate that social communication may hinder information production and worsen market efficiency by enabling traders to free-ride on better informed friends or prices; similarly, Liu (2017) finds that optimal yet *exogenously truthful* disclosure of private long-lived fundamental information by a reputable short-horizon investor exclusively to a nontrivial number of uninformed long-horizon followers, in order to enlist their help in favorably liquidating her position to Kyle (1985) market makers, may lower prior informed trading intensity and equilibrium price informativeness. Relatedly, in a model of "cheap talk" (Crawford and Sobel (1982), Van Bommel (2003)), Schmidt (2020) argues that *anonymous price-taking* "rumormongers" may find truthful information sharing attractive when short-term oriented, while choosing to lie when long-term oriented—an insight which may explain the veracity of takeover rumors about U.S.-listed target companies. Others investigate the notion that firm managers have discretion to disclose information that investors do not observe (e.g., Shin (2003), Goto, Watanabe, and Xu (2009), and Hertzberg (2017)) or whether they should be required to do so when selling risky assets (e.g., Kurlat and Veldkamp (2015)).

Relative to these studies, the main contribution of our theory is in its novel investigation of the natural *interaction* between speculators' *strategic* trading and strategic *public* disclosure of an *optimal mix* of private information about asset payoffs and endowments in pursuit of short-term price manipulation within one of the most popular and well-understood models of informed speculation in the literature (Kyle (1985)), an effort that yields novel implications for the process of price formation, and especially the *liquidity*, in the affected markets. Our accompanying empirical evidence is both suggestively supportive of these implications and (to the best of our knowledge) novel to the literature on mutual fund management (e.g., surveyed in Elton and Gruber (2013)).

The rest of the article proceeds as follows: Section II introduces our model and derives its implications. Section III describes our data sources, while Section IV presents the empirical results. We conclude in Section V.

II. The Theory

In this section, we show how strategic disclosure may naturally arise in a standard Kyle (1985) setting, in contrast with the conventional wisdom in market microstructure that information leakage hurts speculation. As we show, the key ingredient leading up to this result is that speculators face a trade-off between maximization of long-term profit and short-term portfolio value. As we discuss

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next, this stylized trade-off captures parsimoniously a variety of real-life conflicting incentives for sophisticated financial market participants.

We begin by describing a baseline model of speculative trading based on Kyle (1985) and Bhattacharyya and Nanda (2013), which gives rise to PBT. Next, we enrich this model by allowing for informative disclosure and derive novel implications of PBD for the equilibrium quality of the affected market. All proofs are in the Appendix.

A. The Baseline Model

Our basic setting is a batched-order market as in Kyle (1985), with three dates, $t = 0, 1$, and 2, and one risky asset. At date $t = 2$, the payoff of the risky asset, a normally distributed random variable v with mean P_0 and variance σ_v^2, is realized. Three types of risk neutral market participants populate the economy: An informed trader (the speculator or "speculative sector"), competitive market makers (or "market-making sector," MM), and liquidity traders. The structure of the economy and the decision processes leading up to order flow and prices are common knowledge among all market participants.

At date $t = 0$, the speculator privately observes the liquidation value of the risky asset (v), as well as privately receives an initial endowment (e) of the risky asset. Throughout this article, we use the terms "initial position," "initial endowment," and "initial holding" interchangeably, all referring to the speculator's position in the risky asset before the model's single round of trading.[3] Individual allocations are endogenous in a number of models (see, e.g., Back and Zender (1993), among others). This article takes as given the level of information asymmetry (regarding both endowments and fundamentals) to study the speculator's strategic behavior thereafter. Hence, as in Bhattacharyya and Nanda (2013), we parsimoniously assume that e is normally distributed with $\mathrm{E}[e] = \overline{e}$ and $\mathrm{var}(e) = \sigma_e^2$, as well as independent of v ($\mathrm{cov}(v, e) = 0$). These assumptions allow us to better highlight the distortive effects of short-termism on even perfectly informed speculative trading in an otherwise standard Kyle (1985) setting while also capturing the intuition that the speculator's initial holdings may stem from prior informed trading, hence by definition unrelated to current fundamental news. Relaxing these assumptions such that the speculator's private fundamental information is noisy and/or positively correlated with her endowment ($\mathrm{cov}(v, e) > 0$, for example, as for the current information-based initial short positions of the boutique hedge funds in Ljungqvist and Qian (2016)) complicates the analysis without materially affecting its main insights (unless speculative short-termism is relatively insubstantial; see Sections IA-I and IA-II of the Supplementary Material for details and a more in-depth discussion; see also Pasquariello (2003), Chapter 1, Pasquariello and Vega (2009)).

At date $t = 1$, both the speculator and liquidity traders submit market orders, x and z, respectively, to the MM, where $z \sim N\left(0, \sigma_z^2\right)$ is independent of all other

[3]Assuming *private* endowment information (i.e., endowment uncertainty) is plausible and realistic since, as we further discuss in Sections II.B and II.D, extant regulations imply that market participants may learn about only some (but not all) positions of only some (but not all) speculators, and if so only with delay; see also the discussion in Bhattacharyya and Nanda (2013).

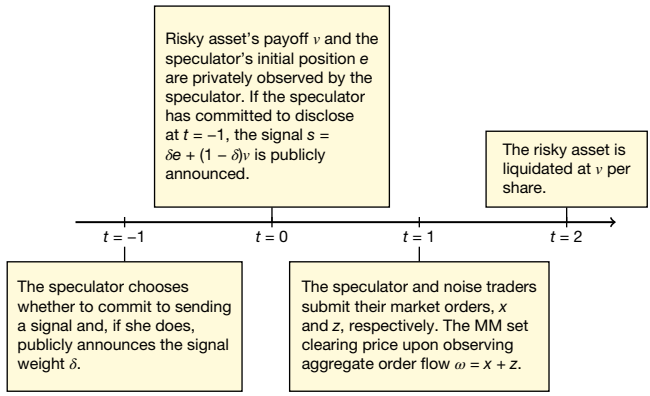
random variables. The MM observe the aggregate order flow $\omega = x + z$ and set the equilibrium price $P_1 = P_1(\omega)$ that clears the market (see also Figure 1).

The departure we take from Kyle (1985) lies in the speculator's objective function. In Kyle (1985) as well as many other theoretical studies of price formation, long-term profit maximization is the sole objective of the speculator. In reality, however, many sophisticated market participants are found to be short-term oriented, or at least partly so. For instance, mutual fund managers are compensated on the basis of the funds' current NAV (see, e.g., Warner and Wu (2011)). A fund's recent performance is crucial to its competition for fund flows (e.g., see Ippolito (1992), Brown, Harlow, and Starks (1996), and Sirri and Tufano (1998)) as well as the success of its fund managers in the job market (see, e.g., Chevalier and Ellison (1999)). Short-term performance also concerns activist investors as many of them choose to exit from their block holdings after carrying out interventions in a firm; the firm's valuation at the time of the exit would therefore largely affect the return to the activist investors.[4] More broadly, any speculator plagued by liquidity constraints (e.g., see Ljungqvist and Qian (2016), Crawford et al. (2017), and references therein), professional money manager facing relatively short expected tenure due to mobility and turnover (as in Dow and Gorton (1994), Goldman and Slezak (2003)), or investor preferring early resolution of uncertainty (e.g., under Epstein and Zin (1989) preferences or when trading in short-lived derivative securities, as in Bernhardt, Davies, and Spicer (2006)) may wish all or part of her investment to pay off early. Lastly, the short-term performance of an asset may be relevant to investors

FIGURE 1

Time Line

Figure 1 depicts the time line of the baseline model (starting from date $t = 0$) and the signaling model (starting from date $t = -1$).



[4]For instance, Becht, Franks, Grant, and Wagner (2017) find activist hedge funds' holding period spans an average of 1.7 years, while Brav, Jiang, Partnoy, and Thomas (2008) estimate the median holding period to be just above 1 year. Accordingly, Greenwood and Schor (2009) associate abnormal returns surrounding hedge funds' announcements of activist intentions about a target to their ability to induce a takeover for that target.

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holding both the asset and options on it. Following Pasquariello and Vega (2009) and Bhattacharyya and Nanda (2013), we capture these short-term incentives parsimoniously by assuming that the speculator's value function is separable in her short-term (i.e., date $t=1$) value $W_1 = e(P_1 - P_0)$, and long-term (i.e., date $t=2$) profit $W_2 = x(v - P_1)$, such that

$$W = \gamma W_1 + (1-\gamma) W_2, \tag{1}$$

where $\gamma \in [0,1)$ captures the relative importance the speculator attaches to her short-term objective (W_1).[5] Finally, at date $t=2$, the risky asset is liquidated at price v.

Consistent with Kyle (1985), we define a Bayesian Nash Equilibrium of this economy as a trading strategy $x(v,e)$ and a pricing rule $P_1(\omega)$, such that the following conditions are satisfied:

1. Utility maximization: $x(v,e) = \arg\max \mathrm{E}[W|v,e]$.
2. Semi-strong form market efficiency: $P_1 = \mathrm{E}[v|\omega]$.

The following proposition characterizes the unique linear equilibrium of this economy.

Proposition 1 (Baseline, Bhattacharyya and Nanda (2013)). The unique equilibrium in linear strategies of this economy is characterized by the speculator's demand strategy

$$x^*(v,e) = \beta\overline{e} + \frac{v - P_0}{2\lambda^*} + \frac{\beta}{2}(e - \overline{e}), \tag{2}$$

and the MM's pricing rule

$$P_1 = P_0 + \lambda^*(\omega - \beta\overline{e}), \tag{3}$$

where

$$\lambda^* = \frac{\sigma_v}{2\left(\beta^2 \frac{\sigma_e^2}{4} + \sigma_z^2\right)^{\frac{1}{2}}}, \tag{4}$$

and

$$\beta = \frac{\gamma}{1-\gamma}. \tag{5}$$

In this model, β can be interpreted as the speculator's marginal rate of substitution between short- and long-term objectives. When $\beta = 0$, the speculator reduces

[5]Specifically, Pasquariello and Vega (2009) and Bhattacharyya and Nanda (2013) assume the speculator's objective function to be separable in her portfolio's short-term ($t=1$) and long-term ($t=2$) NAV (or wealth), that is, $U = \gamma \times \mathrm{NAV}_1 + (1-\gamma) \times \mathrm{NAV}_2$, where $\mathrm{NAV}_1 = \mathrm{NAV}_0 + e(P_1 - P_0)$, $\mathrm{NAV}_2 = \mathrm{NAV}_0 + e(v - P_0) + x(v - P_1)$, and $\mathrm{NAV}_0 = eP_0$ is her initial ($t=0$) NAV. The reduced-form objective function of equation (1) is then derived by removing from U those terms in NAV_1 and NAV_2 that are not affected by (hence do not affect) the speculator's decision process, that is, $W = U - \mathrm{NAV}_0 - (1-\gamma)e(v - P_0)$. This simplification is only for economy of notation and has no bearing on our analysis in that replacing W with U in equation (1) straightforwardly yields identical results. Similarly, we rule out the trivial case in which $\gamma = 1$ in equation (1) yielding unbounded speculation in the risky asset to maximize W_1.

to a long-term profit maximizer and the ensuing equilibrium to the one in Kyle (1985): $x^k = \frac{v-P_0}{2\lambda^k}$ and $\lambda^k = \frac{\sigma_v}{2\sigma_z}$. As β increases, the speculator's trading strategy deviates from information-based, long-term profit maximization ($x^* \neq x^k$) to successfully pump up/down the equilibrium price in the direction of her initial position in the risky asset ($\text{cov}(P_1, e) = \frac{1}{2}\lambda^* \beta \sigma_e^2 > 0$ although $\text{cov}(v, e) = 0$) by exploiting the MM's uncertainty about her endowment ($\sigma_e^2 > 0$) and ensuing PBT intensity in the aggregate order flow ($\omega = x^*(v, e) + z$). Accordingly, PBT improves market liquidity ($\lambda^* < \lambda^k$) by alleviating the MM's adverse selection risk. Further insights on PBT can be found in Pasquariello and Vega (2009) and Bhattacharyya and Nanda (2013).[6]

B. Equilibrium with Disclosure

We now extend the baseline model of Section II.A by allowing the speculator to publicly disclose information before market clearing.

Sophisticated market participants often make public announcements about asset fundamentals in a variety of forms. For instance, Ljungqvist and Qian (2016) document that some small hedge funds, after spending considerable resources to discover that a target firm is overpriced, not only take short positions in that firm but also publicly disclose that information in detailed reports (e.g., accusing the target firm of fabricating accounting figures or inflating productive capacity). Other disclosures are less aggressive. For instance, portfolio managers and financial analysts often make media appearances (on such outlets as CNBC, WSJ, etc.) discussing recent corporate events or market outlook. These talks may allow the involved speculator to reveal her private knowledge of asset fundamentals.

Importantly, however, these disclosures may reveal information not only about asset fundamentals, but also the speculator's own stake in that asset. To begin with, U.S. law mandates that the speculator be explicit about the conflict of interest in her disclosures such that the reader or audience should realize that the speculator stands to gain once her suggestions are followed.[7]

[6]Pasquariello and Vega (2009) and Bhattacharyya and Nanda (2013) also find these insights to be unaffected by allowing for a discrete number of either heterogeneously informed (hence, less aggressively competing) or homogeneously informed (hence, more aggressively competing) speculators, respectively, yet at the cost of greater analytical complexity relative to the baseline model. Accordingly, in this study we concentrate on the trading and disclosure activity of a single speculator (or speculative sector, as in our accompanying empirical analysis of the mutual fund industry), and leave the investigation of competition (or potential collaboration, as suggested by Crawford et al. (2017); see also Liu (2017)) in public disclosure for future research. Relatedly, Goldstein, Xiong, and Yang (2021) investigate private information sharing among two heterogeneously informed strategic insiders in a standard Kyle (1985) setting.

[7]The Securities Exchange Commission (SEC) imposes fiduciary duty on financial advisors, which is made enforceable by Section 206 of the U.S. Investment Advisers Act of 1940. Under the act, an adviser has an affirmative obligation of utmost good faith and full and fair disclosure of all facts material to the client's engagement of the adviser to its clients. This is particularly pertinent whenever the adviser is faced with a conflict (or potential conflict) of interest with a client. The SEC has stated that the adviser must disclose all material facts regarding the conflict such that the client can make an informed decision whether to enter into or continue an advisory relationship with the adviser. Additionally, the Act also applies to prospective clients. The SEC has adopted rule 206(4)-1, prohibiting any registered adviser from using any advertisement (that includes notice through radio or television) that contains any untrue

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Even without conflict of interest, investors may rationally perceive public disclosures by speculators as tainted. After all, a speculator may be inclined, if she holds a long (short) position in an asset, to use her disclosures about that asset to induce investors to buy (sell) it. Current regulations, albeit stringent, may leave the information provider sufficient wiggling room for tuning her message. The speculator may, for instance, disclose evidence with selective emphasis, but without crossing the line between truthful revealing and misrepresentation. Consequently, upon seeing a strongly negatively toned disclosure about an asset by a speculator, a reader has every reason to suspect that the speculator is intentionally tilting her tone and that she is likely to hold a short position in that asset.[8]

Lastly, information on asset fundamentals and speculative holdings is likely indistinguishable to an uninformed investor. On the one hand, any bias in a speculator's disclosure about asset fundamentals will likely depend on the speculator's stake in that asset. On the other hand, speculators are often not entirely transparent about their holdings. Many studies find that institutional investors attempt to disguise their portfolio holdings, for example, by window dressing, to reduce the leakage of potentially valuable proprietary information (e.g., Lakonishok, Shleifer, Thaler, and Vishny (1991), Musto (1999), Agarwal, Jiang, Tang, and Yang (2013), and Shi (2017)).[9] How much the speculators hide their positions may in turn depend on the fundamental information they want to keep private.

In short, speculators' disclosures are likely to reflect both their private fundamental information and their unobservable holdings; accordingly, uninformed market participants are likely to view any public disclosure by speculators as a function of both their private fundamental information and their unobservable holdings. We capture parsimoniously this observation in the model by assuming that the speculator has the option to publicly disclose a signal s that is a convex combination of e and v:

$$s(v,e) = \delta e + (1-\delta)v, \tag{6}$$

where the publicly known coefficient $\delta \in [0,1]$ represents the extent to which the signal is informative about the speculator's holdings (e) versus asset fundamentals (v). The speculator may freely choose which δ to use, but she must commit to disclosing the resulting signal (s) at the chosen δ *before* observing e and v.[10]

statement of material facts or is otherwise misleading. Accordingly, Ljungqvist and Qian ((2016), p. 1989) note that each of the stock reports prepared by boutique hedge funds in their sample "prominently discloses that the arb[itrageur] has a short position in the target stock."

[8]Relatedly, Banerjee, Kim, and Mangla (2018) show that in an investment game in which two players endowed with noisy private fundamental information have an incentive to coordinate, both the sender and the receiver may prefer strategic communication (in the form of only partially informative cheap-talk) to the sender's commitment to perfect disclosure.

[9]For instance, Shi (2017) shows that the mandatory disclosure of hedge funds' positions via Form 13F filings may reveal valuable private information by leading both to a subsequent drop in their performance and to an increase in its correlation with their competitors.

[10]Accordingly, rational MM with ex ante knowledge of the speculator's preferences could compute her ex ante optimal δ even if it was not otherwise publicly known. We discuss how such a δ is derived in Proposition 3 after solving for the equilibrium of the economy for any publicly known δ in Proposition 2.

Equation (6) is a parsimonious characterization of the speculator's non-anonymous disclosure strategy.[11] More detailed discussions about the plausibility of this assumption are in Section II.D, as well as in Section IA-III of the Supplementary Material.

Specifically, we model the strategic disclosure of the signal s of equation (6) in our setting by introducing a date $t=-1$, in which the speculator can choose either i) to do nothing and proceed to date $t=0$ (yielding the baseline equilibrium of Proposition 1), or ii) to commit to the following reporting strategy (i.e., to PBD): She first chooses and commits to a particular δ at $t=-1$; then, at $t=0$ (or at any subsequent time *before* the market clearing price P_1 is set), after observing v and e, she discloses the resulting signal $s(v,e)$ to the public (see also Figure 1). Each reporting strategy thus corresponds to a choice of the weight δ. When the speculator commits to disclose, the ensuing model has a unique equilibrium in linear strategies, in which the price schedule is a linear function of the signal and the order flow and the speculator's trading strategy is linear in the asset's liquidation value, initial position, and the signal.

Proposition 2 (Equilibrium with Disclosure). If the speculator chooses to send a signal s of equation (6) with publicly known weight δ (PBD), the ensuing linear equilibrium of the economy is characterized by the speculator's demand strategy

$$x^*(v,e)=\frac{\beta}{2}(e+\overline{e})+\frac{v-P_0}{2\lambda_1}-\frac{\lambda_2}{2\lambda_1}(s-\overline{s}) \tag{7}$$
$$=\beta\overline{e}+\frac{\beta\lambda_1-\delta\lambda_2}{2\lambda_1}(e-\overline{e})+\frac{1-(1-\delta)\lambda_2}{2\lambda_1}(v-P_0),$$

and the MM's pricing rule

$$P_1=P_0+\lambda_1(\omega-\overline{\omega})+\lambda_2(s-\overline{s}), \tag{8}$$

where

$$\lambda_1=\frac{1}{\sqrt{\alpha^2\beta^2+4\frac{\sigma_z^2}{\sigma_v^2}+4\alpha^2\frac{\sigma_z^2}{\sigma_e^2}}}>0, \tag{9}$$

$$\lambda_2=-\frac{\lambda_1}{\delta}\left(\beta-\frac{4\lambda_1\sigma_z^2}{\left(\frac{1}{\alpha}-\beta\lambda_1\right)\sigma_e^2}\right), \tag{10}$$

and

$$\alpha=\frac{1-\delta}{\delta}. \tag{11}$$

[11]Non-anonymity in signal disclosure makes it plausible that all other market participants (i.e., the MM) use their ex ante knowledge of the speculator's disclosure policy to make inference about v and e from the observed signal s of equation (6). Such inference would be both severely impeded and prima facie implausible if such a signal was observed alongside other equally noisy, unverified, anonymous rumors. See Schmidt (2020) for an investigation of such rumormongering in the stock market.

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The coefficients λ_1 and λ_2 represent the equilibrium price impact of the order flow and public signal, respectively. In particular, we show in Section IA-IV of the Supplementary Material that for any δ such that disclosure is ex ante optimal (as discussed next), $\lambda_2 > 0$ and well defined.[12] Accordingly, relative to the baseline equilibrium of equation (2) and for any given level of market liquidity λ', the speculator trades "less" in equation (7) both on private fundamental information $\left(\frac{1-(1-\delta)\lambda_2}{2\lambda'} < \frac{1}{2\lambda'}\right)$ and her endowment $\left(\frac{\beta\lambda' - \delta\lambda_2}{2\lambda'} < \frac{\beta}{2}\right)$. Intuitively, because the signal partly resolves fundamental uncertainty, information-based trading is less profitable; this captures the "cost" of PBD. However, PBD both alleviates the need for PBT and makes it less effective (by improving market depth, i.e., lowering λ_1).[13] As we show shortly, the former effect of PBD translates into a reduction in long-term profit, whereas the latter yields an increase in long-term profit because of the reduced scale of PBT.

The MM incorporate the signal's information content about fundamentals in the market clearing price of equation (8). However, since the MM are unable to disentangle the signal's fundamental-related component and endowment-related component, both components have a positive impact on the equilibrium price. The fact that the signal moves prices in the direction of the endowment is especially desirable to a speculator who is at least partly short-term-oriented, that is, at least partly interested in increasing the market value of her initial holdings of the risky asset (e.g., as for the boutique hedge funds in Ljungqvist and Qian (2016)). The equilibrium price is high (or low) exactly when a high (or low) price is desirable, that is, when her initial holdings of the asset are large ($e > \overline{e}$) (or small ($e < \overline{e}$)).

As we noted earlier, the equilibrium in Proposition 2 is conditional on the speculator committing to disclose a signal s. We now discuss when such a commitment is optimal. As we show in the following proposition, there always exist suitable choices of signal weight δ, at which committing to disclosure is ex ante optimal.

Proposition 3 (Optimality of Disclosure). Let D be the indicator variable for disclosure: $D = 1$ if the speculator commits to sending a signal s of equation (6) and $D = 0$ otherwise. The following results hold:

1. The ex ante ($t = -1$) expected value function to the speculator of committing to sending a signal with weight δ is given by

[12] Intuitively, ceteris paribus for other model parameters, $\lambda_2 \leq 0$ only for ex ante suboptimally "high" delta coefficients, since in those circumstances the MM use the resulting disclosed signal s of equation (6) to learn mostly about e and so offset any effect of PBT on P_1 via the aggregate order flow. In addition, $\alpha > 0$ and $\beta > 0$ in equation (10) since we show in Proposition 3 (and further discuss in Section IA-V of the Supplementary Material) that both $\delta = 0$ ($s = v$) and $\delta = 1$ ($s = e$) are suboptimal for the speculator while $\gamma \in [0, 1)$ in the baseline model of Section II.A.

[13] Note that λ_1 of equation (9) is increasing, while λ^* of equation (4) is decreasing, in endowment uncertainty σ_e^2. Intuitively, when δ is exogenous, an increase in σ_e^2 makes both the signal s of equation (6) less informative about v and PBT more effective (as in Bhattacharyya and Nanda (2013)), but the former effect dominates upon the latter in Proposition 2. However, it can be shown that when δ is endogenously selected, as we discuss in Proposition 3, it is decreasing in σ_e^2 (see, e.g., Figure 4) such that so is, once again, the ensuing equilibrium price impact.

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$$\text{(12)} \qquad \mathrm{E}[W|D=1,\delta] = (1-\gamma)\lambda_1\sigma_z^2\frac{1+\alpha\beta\lambda_1}{1-\alpha\beta\lambda_1},$$

where λ_1 is defined in equation (9).

2. The ex ante ($t=-1$) expected value function to the speculator of not disclosing a signal is given by

$$\text{(13)} \qquad \mathrm{E}[W|D=0] = \frac{1-\gamma}{4\lambda^*}\left(\sigma_v^2+\beta^2\lambda^{*2}\sigma_e^2\right),$$

where λ^* is defined in equation (4).

3. Disclosing is incentive compatible. Let δ^* be the optimal signal weight with disclosure,

$$\text{(14)} \qquad \delta^* = \arg\max_{\delta} \mathrm{E}[W|D=1,\delta],$$

then $\delta^* \in (0,1)$ and

$$\text{(15)} \qquad \mathrm{E}[W|D=1,\delta^*] > \mathrm{E}[W|D=0], \forall \sigma_v^2>0, \sigma_e^2>0, \sigma_z^2>0, \gamma\in(0,1).$$

The intuition for this result is that even with disclosure, the speculator can still replicate the equilibrium outcome in the baseline model by carefully choosing the signal weight δ. If the speculator sends a signal with no information content above and beyond that of the aggregate order flow, then such a signal is redundant and the equilibrium reduces to the baseline equilibrium. It can be shown that such a redundant signal is one with the weight $\widehat{\delta} = \frac{1}{1+\lambda^*\beta\frac{\sigma_e^2}{\sigma_v^2}} \in (0,1)$ for any $\beta>0$, where λ^* is given by equation (4).[14] Thus the action set of the speculator in the signaling equilibrium of Proposition 2 is $\delta\in[0,1]$ versus $\delta\in\{\widehat{\delta}\}$, which is effectively her action set in the baseline equilibrium of Proposition 1. With a strictly larger action set, optimality of disclosure follows.

It might be counterintuitive that it is suboptimal for the speculator not to disclose. It is an established notion that (more) private information yields (more) trading profit. For instance, in Kyle (1985), the greater her informational advantage, the more profit the speculator could reap from trading. Releasing a signal of her private information is thus tantamount to (at least partly) giving away expected

[14]Specifically, under $\widehat{\delta}$, the MM's two sources of information are: i) The order flow $\omega-\overline{\omega} = \frac{1}{2\lambda^*}(v-P_0)+\varepsilon_\omega$, where $\varepsilon_\omega = \frac{\beta}{2}(e-\overline{e})+z$, is the noise about fundamentals; and ii) the (scaled) signal $\frac{s-\overline{s}}{2\widehat{\delta}\lambda^{*2}\beta^2\frac{\sigma_e^2}{\sigma_v^2}} = \frac{1}{2\lambda^*}(v-P_0)+\varepsilon_s$, where $\varepsilon_s = \varepsilon_\omega+\eta$ with $\eta = \frac{2\sigma_z^2}{\beta\sigma_e^2}(e-\overline{e})-z$. Since ε_ω, η and $v-P_0$ are mutually independent, the signal is just the order flow plus uninformative noise. This implies that $v\perp s|\omega$, that is, given the order flow, a signal with weight $\widehat{\delta}$ is redundant in learning about asset fundamentals. Thus, $\lambda_1=\lambda^*$, $\lambda_2=0$, and the equilibrium reduces to the baseline equilibrium of Proposition 1. Accordingly, when $\gamma=\beta=0$, the above economy reduces to Kyle (1985) such that the long-term profit maximizing speculator is indifferent to her endowment shock e and both the optimal and redundant signals fully reveal it to the MM ($\delta^*=\widehat{\delta}=1$).

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trading profits. Accordingly, most existing models in the microstructure literature do not leave room for voluntary disclosure. In our model, however, the speculator is not a pure long-term profit maximizer. The loss of long-term profit caused by information revelation from PBD is compensated by gains in the short-term value of her portfolio, as implied by what can be shown as a greater $\text{cov}(P_1, e) = \frac{\beta\lambda_1+\delta\lambda_2}{2}\sigma_e^2 > 0$ in equilibrium than in absence of PBD (see also Section II.A); and these gains outweigh those losses, as shown in Proposition 3. By incorporating short-termism in the speculator's objective function, our model has the potential to explain the frequently observed voluntary disclosures in financial markets.

The following example may shed further light on the intuition behind Proposition 3. Assume that a speculator has the intention to "pump" price by disclosing a signal. In order for that signal to have any price impact, it must contain at least some fundamental information. Intuitively, any signal containing only information about the endowment e and possibly some noise ε would not affect the MM's fundamental priors while also reducing ex post uncertainty about e and so making any PBT by the speculator less effective (see also Bhattacharyya and Nanda (2013)). Thus, in general, the signal should be a function of v and possibly some noise ε. If the speculator follows a "naïve" strategy by setting ε to be purely random noise, such a disclosure would move prices in the desired direction only when the speculator's endowment shock happens to be in the same direction as the fundamental shock; otherwise, the signal may backfire. The net effect of such a signal is that the speculator obtains no short-term gain on average but only lowers her long-term profits due to a compromised informational advantage.[15]

Consider now a disclosure strategy that sets $\varepsilon \propto e$. Since from a Bayesian perspective, how the noise is constructed is irrelevant to the inference of v, a signal with $\varepsilon \propto e$ has the same impact on the MM's fundamental priors as a signal with purely random noise (given the same noise variance). But now the signal has an added benefit of leading the MM to interpret, for example, a "large" endowment shock as a "large" fundamental shock, potentially leading to a "large" price change. Note that when $\varepsilon = \frac{1}{\alpha}e$, this is effectively the signal in equation (6). Hence, pumping by disclosing is most effective exactly when the speculator cares most about it—when her endowment is "large".

In Section IA-VI of the Supplementary Material, we further illustrate this intuition by describing the equilibrium of Proposition 2 as the result of a two-stage game in which the MM first observe the signal s and update their priors about v and e, and then sets the market-clearing price after observing the aggregate order flow. While more involved and less conventional in the aforementioned literature, this approach yields an equivalent Perfect Bayesian Equilibrium (Proposition IA-1 in the Supplementary Material) as well as allows us to explicitly separate the effect of PBT and PBD on the speculator's ex ante expected value function (Table IA-1 in the Supplementary Material).

[15]Accordingly, the disclosure of two *separate* such signals for e and v, respectively, would cost the speculator both short-term gains and long-term profits. A formal proof of these arguments in our setting for the class of linear signals $s = e + \varepsilon$ and/or $s = v + \varepsilon$ is available in Section IA-V of the Supplementary Material.

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C. Equilibrium Properties and Comparative Statics

1. Comparative Statics

The optimal signal weight (δ^*) depends on the model's primitives. There is, unfortunately, no analytically tractable solution for δ^*. Therefore, we derive its comparative statics (and some of the properties of the ensuing equilibrium) numerically; alternative parameterizations only affect the scale of the economy. For ease of exposition, we denote with a tilde conditional values after the MM observe the signal s (e.g., $\tilde{v} = \mathrm{E}(v|s)$ and $\tilde{\sigma}_v^2 = \mathrm{var}(v|s)$; see also Section IA-VI of the Supplementary Material). We begin with Figure 2, where we plot δ^* as a function of γ (the relative importance of the speculator's short-term objective) for different combinations of such primitives as σ_v^2 and σ_e^2. For all combinations, optimal signal weight decreases monotonically in γ. Intuitively, when δ is smaller, the signal becomes more informative about v, leading to a larger loss of the speculator's informational advantage and long-term profit. Of course, if the speculator only cared about the long run ($\gamma = 0$), she would choose never to disclose valuable private information (i.e., $\delta = 1$). On the other hand, when the speculator values the short run ($\gamma > 0$), she wants to induce large asset price moves in the direction of her endowment, and thus the signal needs to be informative about both v and e. Correspondingly, as γ increases, the optimal choice of δ decreases from 1 to $\frac{\sigma_v}{\sigma_e+\sigma_v}$, the weight that induces the largest price impact.[16]

Next, Figures 3 and 4 show that, for a number of different values of γ, the optimal signal weight δ^* increases in σ_v^2 but decreases in σ_e^2. There are two forces driving this result. First, as noted earlier, the direct effect of PBD is maximized at $\delta = \frac{\sigma_v}{\sigma_e+\sigma_v}$, which is increasing in σ_v^2 and decreasing in σ_e^2, since in those circumstances so is the ex ante effectiveness of PBD at updating the MM's priors about v toward e. For example, as σ_e^2 decreases, so do the MM's ex ante uncertainty about the speculator's endowment and its comovement with their fundamental posteriors ($\mathrm{cov}(\tilde{v}, e)$); hence, the speculator has to disclose more of e in the signal s to sway those posteriors in the direction of her short-term objective (see, e.g., equation (IA-16) and Table IA-1 in the Supplementary Material). Second, since the indirect effect of disclosure involves reduction in long-term profit, a larger δ means a smaller weight on v, and therefore a smaller information loss. Thus the speculator optimally increases δ when the cost of information loss is larger, that is, when σ_v^2 is large.

Conclusion 1. The optimal signal weight δ^* increases in σ_v^2, decreases in σ_e^2, and decreases in γ.

We turn next to the size of disclosure gains. In particular, we examine how large a cost to disclosure would a speculator be willing to bear while still preferring PBD. Such a cost can be thought of as, for example, the opportunity cost to the manager of spending time in a TV studio, of giving an interview to the press, of

[16]In particular, if the speculator cared only about the short-run, order flow would have zero price impact as her trades would have no information content. Thus, only the signal could move the price and her short-run value would be given by $\mathrm{E}[\gamma e(\tilde{v} - P_0)] = \gamma \mathrm{cov}(\tilde{v}, e)$, which is maximized at $\delta = \frac{\sigma_v}{\sigma_v+\sigma_e}$.

FIGURE 2

Optimal Signal Weight and Short-Termism

Figure 2 plots, for four different combinations of σ_v^2 and σ_e^2, the optimal signal weight δ^* as a function of γ, the weight of short-term gain in the speculator's objective function. In all graphs, we set $\sigma_z^2 = 1$. The solid lines are $\delta^*(\gamma)$ and the dashed lines are the 45° lines.

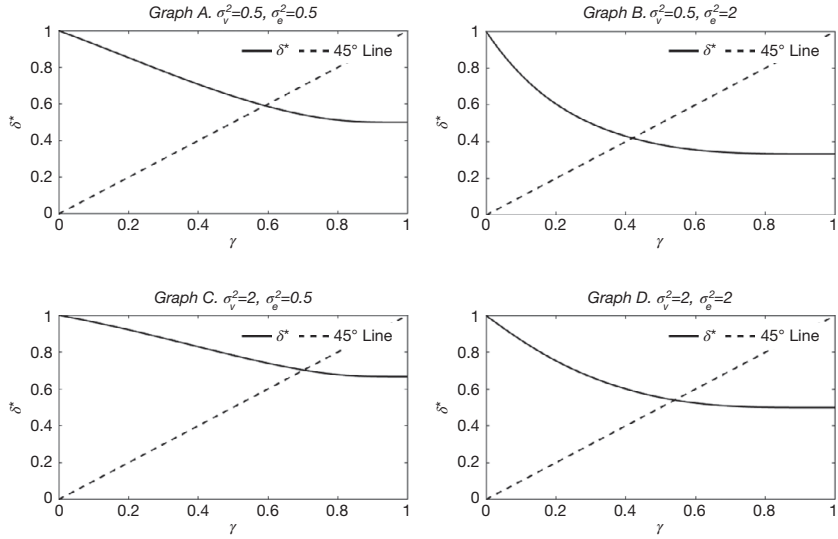

FIGURE 3

Optimal Signal Weight and Fundamental Uncertainty

Figure 3 plots, for four different γ's, the optimal signal weight δ^* as a function of σ_v^2, the asset's fundamental uncertainty. In all graphs, we set $\sigma_e^2 = \sigma_z^2 = 1$.

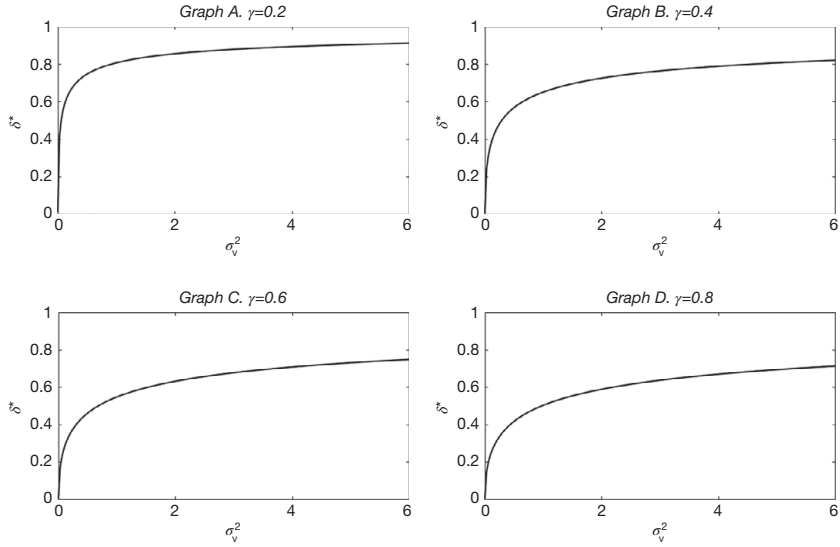

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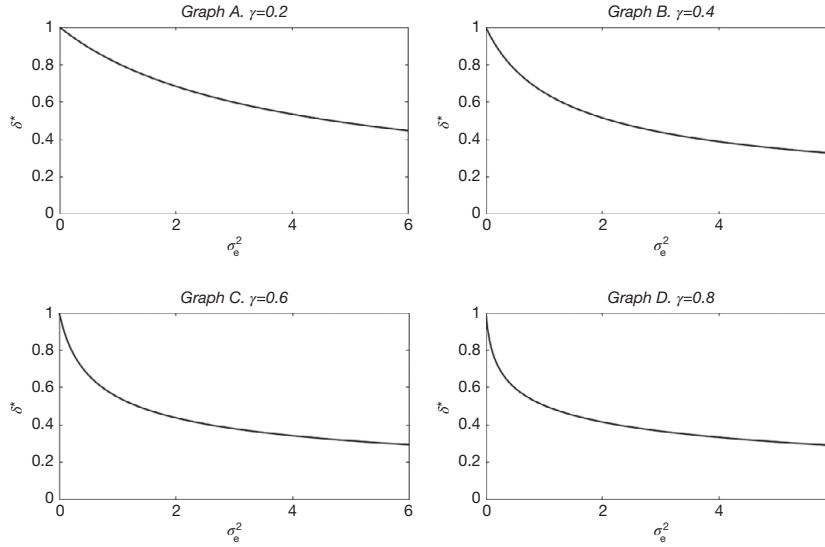
FIGURE 4

Optimal Signal Weight and Endowment Uncertainty

Figure 4 plots, for four different γ's, the optimal signal weight δ^* as a function of σ_e^2, the uncertainty about the speculator's endowment. In all graphs, we set $\sigma_v^2 = \sigma_z^2 = 1$.



composing and publishing a report, the monetary cost of making an advertisement, or any entry barrier to media disclosures. For simplicity, we assume this cost to be a fixed amount c paid by the speculator if she commits to send a signal at $t = -1$. Proposition 3 suggests that disclosure is always optimal when it is costless. Given a fixed cost c to disclose, we ask the following questions: For what range of γ would the speculator still find it optimal to disclose? How does this range depend on the information environment (σ_v^2 and σ_e^2)?

To answer these questions, let

$$I^{\gamma}\left(c, \sigma_v^2, \sigma_e^2, \sigma_z^2\right) = \left\{\gamma \in [0,1) \,|\, \max_{\delta} \mathrm{E}[W|D=1,\delta] - c > \mathrm{E}[W|D=0]\right\}.$$

Intuitively, I^{γ} is the set of γ such that the speculator prefers costly disclosure to no disclosure ex ante. Figures 5 and 6 then plot the relation between I^{γ} and σ_v^2 and σ_e^2, respectively. Note that the direct effect of PBD is to boost the short-term objective by $\gamma \mathrm{cov}(\tilde{v}, e) = \gamma \frac{\delta^*(1-\delta^*)\sigma_v^2\sigma_e^2}{\delta^{*2}\sigma_e^2 + (1-\delta^*)^2\sigma_v^2}$, which suggests that the direct gains to disclosure may be increasing in both σ_v^2 and σ_e^2.[17] This is generally consistent with Figures 5 and 6. Intuitively, both larger σ_v^2 and larger σ_e^2 increase the scope of the speculator's value function (i.e., short-termism and pumping become more important for it), and therefore can support a wider range of γ for a given fixed disclosure cost c. The sole

[17]Specifically, $\frac{\partial \mathrm{cov}(\tilde{v}, e)}{\partial \sigma_v^2} = \frac{\delta^{*3}(1-\delta^*)\sigma_e^4}{\left(\delta^{*2}\sigma_e^2 + (1-\delta^*)^2\sigma_v^2\right)^2} > 0$ and $\frac{\partial \mathrm{cov}(\tilde{v}, e)}{\partial \sigma_e^2} = \frac{\delta^*(1-\delta^*)^3\sigma_v^4}{\left(\delta^{*2}\sigma_e^2 + (1-\delta^*)^2\sigma_v^2\right)^2} > 0$.

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FIGURE 5

Cost of Disclosure and Fundamental Uncertainty

Figure 5 plots, for four different values of the fixed disclosure cost c, I^{γ} as a function of σ_v^2, the asset's fundamental uncertainty. I^{γ} is the set of γ such that the speculator prefers disclosure (with an optimally chosen signal weight) to no disclosure. The two dashed lines are upper and lower bounds of I^{γ} and the solid line is the width of the interval $[\inf I^{\gamma}, \sup I^{\gamma}]$. In all graphs, we set $\sigma_e^2 = \sigma_z^2 = 1$.

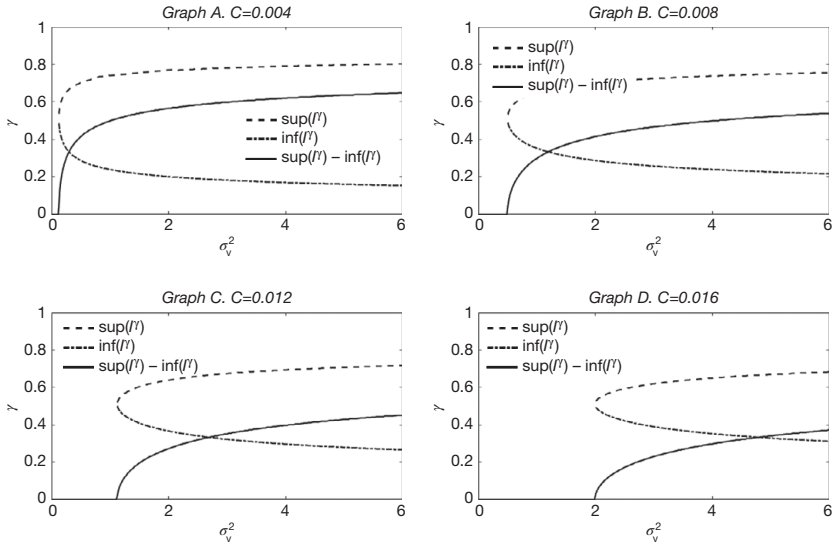
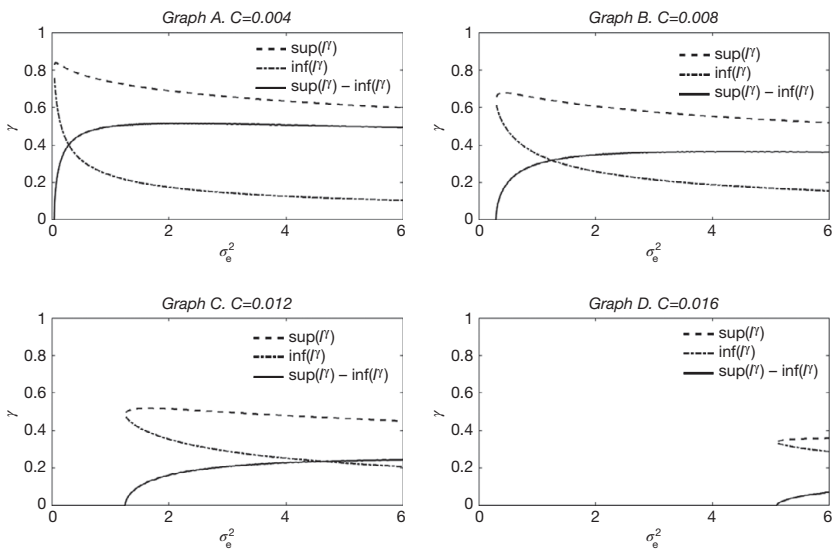


FIGURE 6

Cost of Disclosure and Endowment Uncertainty

Figure 6 plots, for four different values of the fixed disclosure cost c, I^{γ} as a function of σ_e^2, the uncertainty about the speculator's endowment. I^{γ} is the set of γ such that the speculator prefers disclosure (with an optimally chosen signal weight) to no disclosure. The two dashed lines are upper and lower bounds of I^{γ} and the solid line is the width of the interval $[\inf I^{\gamma}, \sup I^{\gamma}]$. In all graphs, we set $\sigma_v^2 = \sigma_z^2 = 1$.



(unreported) exception arises at implausibly large values of σ_e^2, where $(\sup I^\gamma - \inf I^\gamma)$ may decline in σ_e^2 since the resulting disclosed signal s of equation (6) becomes so noisy as to make PBD less valuable to a short-term-oriented speculator relative to PBT alone.

Conclusion 2. $(\sup I^\gamma - \inf I^\gamma)$ is decreasing in c, increasing in σ_v^2 and generally increasing in σ_e^2.

2. Disclosure and Market Liquidity

We now turn to the effect of PBD on market liquidity. As a benchmark, consider first the effect of a public signal of v on the equilibrium depth of an economy where the speculator maximizes exclusively her long-term profit ($\gamma = 0$). Intuitively, any signal of v would reduce the uncertainty about the asset's payoff, hence lowering adverse selection risk and equilibrium price impact (e.g., Pasquariello and Vega (2007), Kahraman (2021)), the more so the greater is the initial uncertainty about v. Next, consider the effect of PBT alone on market liquidity. PBT also lowers equilibrium price impact since it induces the speculator to deviate from long-term profit maximization to increase the short-term value of her portfolio—the more so the greater is endowment uncertainty (Bhattacharyya and Nanda (2013)).[18] The release of a signal may not only alleviate information asymmetry about v but also reduce uncertainty about e (and PBT), leading to opposite effects on liquidity. Accordingly, we show that disclosing can either increase or decrease the price impact depending on the signal weight δ; yet, price impact is always smaller if PBD is ex ante optimal. Equivalently, the effect of s on fundamental uncertainty prevails upon its effect on endowment uncertainty.

Corollary 1. i) λ_1 increases with δ; ii) $\lambda_1 < \lambda^*$ if and only if $\delta < \widehat{\delta}$, where $\widehat{\delta}$ is the signal weight at which the speculator is indifferent between disclosing and not disclosing (see equation (A-16) in the Appendix); iii) In particular, if δ is such that $\mathrm{E}[W|D=1,\delta] > \mathrm{E}[W|D=0]$, then $\lambda_1 < \lambda^*$.

Figure 7 plots equilibrium price impact in the baseline (λ^*) and signaling economies (λ_1), as well as their positive difference for the optimal signal weight δ^*, with respect to ex ante fundamental uncertainty σ_v^2. In both economies and for different values of γ and σ_e^2, equilibrium price impact is increfasing in fundamental uncertainty (as in Kyle (1985)), since so is the accompanying adverse selection risk faced by the dealership sector when clearing the market. Accordingly, in those circumstances, strategic disclosure yields an increasing improvement in equilibrium market depth (i.e., a greater $\lambda^* - \lambda_1 > 0$), since it mitigates such risk more than the decreasing weight on the asset fundamental value in the signal (i.e., greater δ^* in s of equation (6); see Figure 3) worsens it. We summarize these observations as follows.[19]

[18]Accordingly, the speculator becomes de facto in part a noise trader.

[19]We further show in Section IA-VII of the Supplementary Material that with optimal disclosure, equilibrium prices are more informative (and at the same time more volatile) in the sense that they reflect

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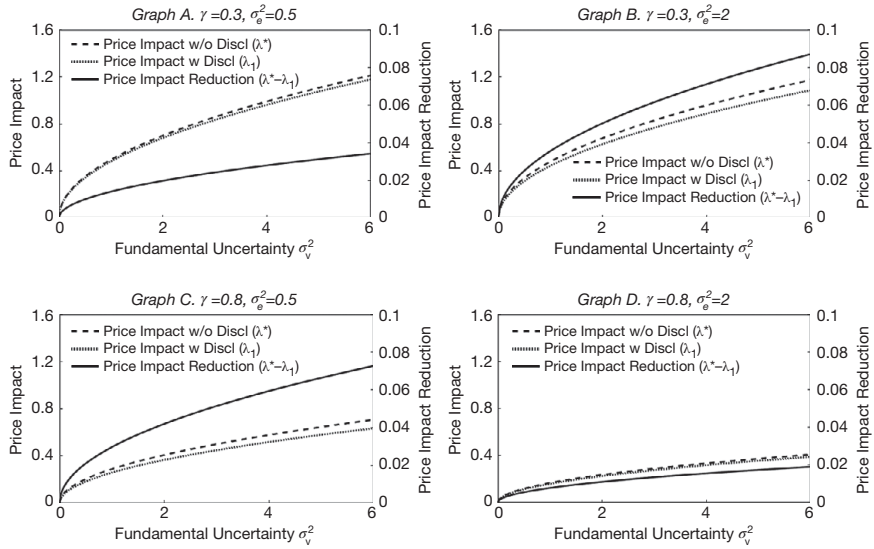
FIGURE 7

Price Impact and Fundamental Uncertainty

Figure 7 plots, for different combinations of γ and σ_e^2, the relation between equilibrium price impact and the asset's fundamental uncertainty σ_v^2. The dashed and dotted lines, which are plotted against the left axis, are the price impact in the baseline equilibrium (λ^*) and the signaling equilibrium (λ_1, in correspondence with the optimal signal weight δ^*), respectively. The solid line, plotted against the right axis, is the reduction in price impact from the baseline equilibrium to the signaling equilibrium ($\lambda^* - \lambda_1$).



Conclusion 3. The liquidity improvement from optimal disclosure (i.e., $\lambda^* - \lambda_1 > 0$) is increasing in the asset's fundamental uncertainty σ_v^2.

D. Discussion of Model Assumptions

In delivering our theoretical results on the implications of strategic disclosure for equilibrium price formation, we made two important assumptions: i) The speculator commits not to deviate, upon observing her private information, from her disclosing strategy (which is determined ex ante) and ii) the speculator's signal is a convex combination of endowment (e) and fundamentals (v).

In our model, it is crucial that the speculator commits both to disclose and to a predetermined form of disclosure. Were the speculator not bound to disclose exactly $s = \delta e + (1-\delta)v$ ex post, she would have a strong incentive to deviate—given the significant gains from signal manipulation when the MM take the signal at its face value. We discuss in detail the plausibility of our assumptions in Section IA-III of the Supplementary Material. There, we argue that these assumptions are consistent both with the extant theoretical literature on information acquisition and transmission (e.g., see Grossman and Stiglitz (1980), Admati and

a larger proportion of speculators' private information, even though speculators trade more cautiously with their private information and aggregate order flow carries less fundamental information.

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Pfleiderer (1988), and Kamenica and Gentzkow (2011)), as well as with extant large reputation costs and regulatory constraints, especially in U.S. financial markets (e.g., see the Investment Advisory Act of 1940), deterring any deviation from the speculator's pre-committed disclosure strategy (e.g., see Benabou and Laroque (1992), Van Bommel (2003), Agarwal et al. (2013), and Ljungqvist and Qian (2016)). With this discussion in mind, we test our model's main implications within the U.S. stock market next.

III. Data and Sample Selection

Our model argues that a speculator who cares about the short-term value of her holdings may voluntarily disclose some of her private information. Consistent with our model, Ljungqvist and Qian (2016) show that small hedge fund managers make public their findings about problematic firms after taking large short positions in those companies. Anecdotally, activist investors such as Carl Icahn or Bill Ackman frequently communicate their perspectives to the public through media interviews, Twitter feeds, or blogs.[20] Our theory suggests that the use of strategic public disclosure may be even more widespread than what is currently reported in the literature, especially among (at least partly) short-term oriented sophisticated financial market participants.

Accordingly, we set to test our model by studying the effect of all voluntary non-anonymous disclosures by mutual funds in WSJ, FT, and NYT on the U.S. stock market. Four observations motivate our choice. First, mutual funds arguably are among the most sophisticated financial market participants (e.g., Wermers (2000), Kacperczyk, Sialm, and Zheng (2008), and Huang, Sialm, and Zhang (2011)). Second, as noted earlier, many studies show that mutual fund managers are subject to short-term concerns. For instance, numerous papers find that mutual fund flows are sensitive to past performance (e.g., Ippolito (1992), Sirri and Tufano (1998), and Del Guercio and Tkac (2002)). Additionally, mutual fund managers exhibit tournament-like behavior (e.g., Brown et al. (1996), Chevalier and Ellison (1999), and Chen, Hughson, and Stoughton (2018)), consistent with short-term objectives. Third, the large reader base of those three newspapers and their ample coverage of the financial sector grants speculators broad access to the investor community (consistent with our model's notion of the disclosed signal being common knowledge) while their well-established reputation as providers of accurate and ex post verifiable financial information mitigates potential media bias in their reporting (see, e.g., Gentzkow and Shapiro (2006)). Fourth, newspaper disclosures leave traceable records, and mutual funds are required by law to regularly report their portfolio compositions; both ensure adequate availability of data to test our theory.[21]

[20]See, for instance, "Carl Icahn Takes 'Large' Apple Stake" on CNN Money, available at http://money.cnn.com/2013/08/13/technology/mobile/carl-icahn-apple/.

[21]Investigating strategic disclosure and trading by hedge funds is significantly more challenging in light of severe data limitations on their managers' identity and portfolio holdings. Accordingly, the unreported analysis of a much smaller sample of hedge funds with viable such data and only a few newspaper disclosures yields qualitatively similar, yet noisier and less uniform inference.

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A. Data and Identification Criteria

1. Mutual Fund Holding Data

Our sample spans a decade from 2005 to 2014. Mutual fund holdings are an important input to our study. We obtain holdings data from the CRSP mutual fund database. The database provides portfolio compositions, including both long and short positions, of all open-end mutual funds in the United States. While holdings data are available at the monthly frequency, non-quarter-end month data are missing for most funds as reporting of portfolio composition is only mandatory quarterly. Hence, our sample is constructed (and the accompanying empirical analysis of our model's predictions is conducted) at the quarterly (i.e., calendar quarter-end month) frequency.[22] Our theory focuses on strategic disclosures by an active, privately informed speculative sector about assets with nontrivial fundamental uncertainty. Accordingly, we exclude from our sample all index funds, ETFs (given their overwhelmingly passive management style and distinct regulatory framework over our sample period; see, e.g., Lettau and Madhavan (2018), SEC (2019)), and fixed income funds. CRSP provides holdings data at the portfolio level. For our tests, however, we consolidate all data to the fund holding company level for two reasons. First, our empirical study involves linking a speculator's disclosure behavior to her incentives to disclose and (as we observe next) most disclosures are only identifiable at the fund holding company level. Second, it is plausible that funds within the same family may coordinate their disclosing strategy to serve the same or similar family-level objectives. The fund holding family, therefore, fits more closely with our notion of a sophisticated speculator in the model. We also collect from CRSP the names of all portfolio managers who have worked at each of the fund holding families during our sample period.[23]

For each quarter, we consider as potential disclosure targets all firms that are in the S&P 1500 universe. Those firms are the largest in the U.S. stock market, hence presumably the most likely subject of financial media coverage. We exclude all financial companies, as most of them are often also classified as speculators in our mutual fund sample.

2. Mutual Fund Disclosure Data

Our disclosure data comes from two sources. We obtain WSJ articles from ABI/INFORM and FT and NYT articles from LexisNexis.[24] For each newspaper,

[22]A small fraction (5.4%) of the fund portfolios in our sample report fiscal (rather than calendar) quarter-end holdings. In those circumstances, we convert these holdings at the calendar quarter-end level by assigning them to the closest calendar quarter to their as-of dates. Schwarz and Potter (2016) document that the CRSP mutual fund database contains some inaccurate holdings prior to 2008. However, restricting the analysis that follows to the subsample 2008–2014 does not affect our findings. Higher-frequency holdings are scarcely available and likely affected by the quarter-end mandatory reporting cycle. For instance, using proprietary trade-level data from mutual funds and pension funds, Gormley, Kaplan, and Verma (2022) provide evidence of abnormal daily portfolio formation around those quarter-end dates.

[23]CRSP reports fund manager names with varying levels of precision. For the majority of fund managers, CRSP reports their first and last names; sometimes all first, middle, and last names are available; sometimes CRSP either only reports the last name or states that the fund is "team-managed."

[24]ABI/INFORM and LexisNexis give us access to the U.S. edition of the WSJ and NYT, respectively; most issues of the FT on LexisNexis are instead from the U.K. edition (with the remaining ones from the U.S. edition).

we obtain all articles published between 2005 and 2014. We then drop articles that are published in a nonbusiness-related section, letters from readers, or corrections. We parse the news by paragraph to identify (potentially) strategic public disclosures by fund holding company *j* about target firm *i* via a procedure detailed in Table 1 based on seeking both (exact) names of the target company *i* and either the fund management company *j* or the full name of any portfolio manager at fund holding company *j* if accompanied by such key words as "analyst," "portfolio manager," or "strategist."[25]

Importantly, in applying these screenings, we do not separately search for information disclosures about fundamentals (v) versus the speculator's endowment (e), since, as noted earlier, the two are likely indistinguishable. Plausibly, speculators may provide information to the media with selective emphasis. Upon seeing a disclosure about fundamentals, a reader may rationally infer that the information provider has such a position that she stands to gain if her disclosure is impounded into the price. Second, as sophisticated investors choose their positions endogenously, information about those positions is also likely to be suggestive about fundamentals.

Table 2 reports, for each newspaper, the number of articles so identified as disclosures, as well as the number of articles that are in the business-related and business-unrelated sections; plots of the total and relative number of these disclosures over our sample period are in Figure 8. Out of the 675,452 articles published in the business-related sections of WSJ, FT, and NYT, 11,550 are identified as potentially strategic non-anonymous disclosures between 2005 and 2014, amounting to a plausible and relatively stable 1.7% of their total business coverage.[26] Visual inspection of the identified articles shows that they capture the notion of "strategic disclosure" with reasonable accuracy. Table 3 reports five such paragraphs as examples.

To further validate this approach, we plot in Figure 9 OLS estimates of daily absolute abnormal returns (AARs, solid line, in percentage, defined as the absolute difference between individual stock returns and nonfinancial S&P 1500 index returns; see Section III.A.1) for the stocks mentioned in those articles over a 40-day window around their first U.S. *print* publication date as available to us (day 0; U.S. edition for NYT and WSJ, U.K. edition for FT), as well as their 95% confidence interval (dashed lines, based on standard errors clustered at the event-date level). We focus on unsigned price changes to avoid any subjective or mechanical interpretation of the articles' information content; print publication is usually preceded (by at least a day; day -1) by online access and newspapers print multiple editions at different time zones around the world. Consistent with the model's

[25]News articles rarely refer to individual funds within a family. For example, it is much more likely for a news article to report a quote from "a portfolio manager with T. Rowe Price" rather than a quote from "a portfolio manager at T. Rowe Price Blue Chip Growth Fund."

[26]Some of these news articles may also be reprinted or discussed in blogs and other business news outlets (e.g., Bloomberg, Reuters, CNBC, or FBN), further increasing their potential audience. A number of these articles (3,685 out of 11,550) mention more than one firm and/or fund management company in our sample, hence are treated as potential strategic disclosures for more than one firm *i* and/or fund *j* in the empirical analysis that follows.

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TABLE 1

Variable Definitions

Table1 provides construction details of the variables used in our empirical analysis of Section IV. Throughout this table, we use the subscripts i, j, k, and t to index for firm, fund holding company (fund, for short), individual portfolio managed by a fund holding company, and quarter, respectively. $K_{j,t}$ is the set of portfolios k managed by fund j in quarter t. Newspaper data are from ABI/INFORM and LexisNexis; mutual fund and stock-level data are from CRSP; analyst-level data are from I/B/E/S; S&P 1500 composition data are from Compustat.

Disclosures. At firm-fund-quarter level, we define $\text{DISCL}_{i,j,t}$ as the number of disclosures made by fund j about firm i during quarter t, $\text{DISCL}_{-i,j,t}$ as the number of disclosures made by fund j about all firms except firm i, and $\text{DISCL}_{i,-j,t}$ as the number of disclosures made by all funds except fund j about firm i. At firm-quarter level, we define $\text{DISCL}_{i,t}$ as the number of disclosures made by all sample funds about firm i in quarter t. We define a disclosure made by fund holding company j about target firm i as an article published in the Wall Street Journal, the Financial Times, or the New York Times, which contains a paragraph such that either one of the following is satisfied:

1. Both names of the target company i and the fund management company j are found. Because investment banks are frequently covered in the media together with other firms for reasons unrelated to strategic information disclosure (equity or bond underwriting, grading assignments, etc.), to avoid confounding our analysis, we exclude investment banks (e.g., Goldman Sachs, Merrill Lynch, Wells Fargo, etc.) from fund management companies, unless i) key words such as "analyst," "portfolio manager," or "strategist" appear in the same sentence as the mention of the fund holding company; ii) key words such as "securities," "holdings," or "asset management," which indicates the disclosure comes from a non-investment banking branch of j, closely follow the mention of the fund management company (with no more than one word in between); or iii) the name (first name followed by last name) of a portfolio manager associated with fund holding company j is also found in the same paragraph.
2. The name of the target company i is found and either i) all first, middle, and last names of any portfolio manager at fund holding company j is found, or ii) the first and last names of any portfolio manager at fund holding company j is found, and in the same sentence there is any of the following key words: analyst, fund manager, portfolio manager, strategist, director of research, research director, financial expert, investment advisor, financial advisor, portfolio advisor, fund advisor, research professional, asset manager, client advisor, private wealth advisor, head of, investment officer, the plural form of the above phrases, as well as their alternative spellings (e.g., "advisor" spelled as "adviser").

Amihud's (2002) Illiquidity. Following Amihud (2002), for each firm i and quarter t, we compute $\text{AMIHUD}_{i,t}$ as $\frac{1}{N_t}\sum_{d=1}^{N_t}\frac{|r_{i,d}|}{\text{DVOL}_{i,d}}$, where $r_{i,d}$ and $\text{DVOL}_{i,d}$ denote, respectively, daily return and dollar trading volume for firm i shares on day d. The sum is taken over all trading days d in quarter t, with a total of N_t days.

Flow-Perf Sensitivity. First, for each portfolio k managed by holding company j and each quarter t, we estimate the following regressions: $\text{FLOW}_{k,m}=\alpha_{k,t}+\sum_{h=0}^{2}\zeta_{k,t}^{h}\text{PERF}_{k,m-h}+\varepsilon_{k,m}$, where m indexes for month, and $\text{FLOW}_{k,m}$ and $\text{PERF}_{k,m}$ are monthly percentage fund flows and performance, respectively. We estimate the regression over 12 rolling months ending in the last month of quarter t. We measure fund performance with its CAPM alpha. We define the portfolio-quarter level sensitivity as $\zeta_{k,t}=\zeta_{k,t}^{0}+\zeta_{k,t}^{1}+\zeta_{k,t}^{2}$. Next, we define the firm-fund-quarter level flow-performance sensitivity as

$$\text{FLOW_PERF_SENSITIVITY}_{i,j,t}=\sum_{k\in K_{j,t}}\text{VALHOL}_{i,k,t}\times\zeta_{k,t}/\sum_{k\in K_{j,t}}\text{TNA}_{k,t},$$

where $\text{VALHOL}_{i,k,t}$ is the market value of firm i's shares held in portfolio k and $\text{TNA}_{k,t}$ is portfolio k's total net assets. Finally, we define the firm-quarter and fund-quarter level sensitivity as

$$\text{FLOW_PERF_SENSITIVITY}_{i,t}=\sum_{j}\sum_{k\in K_{j,t}}\text{VALHOL}_{i,k,t}\times\zeta_{k,t}/\sum_{j}\sum_{k\in K_{j,t}}\text{TNA}_{k,t},$$

and

$$\text{FLOW_PERF_SENSITIVITY}_{j,t}=\sum_{k\in K_{j,t}}\text{TNA}_{k,t}\times\zeta_{k,t}/\sum_{k\in K_{j,t}}\text{TNA}_{k,t},$$

respectively. Intuitively, $\text{FLOW_PERF_SENSITIVITY}_{i,j,t}$ ($\text{FLOW_PERF_SENSITIVITY}_{i,t}$) is the change in fund flows to fund j (all sample funds) holding firm i as a percentage of fund j's (those funds' combined) total net assets in response to a 1% increase in firm i's stock return, and $\text{FLOW_PERF_SENSITIVITY}_{j,t}$ captures the additional percentage fund flows in response to a 1% performance improvement in all the portfolios managed by the fund.

Pivotal. At firm-fund-quarter level, we define $\text{PIVOTAL}_{i,j,t}=\max\left\{\frac{\text{PCTHOL}_{i,j,t}^{\text{F}}}{\text{PCTHOL}_{i,t}^{\text{M}}},\frac{\text{PCTHOL}_{i,t}^{\text{M}}}{\text{PCTHOL}_{i,j,t}^{\text{F}}}\right\}$, where $\text{PCTHOL}_{i,j,t}^{\text{F}}$ is the market value of fund j's holdings of firm i shares as a fraction of the market value of its holdings of all S&P 1500 firm shares at the end of quarter t, and $\text{PCTHOL}_{i,t}^{\text{M}}$ is firm i's market capitalization as a fraction of the market capitalization of the S&P 1500 universe at the end of quarter t. At firm-quarter level, we define $\text{PIVOTAL}_{i,t}=\max\left\{\frac{\text{PCTHOL}_{i,t}^{\text{F}}}{\text{PCTHOL}_{i,t}^{\text{M}}},\frac{\text{PCTHOL}_{i,t}^{\text{M}}}{\text{PCTHOL}_{i,t}^{\text{F}}}\right\}$, where $\text{PCTHOL}_{i,t}^{\text{F}}$ is the market value of sample funds' combined holdings of firm i shares scaled by the market value of their combined holdings of all S&P 1500 firm shares at the end of quarter t. Finally, at fund-quarter level, $\text{PIVOTAL}_{j,t}$ is defined as the average of $\text{PIVOTAL}_{i,j,t}$ across sample firms. In constructing $\text{PIVOTAL}_{i,j,t}$ and $\text{PIVOTAL}_{i,t}$, we first exclude observations with nonpositive holdings (for which the variables are not well-defined). We then censor the resulting variables at their 98% levels (but not at their 2% levels because, by construction, the variables are bounded from below by 1). Lastly, we replace observations with nonpositive holdings by the 98th percentile value.

Churn Rate. We measure churn rate based on Gaspar et al. (2005). First, let

$$\text{CR}_{i,j,t}=\sum_{k\in K_{j,t}}|\text{SHR}_{i,k,t}-\text{SHR}_{i,k,t-1}|\times\text{PRC}_{i,t}/\sum_{k\in K_{j,t}}\frac{1}{2}(\text{SHR}_{i,k,t}\times\text{PRC}_{i,t}+\text{SHR}_{i,k,t-1}\times\text{PRC}_{i,t-1}),$$

$$\text{CR}_{i,t}=\sum_{j}\sum_{k\in K_{j,t}}|\text{SHR}_{i,k,t}-\text{SHR}_{i,k,t-1}|\times\text{PRC}_{i,t}/\sum_{j}\sum_{k\in K_{j,t}}\frac{1}{2}(\text{SHR}_{i,k,t}\times\text{PRC}_{i,t}+\text{SHR}_{i,k,t-1}\times\text{PRC}_{i,t-1}),$$

and

$$\text{CR}_{j,t}=\sum_{i}\sum_{k\in K_{j,t}}|\text{SHR}_{i,k,t}-\text{SHR}_{i,k,t-1}|\times\text{PRC}_{i,t}/\sum_{i}\sum_{k\in K_{j,t}}\frac{1}{2}(\text{SHR}_{i,k,t}\times\text{PRC}_{i,t}+\text{SHR}_{i,k,t-1}\times\text{PRC}_{i,t-1}),$$

(continued on next page)

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TABLE 1 (continued)

Variable Definitions

where $\text{SHR}_{i,k,t}$ is the number of firm i shares held in portfolio k, and $\text{PRC}_{i,t}$ is the share price. We then define the firm-fund-quarter-, firm-quarter-, and fund-quarter-level churn rate as the corresponding eight-quarter rolling averages $\overline{\text{CR}}_{i,j,t} = \frac{1}{8}\sum_{h=0}^{7}\text{CR}_{i,j,t-h}$, $\overline{\text{CR}}_{i,t} = \frac{1}{8}\sum_{h=0}^{7}\text{CR}_{i,t-h}$, and $\overline{\text{CR}}_{j,t} = \frac{1}{8}\sum_{h=0}^{7}\text{CR}_{j,t-h}$, respectively.

Turnover Rate. For each firm i, quarter t, and portfolio k managed by some sample fund, let $\text{BUY}_{i,k,t} = \max\{\text{SHR}_{i,k,t} - \text{SHR}_{i,k,t-1}, 0\} \times \text{PRC}_{i,t}$ and $\text{SELL}_{i,k,t} = \max\{\text{SHR}_{i,k,t-1} - \text{SHR}_{i,k,t}, 0\} \times \text{PRC}_{i,t}$, where $\text{SHR}_{i,k,t}$ is the number of firm i shares held in portfolio k, and $\text{PRC}_{i,t}$ is the share price. Let

$$\text{TR}_{i,j,t} = \min\left\{\sum_{k\in K_{j,t}}\text{BUY}_{i,k,t}, \sum_{k\in K_{j,t}}\text{SELL}_{i,k,t}\right\} / \sum_{k\in K_{j,t}}\text{SHR}_{i,k,t}\times\text{PRC}_{i,t},$$

$$\text{TR}_{i,t} = \min\left\{\sum_{j}\sum_{k\in K_{j,t}}\text{BUY}_{i,k,t}, \sum_{j}\sum_{k\in K_{j,t}}\text{SELL}_{i,k,t}\right\} / \sum_{j}\sum_{k\in K_{j,t}}\text{SHR}_{i,k,t}\times\text{PRC}_{i,t},$$

and

$$\text{TR}_{j,t} = \min\left\{\sum_{i}\sum_{k\in K_{j,t}}\text{BUY}_{i,k,t}, \sum_{i}\sum_{k\in K_{j,t}}\text{SELL}_{i,k,t}\right\} / \sum_{i}\sum_{k\in K_{j,t}}\text{SHR}_{i,k,t}\times\text{PRC}_{i,t}.$$

We then define the firm-fund-quarter-, firm-quarter-, and fund-quarter-level turnover rate as the corresponding eight-quarter rolling averages $\overline{\text{TR}}_{i,j,t} = \frac{1}{8}\sum_{h=0}^{7}\text{TR}_{i,j,t-h}$, $\overline{\text{TR}}_{i,t} = \frac{1}{8}\sum_{h=0}^{7}\text{TR}_{i,t-h}$, and $\overline{\text{TR}}_{j,t} = \frac{1}{8}\sum_{h=0}^{7}\text{TR}_{j,t-h}$, respectively.

Inverse Holding Period (#Qtr). HOLDING_PERIOD measures the average number of quarters a fund has (a set of funds have) kept a firm's (a set of firms') shares in the portfolio. In constructing the variable, we treat long and short positions symmetrically. Specifically, let $a^{+}_{i,k,t} = 7 \times \max\{\text{SHR}_{i,k,t-7}, 0\} + \sum_{h=0}^{6}(\max\{\text{SHR}_{i,k,t-h}, 0\} - \max\{\text{SHR}_{i,k,t-h-1}, 0\}) \times h$, and let $a^{-}_{i,k,t} = 7 \times \max\{-\text{SHR}_{i,k,t-7}, 0\} + \sum_{h=0}^{6}(\max\{-\text{SHR}_{i,k,t-h}, 0\} - \max\{-\text{SHR}_{i,k,t-h-1}, 0\})$. Then $a^{+}_{i,k,t}$ and $a^{-}_{i,k,t}$ are the holding quarters weighted long and short positions taken by a fund, respectively. Note that we cap the maximum number of holding quarters at seven. Similarly, let $b^{+}_{i,k,t} = \max_{h=0,1,\ldots,7}\max\{\text{SHR}_{i,k,t-h}, 0\}$ and $b^{-}_{i,k,t} = \max_{h=0,1,\ldots,7}\max\{-\text{SHR}_{i,k,t-h}, 0\}$ be the maximum long and short positions taken by the fund over the current and the past seven quarters, respectively. We then define the average holding period at firm-fund quarter level as

$$\text{HOLDING_PERIOD}_{i,j,t} = \sum_{k\in K_{j,t}} a^{+}_{i,k,t} + a^{-}_{i,k,t} / \sum_{k\in K_{j,t}} b^{+}_{i,k,t} + b^{-}_{i,k,t},$$

$$\text{HOLDING_PERIOD}_{i,t} = \sum_{j}\sum_{k\in K_{j,t}} a^{+}_{i,k,t} + a^{-}_{i,k,t} / \sum_{j}\sum_{k\in K_{j,t}} b^{+}_{i,k,t} + b^{-}_{i,k,t},$$

and

$$\text{HOLDING_PERIOD}_{j,t} = \sum_{i}\sum_{k\in K_{j,t}} a^{+}_{i,k,t} + a^{-}_{i,k,t} / \sum_{i}\sum_{k\in K_{j,t}} b^{+}_{i,k,t} + b^{-}_{i,k,t},$$

respectively. Finally, we define the firm-fund-quarter-, firm-quarter-, and fund-quarter-level inverse holding period as $\text{IHP}_{i,j,t} = 1/\text{HOLDING_PERIOD}_{i,j,t}$, $\text{IHP}_{i,t} = 1/\text{HOLDING_PERIOD}_{i,t}$, and $\text{IHP}_{j,t} = 1/\text{HOLDING_PERIOD}_{j,t}$.

Firm Market Cap. We define $\text{SIZE}_{i,t}$ as the market capitalization of firm i at the end of quarter t.

Analyst Forecast Inaccuracy. Let $\mu^{\text{EPS}}_{i,t,h}$ be the mean of analyst forecasts of firm i's quarterly earnings per share (EPS) in month h of quarter t, and let $\text{EPS}_{i,t}$ be the firm i's realized EPS. We define *Analyst Forecast Inaccuracy* as

$$\text{INACCU}_{i,t} = \left|\left(\frac{1}{\text{NUMBER_OF_MONTHS_WITH_FORECAST_DATA}}\sum_{h\in\text{MONTHS_WITH_FORECAST_DATA}}\mu_{i,t,h}\right) - \text{EPS}_{i,t}\right| / \text{EPS}_{i,t}.$$

This variable captures the deviation of (outside) investors' perceived firm performance from the actual performance.

Stock Return Std. Dev. (%). We define $\text{STDEV_RET}_{i,t}$ as the annualized standard deviation of firm i's daily stock return in quarter t.

Trading Intensity (%). We define trading intensity as the percentage of a firm's shares outstanding traded by all sample funds during a quarter, that is, $\text{PCTTRD}_{i,t} = \frac{|\sum_j \text{SHR}_{i,j,t} - \sum_j \text{SHR}_{i,j,t-1}|}{\text{SHROUT}_{i,t-1}} \times 100$, where $\text{SHR}_{i,j,t}$ is the total number of firm i shares held by fund j at the end of quarter t and $\text{SHROUT}_{i,t}$ is the firm's shares outstanding.

TABLE 2

Summary Statistics of WSJ/NYT/FT Data

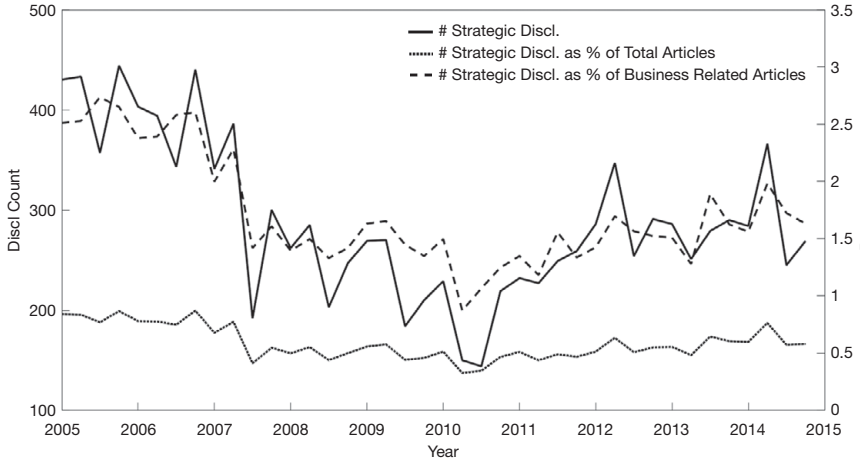
Table 2 summarizes our disclosure data. Our sample spans a decade from 2005 to 2014 and covers all articles published in the *Wall Street Journal*, the *Financial Times*, and the *New York Times*. To identify an article as containing a strategic disclosure, we apply a filtering procedure described in Table 1. For each of the three newspapers, we count separately the number of articles that we identify as disclosures, which we do not identify as disclosures but are published in a business-related section, and which are published in a business-unrelated section (such as leisure, art, or food).

	No. of Articles			
	FT	NYT	WSJ	All
Disclosures	3,531	2,886	5,133	11,550
Business-related	189,472	133,191	352,789	675,452
Business-unrelated	405,769	872,169	4,678	1,282,616
All	595,275	1,005,363	357,476	1,958,114

FIGURE 8

Number of Potentially Strategic Disclosures over Time

Figure 8 plots the total number of potentially strategic disclosures (as defined in Section III.A.2) about S&P 1500 nonfinancial firms (left axis, solid line), and as a fraction of the total number of business-related articles (right axis, dashed line) or all articles (right axis, dotted line) printed in WSJ, FT, and NYT, over each quarter of the sample period 2005–2014. Newspaper data are from ABI/INFORM and LexisNexis; mutual fund data are from CRSP; S&P 1500 composition data are from Compustat.



premise, the event study in Figure 9 suggests that market participants are aware of and nontrivially react to the potentially strategic disclosures in our sample: Estimated AARs increase sharply around their earliest (online, day −1) release (e.g., from −0.02 on day −2 to 0.64 on day −1, 0.23 on day 0, and 0.03 on day 1) and do not fully revert to pre-event levels until several days afterward.

3. Liquidity

We use stock price and trading data to compute a measure of illiquidity that is both commonly used in the literature and broadly consistent with the notion of Kyle's (1985) lambda in the model, while also providing ample sample coverage: Amihud's (2002) price impact. For each stock i and quarter t, it is computed as a quarterly average of daily price impact, that is, absolute percentage price change per dollar traded.[27]

4. Sample Construction and Summary Statistic

As discussed previously, we identify mutual fund disclosures at the fund holding company level. Correspondingly, all our empirical tests use only information at this level. Hence, for simplicity, we use the term "fund" to refer to a fund holding company or fund family throughout the remainder of this article. To avoid

[27]In unreported analysis, qualitatively similar (yet noisier) inference ensues from employing the (Amivest) liquidity ratio of Cooper, Groth, and Avera (1985) and Amihud, Mendelson, and Lauterbach (1997), a popular alternative measure of firm-level market depth computed as a quarterly average of the daily ratio between dollar trading volume and absolute stock return.

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TABLE 3

Examples of Identified Disclosures

Table 3 lists sample paragraphs with which a journal article is identified as a strategic disclosure using the screening technique described in Section III.A.2.

Time Warner's Cable Plan Is Attracting Bargain Hunters Julia Angwin The Wall Street Journal, Mar. 3, 2005	Time Warner plans to pay for Adelphia partly by issuing stock in the new Time Warner cable company. "I'm not the biggest cable bull in the world, but I'm positive on the speculated deal terms," said Henry Ellenbogen, an analyst with T. Rowe Price, which owned a 1.2% stake in Time Warner as of Dec. 31, according to FactSet Research. Mr. Ellenbogen believes the new cable stock likely would trade at a higher multiple than Time Warner shares do currently, indicating that it would be fast-growing. It would "showcase the growth and quality of cable operation and show that Time Warner's high-quality, albeit moderate-growth, media assets trade at a significant discount to their peers," he said.
The Energy Conundrum: To Own or Ignore? Ian McDonald The Wall Street Journal, Oct. 7, 2005	Energy bulls believe that the dearth of major oil and natural-gas discoveries in recent years should keep oil prices and energy-company profits high. And, despite the recent drop in crude-oil prices, cuts in refining capacity because of the Gulf Coast hurricanes add to the bulls' optimism for sustained high prices. "The cash flows from these companies should be pretty staggering for some time," says David Dreman, chairman and chief investment officer at Dreman Value Management in Jersey City, N.J. His firm didn't own energy stocks during the 1990s, but built up big positions late last year in stocks like Devon Energy, ConocoPhillips and Occidental Petroleum, which are all up more than 35% so far this year but off over the past week.
Starbucks Investors May Get Jitters Ian McDonald and Janet Adamy The Wall Street Journal, May 9, 2006	Starbucks bulls argue that those who steer clear of the shares today match Oscar Wilde's definition of a cynic: someone who knows the price of everything and the value of nothing. "It's expensive. It will probably always be expensive," says Bill McVail, a portfolio manager with Turner Investment Partners of Berwyn, Pa., which has $21.2 billion under management. The firm has owned Starbucks in client portfolios for more than three years. "A company with this kind of franchise won't sell at a market multiple."
EBay Merchants Seek Management Change Mylene Mangalindan The Wall Street Journal, Aug. 21, 2006	Kevin Landis, chief investment officer of Firsthand Capital Management, which owns eBay shares, says much of the hand-wringing by merchants is overblown. EBay "isn't exactly a turnaround situation," he says. "You still have a very healthy, growing profitable company." He notes eBay's price/earnings ratio of 36 is comparable with those of Amazon.com Inc. and Yahoo Inc., which have multiples of 39 and 33, respectively. But eBay's forward P/E multiple of 20, which incorporates earnings estimates for next year, looks like a steal, he says. In contrast, Amazon's richer forward P/E multiple is 40, and Yahoo has a forward P/E of 42. "Unless these guys are done growing, that's cheap," says Mr. Landis, who believes eBay will keep growing.
Reed Krakoff Seals $50M Buyout Elizabeth Paton The Financial Times, Sept. 3, 2013	Henry Ellenbogen, portfolio manager at T Rowe Price, a mutual fund that has invested in U.S. luxury retail companies such as Tory Burch and Michael Kors, said: "We have an extremely strong record in the sector and see this business as a future force to be reckoned with on a global scale."

confusion, we henceforth label the subsidiary funds managed by those holding companies as "portfolios"; in Section III.B we then consolidate portfolio-level information of interest at the fund holding company-level. We use the subscripts i, j, k, and t to index for firms (disclosure targets), funds, portfolios, and quarter (i.e., quarter year), respectively.

Next, we use this consolidated data to form two samples, one at firm-fund-quarter level and the other at firm-quarter level. We use the former to investigate the determinants of the aforementioned potentially strategic disclosures, and use the latter to understand their effects on the stock liquidity of the target firms. Our firm-fund-quarter level sample is composed of all triples (i,j,t) where in quarter t between 2005 and 2014, i) firm i belongs to the (nonfinancial) S&P 1500 universe and appears in at least one disclosure article, and ii) fund j makes at least one disclosure and its holding data are available. This sample restriction is motivated by the preponderance of zero disclosures in the otherwise much larger raw sample

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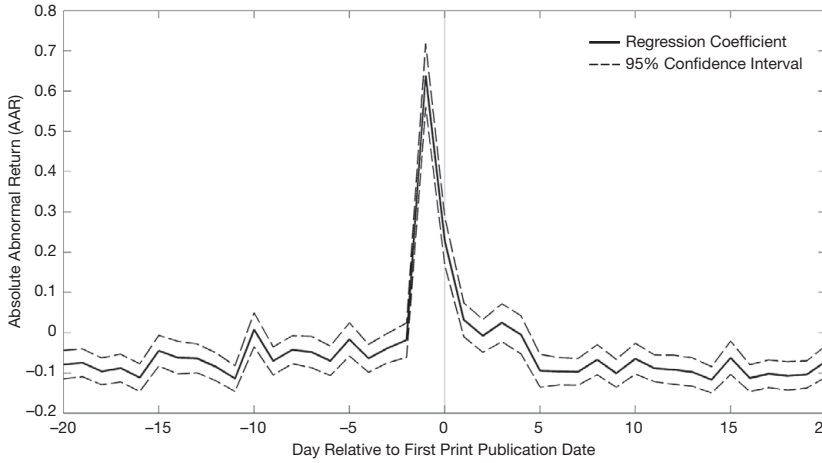
FIGURE 9

Abnormal Absolute Returns Around Disclosure Dates

Figure 9 plots OLS estimates of daily absolute abnormal returns (AARs, solid line, in percentage, net of value-weighted nonfinancial S&P 1500 index returns) for the stocks mentioned in the potentially strategic disclosures in our sample (in the form of WSJ, FT, and NYT articles, as defined in Section III.A.2) within 40 trading days around the U.S. date of first print publication (day 0; U.S. edition for NYT and WSJ, U.K. edition for FT) over the sample period 2005–2014, as well as the corresponding 95% confidence interval based on standard errors clustered at the event-date level (dashed lines). Newspaper data are from ABI/INFORM and LexisNexis; mutual fund and stock-level data are from CRSP; S&P 1500 composition data are from Compustat.



(e.g., because of unobserved high disclosure costs or barriers relative to its expected benefits, as suggested by the model extension of Section II.C.1; see also Proposition 3 and Figures 5 and 6) in light of our focus on the determinants and implications of observed firm-fund-quarter level disclosure activity (rather than of any sample-wide absence thereof).[28] The resulting sample consists of 146,181 observations from 993 firms disclosed about at least once and 335 funds disclosing at least once over the sample period.

Our firm-quarter level sample includes all pairs (i,t) where in quarter t between 2005 and 2014, firm i belongs to the (nonfinancial) S&P 1500 universe, yielding a total of 47,819 observations from 1,845 firms. Summary statistics for all variables of interest listed and defined in Table 1 in each of the two samples are in Table 4. All variables are winsorized at the 2% and 98% levels to further remove extreme realizations. Mean and median for each variable are computed for the full sample, as well as for each of the four increasingly smaller subsamples where we restrict the number of disclosures to be equal to 0 or at least 1, 5, or 10. As noted earlier, disclosures are infrequent but not uncommon over our sample period (e.g., a median of 0 but a mean of 0.29 per quarter at the firm level), as well as evenly distributed among disclosed firms and disclosing funds over time (e.g., less than 2% occurring more than four times in a quarter at the firm-fund level). We further

[28]In addition, as we discuss next, our inference from the restricted sample is robust to the inclusion of firm or fund fixed effects; accordingly, the unreported analysis of the raw sample with those fixed effects (absorbing all sample-wide zero firm or fund observations) yields qualitatively similar inference.

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TABLE 4

Sample Summary Statistics

Table 4 contains summary statistics for all variables of interest in the article. We consolidate the data into two samples: the first at firm-fund-quarter level and the second at firm-quarter level. The former consists of firm-fund-quarter triples (i,j,t) where in quarter t between 2005 and 2014, (i) firm i belongs to the (nonfinancial) S&P 1500 universe and appears in at least one disclosure article, and (ii) fund j makes at least one disclosure and its holdings data are available. Our firm-quarter level sample includes all pairs (i,t) where in quarter t between 2005 and 2014, firm i belongs to the (nonfinancial) S&P 1500 universe. Variable definition and construction details can be found in Table 1. All variables are winsorized at the 2% and 98% levels. Several variables are constructed at multiple, different levels, which we report in the Var Lv column. For each of the variables, we report its mean and median in the full sample, and in each of the five subsamples characterized by an increasing number of strategic disclosures. We also report each variable's sample-wide standard deviation.

		Mean						Median				Std. Dev.
		Full	#_DISCL				Full	#_DISCL				Full
	Var Lv	Sample	=0	≥1	≥5	≥10	Sample	=0	≥1	≥5	≥10	Sample
Panel (A) Firm-Fund-Quarter Level Sample.												
# Disclosures	(i,j,t)	0.11	0.00	1.34	7.00	13.72	0.00	0.00	1.00	6.00	12.00	0.28
Flow-perf sensitivity ($\times 10^3$)	(i,j,t)	1.54	1.55	1.32	2.85	1.78	0.16	0.16	0.12	0.31	0.47	20.23
	(j,t)	15.23	15.65	10.53	15.25	54.46	4.52	5.07	0.00	0.00	9.49	173.07
Pivotal	(i,j,t)	23.55	18.49	86.82	73.70	66.96	3.09	2.96	14.11	6.84	4.73	53.40
	(j,t)	109.74	108.71	122.36	121.21	122.12	109.59	109.26	125.14	128.01	120.40	46.29
Churn rate (%)	(i,j,t)	71.03	70.61	78.02	69.99	32.05	64.61	64.34	68.83	58.66	26.21	47.47
	(j,t)	51.77	51.09	59.74	63.65	43.95	48.25	47.34	57.16	61.75	40.94	30.79
Turnover rate (%)	(i,j,t)	0.02	0.02	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.77
	(j,t)	8.98	8.95	9.43	9.39	7.53	7.94	7.86	8.69	9.10	6.98	5.21
Holding period (#Qtr)	(i,j,t)	3.12	3.11	3.27	3.47	4.43	3.09	3.08	3.30	3.61	4.80	1.78
	(j,t)	3.57	3.58	3.39	3.38	3.82	3.70	3.72	3.58	3.52	4.23	1.15
Short-termism index ($\tilde{\gamma}$)	(i,j,t)	0.07	0.00	0.91	0.72	0.65	−0.07	−0.08	0.15	0.07	−0.14	0.54
	(j,t)	0.00	−0.01	0.13	0.18	−0.02	−0.06	−0.07	0.06	0.15	0.06	0.44
Firm market cap ($B)	(i,t)	48.91	48.33	55.45	71.48	75.97	21.43	21.43	21.07	23.28	24.18	62.44
Analyst forecast inaccuracy	(i,t)	0.17	0.17	0.19	0.23	0.10	0.07	0.07	0.07	0.09	0.05	0.31
Stock return std. dev. (%)	(i,t)	19.77	19.72	20.29	22.42	19.55	16.77	16.71	17.04	17.60	19.71	11.01
No. of obs.		146,181	133,894	12,287	202	29	146,181	133,894	12,287	202	29	
Panel (B) Firm-Quarter Level Sample.												
# Disclosures	(i,t)	0.29	0.00	2.43	8.64	15.50	0.00	0.00	1.00	7.00	12.00	0.73
Flow-perf sensitivity ($\times 10^3$)	(i,t)	0.60	0.60	0.62	0.52	0.52	0.37	0.36	0.49	0.40	0.32	1.45
Pivotal	(i,t)	3.09	3.14	2.68	2.77	3.07	1.58	1.60	1.50	1.51	1.46	6.02
Churn rate (%)	(i,t)	0.47	0.47	0.44	0.39	0.34	0.43	0.44	0.41	0.34	0.29	0.25
Turnover rate (%)	(i,t)	9.35	9.35	9.27	8.09	7.63	8.22	8.23	8.19	7.42	7.33	5.48
Holding period (#Qtr)	(i,t)	3.70	3.68	3.84	4.07	4.10	3.78	3.75	3.93	4.23	4.32	1.14
Short-termism index ($\tilde{\gamma}$)	(i,t)	0.02	0.02	−0.03	−0.10	−0.13	−0.08	−0.08	−0.11	−0.19	−0.20	0.47
Amihud's (2002) illiquidity ($\times 10^6$)	(i,t)	0.003	0.004	0.001	0.001	0.000	0.001	0.001	0.000	0.000	0.000	0.007
Firm market cap ($B)	(i,t)	7.65	5.33	24.71	46.65	58.61	2.14	1.82	11.92	54.53	80.02	14.90
Analyst forecast inaccuracy	(i,t)	0.29	0.29	0.24	0.21	0.14	0.10	0.11	0.08	0.07	0.06	0.52
Stock return std. dev. (%)	(i,t)	24.44	24.79	21.81	19.51	18.97	21.04	21.44	18.23	15.75	15.70	13.23
Trading intensity (%)	(i,t)	0.10	0.10	0.10	0.09	0.14	0.00	0.00	0.00	0.00	0.00	2.52
No. of obs.		47,819	42,071	5,748	683	173	47,819	42,071	5,748	683	173	

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discuss those summary statistics as we introduce our main variables of interest and accompanying empirical analysis next.

B. Measuring Short-Term Incentives

The model of Section II suggests that the strategic disclosure activity of such sophisticated market participants as mutual funds may be related to their short-term incentives. Measuring those incentives is challenging, as fund managers' objective functions are typically not directly observable. The delegated portfolio management literature has proposed numerous explanation for a fund's short-termism (discussed in Section II.A), as well as developed a number of empirical proxies for a fund's investment horizon that are based on such observable fund characteristics as its asset composition or trading behavior (e.g., Gaspar, Massa, and Matos (2005), Cremers and Pareek (2014)). We use this guidance to construct several such proxies. However, as noted earlier, speculative short-termism is also multi-faceted in nature such that each individual proxy may only partially capture its intensity. These proxies are also likely plagued by measurement noise. Thus, we capture their information commonality parsimoniously while mitigating their idiosyncratic shocks by combining them into three composite indices of firm-fund, fund, and firm level short-termism.

Specifically, we consider five such proxies: flow-performance sensitivity, position "pivotalness," churn rate, turnover rate, and inverse holding duration. We first construct each of these five proxies at the firm-fund-quarter (i,j,t) level, to measure a fund j's short-termism as stemming from its position in a firm i in a quarter t. We then aggregate each of them at the firm-quarter (i,t) and the fund-quarter (j,t) levels, to capture either the short-termism of all sample funds holding firm i or the short-termism of fund j as stemming from its holdings of all sample firms, respectively. Finally, we scale and average the resulting firm-fund, fund, and firm level proxies separately into their corresponding short-termism indices. In the remainder of this section, we motivate and briefly discuss how we compute each proxy and form these indices. Full details are in Table 1, while summary statistics are in Table 4.

1. Flow-Performance Sensitivity

Fund flows are crucial not only to fund managers' compensation (Brown et al. (1996), Carhart, Kaniel, Musto, and Reed (2002)) but also to their ability to exploit future arbitrage opportunities (Shleifer and Vishny (1997)). It is well established that fund flows chase recent performance (Ippolito (1992), Chevalier and Ellison (1997), and Sirri and Tufano (1998)). Therefore, the strength of this relationship is likely to affect those incentives and fund managers' decision-making, in that funds with greater flow-return sensitivity may be more responsive to their short-term valuation.

We compute flow-return sensitivity in two steps. First, for each portfolio managed by our sample funds, we estimate a rolling regression of its flows on its contemporaneous and past performance.[29] We sum up the regression coefficients to

[29]Each regression is estimated over 12 rolling months of data, ending in the last month of the quarter of interest. We measure fund performance using its monthly CAPM-adjusted returns. Our inference is

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obtain a flow-performance sensitivity measure at the portfolio-quarter level. Second, we aggregate this measure at the firm-quarter (FLOW_PERF_SENSITIVITY$_{i,t}$), fund-quarter (FLOW_PERF_SENSITIVITY$_{j,t}$), or firm-fund-quarter level (FLOW_PERF_SENSITIVITY$_{i,j,t}$). Intuitively, FLOW_PERF_SENSITIVITY$_{i,j,t}$ and FLOW_PERF_SENSITIVITY$_{i,t}$ capture the percentage change in flows to either a particular fund or all sample funds holding firm i, respectively, in response to a 1% increase in that firm's stock performance ceteris paribus for the performance of all other stocks, while FLOW_PERF_SENSITIVITY$_{j,t}$ measures a fund's percentage change in flows in correspondence with a 1% increase in its overall performance.

2. Position "Pivotalness"

Our second measure of a fund's short-termism exploits the deviation of its portfolio composition from the market portfolio. Practitioners typically evaluate fund managers by comparing their performance to that of various benchmarks, most commonly the market portfolio. Portfolio managers attempt to "beat" these benchmarks by making "bets," that is, with stock holdings that differ from the benchmark's. The largest such bets are also the most "pivotal," that is, have the largest impact on relative short-term fund performance, hence not only on its flow-return sensitivity but also on its exposure to limits to arbitrage, noise trader risk, or illiquidity in the short term. As noted in Section II.A, other market participants typically learn about a fund's bets only with delay. Within our model, these bets correspond to the *unsigned* difference between the speculator's private initial holdings in the risky asset (e) and their unconditional expectation ($\overline{e}$; as a function of its variance σ_e^2). Thus, ceteris paribus, the greater this difference, the greater the speculator's incentive to deviate from long-term profit maximization in pursuit of short-term portfolio gains (via strategic disclosure).

Accordingly, we argue that a fund's short-termism and its incentives to disclose are likely to be greater the larger are its bets relative to the market, and especially so for the largest of these bets. This idea underlies the construction of our second proxy, position "pivotalness" of firm i's shares. At the firm-fund-quarter level, this proxy (PIVOTAL$_{i,j,t}$) captures the unsigned deviation of fund j's holdings of firm i's shares from the market (i.e., relative to the S&P 1500 universe) in quarter t.[30] We then compute position "pivotalness" at the firm-quarter level (PIVOTAL$_{i,t}$) from firm i's percentage share of the combined portfolio of all sample funds.

robust to using such alternative performance measures as raw returns and Fama–French 3-factor-adjusted returns, to estimating the regression over longer rolling windows of past monthly data, as well as to replacing each estimated slope coefficient with its absolute value or corresponding t-statistics.

[30]Importantly, this measure treats upward and downward pivotalness symmetrically (e.g., such that holding either 50% or twice of the market's position yields the same PIVOTAL$_{i,j,t}$) since, as mentioned above, the ex ante effectiveness of (hence the short-term incentive to engage in) PBT and PBD in our model (see, e.g., the expression for $\text{cov}(P_1, e)$ in Section II.A) does not depend on signed relative holdings but only on their absolute magnitude (i.e., on σ_e^2). In unreported analysis, when separating PIVOTAL$_{i,j,t}$ in its upward and downward components, we find that the latter plays a greater role in our inference for it occurs more frequently in our sample (as active fund holdings are typically much more concentrated relative to the market portfolio).

Finally, we average $\text{PIVOTAL}_{i,j,t}$ across all sample firms to arrive at our fund-quarter level measure ($\text{PIVOTAL}_{j,t}$).

3. Churn Rate

Our next short-termism measure is the churn rate. Extant literature argues that institutional investors with shorter investment horizons may revise their portfolios more often (e.g., Wermers (2000), Gaspar et al. (2005), Cremers and Pareek (2014), and Schmidt (2020)). Similarly, in the baseline model of Section II.A, short-termism leads the speculator to trade excessively in order to "rebalance" her otherwise long-term profit-maximizing asset holdings (see, e.g., $x^*(v, e)$ of equation (2) as well as the accompanying discussion in Bhattacharyya and Nanda (2013)).

Accordingly, following Gaspar et al. (2005) and Schmidt (2020), we first define $\text{CR}_{i,j,t}$, $\text{CR}_{i,t}$, and $\text{CR}_{j,t}$ as the speed at which either fund j rotates its position in firm i, all sample funds rotate their positions in firm i on average, or fund j rotates its overall positions, respectively. Next, we take a rolling average of these values over eight quarters to obtain our final churn rate measures, which we conjecture to be larger the greater is firm-fund-quarter, firm-quarter, or fund-quarter level intensity of speculative short-termism, respectively.

4. Turnover Rate

Turnover rates are alternative proxies for the intensity of speculative portfolio rebalancing due to short-termism. In particular, as in Wermers (2000), we compute turnover rates in two steps as follows. First, we define $\text{TR}_{i,j,t}$ as the minimum of the absolute values of purchases and sales of firm i's shares by fund manager j in quarter t, scaled by the value of firm i's shares owned by that fund in that quarter. Second, we calculate our turnover measure at the firm-fund-quarter level as a rolling average of $\text{TR}_{i,j,t}$ over eight quarters. To compute turnover rate at the firm-quarter level, we amend the first step by using purchases and sales of firm i's shares by all sample funds (instead of just fund j) as well as the value of all shares of firm i held by all sample funds (instead of just fund j). Similarly, we compute fund-quarter level turnover rates by using a fund's purchases and sales of shares in all sample firms (instead of just in firm i) as well as the value of all shares held by that fund (instead of just firm i's shares). Accordingly, a high turnover rate may indicate a fund's (or all funds') more intense trading activity (in either firm i or all sample firms) in pursuit of short-term objectives.

5. Inverse Holding Duration

Our last proxy for the intensity of speculative short-termism is based on the measure of stock holding duration proposed by Cremers and Pareek (2014). As for position pivotalness, we amend their measure so that it accounts for long and short holdings symmetrically, as follows. First, we compute the average maximum number of quarters a portfolio k has kept its "long" and "short" positions in firm i over the past eight quarters, $\text{HOLDING_PERIOD}_{i,k,t}$. "Long" ("short") positions are defined to equal the portfolio holdings in firm i if those holdings are positive (negative) and 0 if those holdings are nonpositive (nonnegative). Next, we calculate the firm-fund-quarter, firm-quarter, and fund-quarter level duration measures as the corresponding holdings-weighted averages of $\text{HOLDING_PERIOD}_{i,k,t}$, which we

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TABLE 5

Short-Termism Proxy Correlations

Table 5 reports sample-wide pairwise correlations among our short-termism proxies at firm-quarter, fund-quarter, and firm-fund-quarter levels. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

	Flow-Perf Sensitivity	Pivotal	Churn Rate	Turnover Rate	Inverse Holding Period
Panel A. Firm-Quarter Level					
Flow-perf sensitivity	1.000***				
Pivotal	−0.009*	1.000***			
Churn rate	0.001	0.308***	1.000***		
Turnover rate	0.016***	0.133***	0.517***	1.000***	
Inverse holding period	−0.000	0.004	0.034***	−0.000	1.000***
Panel B. Fund-Quarter Level					
Flow-perf sensitivity	1.000***				
Pivotal	0.009	1.000***			
Churn rate	−0.022	0.321***	1.000***		
Turnover rate	0.001	0.042**	0.196***	1.000***	
Inverse holding period	−0.008	0.088***	0.247***	0.028	1.000***
Panel C. Firm-Fund-Quarter Level					
Flow-perf sensitivity	1.000***				
Pivotal	−0.002	1.000***			
Churn rate	−0.003	0.060***	1.000***		
Turnover rate	−0.000	−0.013***	0.023***	1.000***	
Inverse holding period	−0.000	−0.001	0.006**	−0.000	1.000***

interpret as either the average number of quarters fund j holds on to firm i, all sample funds hold on to firm i, or fund j holds on to all sample firms, respectively. Finally, our short-termism proxy is the inverse of the average holding period.

6. Short-Termism Indices

By construction, each of the five aforementioned proxies is increasing in firm, fund, or firm-fund level short-termism. Yet, as noted earlier, these proxies may also reflect different features of speculative short-term concerns. Accordingly, their sample-wide pairwise correlations in Table 5 are nearly always positive but mostly small. Furthermore, these proxies are on a different scale and may be plagued by noise and idiosyncratic shocks. Thus, their normalization and aggregation may allow us to parsimoniously isolate the portion of their commonality driven by speculative short-termism while reducing their idiosyncratic variance (e.g., as in Chordia, Roll, and Subrahmanyam (2000), Korajczyk and Sadka (2008), Bharath, Pasquariello, and Wu (2009), and Pasquariello (2023), among others).

In this article, we propose three composite indices of firm, fund, and firm-fund level short-termism in a quarter, $\widehat{\gamma}_{i,t}$, $\widehat{\gamma}_{j,t}$, and $\widehat{\gamma}_{i,j,t}$, as the equal-weighted averages of the standardized values of all available firm, fund, and firm-fund level short-termism proxies in that quarter, respectively.[31] Hence, by definition, $\widehat{\gamma}_{i,t}$, $\widehat{\gamma}_{j,t}$, and $\widehat{\gamma}_{i,j,t}$ are increasing in speculative short-termism. Consistent with the model, sample

[31]Alternative aggregation of those proxies via principal component analysis (PCA, despite the ensuing look-ahead bias and absence of dominating eigenvalues, and only one of them nontrivially greater than 1, from the correlation matrices of Table 5; e.g., Baker and Wurgler (2006), Korajczyk and Sadka (2008), and Bharath et al. (2009)) or the separate analysis of each of them yield broadly similar inference; see Tables IA-2 and IA-8, or Tables IA-3–IA-7, IA-9–IA-13 in the Supplementary Material, respectively.

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averages of all three indices (in Table 4) and of their components are also mostly increasing (while stock illiquidity is instead decreasing) across disclosure intensity subsamples. We assess this relationship formally in the empirical analysis next.

IV. Empirical Analysis

A. Strategic Disclosure and Incentives To Disclose

Our theory postulates that the strategic disclosure of some private fundamental information (PBD) may be optimal for at least partially short-term oriented speculators. Empirically, we argue that, ceteris paribus, funds with stronger short-term incentives disclose more often. The reason is twofold. First, relative to the extreme case of purely long-term profit maximizers ($\gamma = 0$), who find any form of disclosure suboptimal, speculators with short-term incentives ($\gamma > 0$) clearly disclose more often. Second, even when $\gamma > 0$, some of those speculators may not find PBD optimal if its perceived gains are lower than its stated cost (pecuniary or otherwise; see, e.g., Conclusion 2). In those circumstances, PBD should occur more often as γ increases and short-termism becomes more important for strategic speculators (see, e.g., Figures 5 and 6).[32]

To test this implication of our model, we start by estimating the following OLS model:

$$\text{DISCL}_{i,j,t} = \beta_0 + \beta_1 \widehat{\gamma} + \beta_2 \text{DISCL}_{-i,j,t} + \beta_3 \text{DISCL}_{i,-j,t} + \delta_y + \delta_q + \varepsilon_{i,j,t}, \tag{16}$$

where $\text{DISCL}_{i,j,t}$ is the number of articles in WSJ, FT, and NYT identified as strategic disclosures about firm i by fund j during quarter t, and $\widehat{\gamma} = \widehat{\gamma}_{j,t}$ or $\widehat{\gamma} = \widehat{\gamma}_{i,j,t}$. All variables in our empirical analysis are standardized to adjust for differences in scale within and across variables and to facilitate the interpretation of the corresponding coefficients of interest; our inference is unaffected by this normalization. Our model predicts that $\beta_1 > 0$, that is, funds with stronger short-term incentives should disclose more often both in general (i.e., for higher $\widehat{\gamma} = \widehat{\gamma}_{j,t}$) as well as in firms more critical for achieving their short-term goals (i.e., for higher $\widehat{\gamma} = \widehat{\gamma}_{i,j,t}$). Some fund managers may make more frequent media appearances for reasons unrelated to short-termism (e.g., stronger media connections). We control for this possibility in equation (16) by including $\text{DISCL}_{-i,j,t}$, the number of disclosures made by fund j about all firms except firm i during quarter t. Similarly,

[32]Note however that in our model, the gains from PBD are not monotonic in γ. In particular, Figures 5 and 6 suggest that ex ante disclosure gains first increase but then decrease as γ increases. Intuitively, as the speculator places less weight on her long-term profit (when γ grows larger), she is less concerned about the cost of PBT; thus she can achieve her short-term objective efficiently enough by PBT alone. As a result, PBD is less valuable to the speculator when γ is sufficiently large. Nonetheless, for our empirical tests, however, we ignore the decreasing portion of the gains from PBD (as a function of γ) because a so-behaving speculator would have to trade aggressively to take advantage of PBT. Such overt PBT is, however, unfeasible over our sample period (2005–2014) due to the sharp increase in investor attention about, and SEC enforcement against portfolio pumping since 2001 (e.g., Gallagher, Gardner, and Swan (2009), SEC (2014), and Duong and Meschke (2020)). With PBT constrained by regulation, it is plausible that speculators would turn to PBD as a substitute, and the more so the greater is their short-termism. Consequently, it is plausible that the gains from PBD are increasing for the entire feasible range of γ.

some firms may become media's targets for reasons unrelated to PBD, for example, if going through such important, newsworthy corporate events as CEO turnover or merger talks. Accordingly, we also include $\text{DISCL}_{i,-j,t}$, the number of disclosures made about firm i by all funds except fund j during quarter t.[33] We further include year fixed effects (δ_y) and quarter fixed effects (δ_q) to control for macroeconomic trends as well as seasonality in disclosure patterns (e.g., year-end earnings releases).[34]

We report estimates of equation (16) for $\widehat{\gamma} = \widehat{\gamma}_{i,j,t}$ and $\widehat{\gamma} = \widehat{\gamma}_{j,t}$ in columns 1 and 5 of Table 6, respectively.[35] Consistent with our model, in both cases the estimate for β_1 is positive, strongly statistically significant, and economically meaningful. For instance, column 1 implies that a 1-standard-deviation increase in firm i's contribution to fund$j$'s short-termism in quarter t ($\widehat{\gamma}_{i,j,t}$) is accompanied by nearly half (0.425) of a standard deviation increase in the number of disclosures made by fund j about firm i in that quarter (0.28 in Table 4); this estimate translates into 0.12 additional firm-fund level disclosures per quarter (0.425×0.28), a significant change given its corresponding sample mean of 0.11 in Table 4. Estimated β_1 is smaller for fund-quarter level short-termism ($\widehat{\gamma}_{j,t}$) in column 5, perhaps because its effect on disclosure intensity may be subsumed by the fund-level control variable $\text{DISCL}_{-i,j,t}$; yet, this effect remains nontrivial, for example, amounting to 11% (0.106) standard deviation increase in firm-fund-quarter disclosures, that is, to roughly 27% of its sample mean ($0.106 \times 0.28/0.11$).

Next, we investigate whether the effect of short-termism on disclosure is more pronounced for firms about which speculators may have a greater information advantage, hence for which PBD may be more effective. For instance, our model implies that, ceteris paribus, (costly) strategic disclosure about a firm's fundamentals may become optimal for a greater number of funds (e.g., for a wider range of γ in Conclusion 2 and Figure 5; see also the discussion in Section II.C.1) if those fundamentals are more volatile (higher σ_v^2) such that private information about them is more valuable and the revision in MM's priors in correspondence with the release of a public signal is larger (e.g., see equation (IA-11)).

To assess this possibility, we first consider three popular measures of firm-level fundamental uncertainty in a quarter: inverse firm size ($1/\text{SIZE}_{i,t}$), analyst

[33]While $\text{DISCL}_{-i,j,t}$ and $\text{DISCL}_{i,-j,t}$ are not group-level quarterly averages of $\text{DISCL}_{i,j,t}$, either replacing them with or including two-way firm-time (i.e., quarter year) and fund-time fixed effects in all specifications of equation (16) to control for unobserved heterogeneity (Gormley and Matsa (2014)) does not affect the analysis that follows.

[34]When reporting about a firm, journalists often contact such relevant financial practitioners as some of its largest shareholders for comments. Although not strategic in nature, such media-initiated reporting may involve both a speculator and the target firm; therefore, it may be labeled as potential PBD by our identification algorithm in Section III.A.2. However, unreported analysis indicates that controlling for the potentially confounding effects of these disclosures by either excluding, for each firm in each quarter, the funds with the largest long and short positions in that firm or by including one-way firm and/or fund, or two-way firm-fund fixed effects in all specifications of equation (16) does not qualitatively affect our inference.

[35]In these regressions, we use two-way cluster-robust standard errors at the firm and fund levels to account for heteroscedasticity and within firm-fund serial correlation (e.g., Petersen (2009)). The usual Huber–White standard errors or robust standard errors clustered at either the firm or the fund level, or three-way clustered by firm, fund, and year do not materially affect our inference.

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TABLE 6

Strategic Disclosure and Short-Termism

Table 6 reports test results on the effect of short-termism on mutual fund disclosures. In particular, we estimate various specifications of the following regression model (see equations (16) and (17)):

$$\mathrm{DISCL}_{i,j,t} = \beta_0 + \beta_1\widehat{\gamma} + \beta_2\mathrm{SUIT}_{i,t} + \beta_3\widehat{\gamma}\times\mathrm{SUIT}_{i,t} + \beta_4\mathrm{DISCL}_{-i,j,t} + \beta_5\mathrm{DISCL}_{i,-j,t} + \delta_q + \delta_y + \varepsilon_{i,j,t},$$

where $\mathrm{DISCL}_{i,j,t}$ is the number of disclosures made by fund j about firm i during quarter t (as defined in Section III.A); $\widehat{\gamma}$ is an index of either fund or firm-fund level short-termism in a quarter, $\widehat{\gamma}_{j,t}$ and $\widehat{\gamma}_{i,j,t}$, defined as the equal-weighted averages of the standardized values of five fund and firm-fund level short-termism proxies in that quarter (flow-performance sensitivity, position pivotalness, churn rate, turnover rate, and the inverse of holding duration), respectively, when available; $\mathrm{SUIT}_{i,t}$ is defined as either the inverse of firm size (market capitalization, $\mathrm{SIZE}_{i,t}$), analyst forecast inaccuracy about the firm (deviation of analyst EPS forecasts from the realized EPS, $\mathrm{INACCU}_{i,t}$), or the firm's stock return volatility ($\mathrm{STDEV_RET}_{i,t}$); $\mathrm{DISCL}_{-i,j,t}$ is the number of disclosures made by fund j about all S&P 1500 firms except firm i during quarter t; $\mathrm{DISCL}_{i,-j,t}$ is the number of disclosures about firm i made by all sample funds except fund j. Details on the construction of all variables are in Table 1. In all specifications, we include year fixed effects (δ_y) and quarter fixed effects (δ_q). All variables are winsorized at the 2% and 98% levels and standardized. Standard errors in parentheses are heteroscedasticity-robust and two-way clustered by firm-fund. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

LHS Var.	$\mathrm{DISCL}_{i,j,t}$							
	$\widehat{\gamma}$ at firm-fund-quarter level ($\widehat{\gamma}_{i,j,t}$)				$\widehat{\gamma}$ at fund-quarter level ($\widehat{\gamma}_{j,t}$)			
	1	2	3	4	5	6	7	8
$\widehat{\gamma}$	0.425***	0.409***	0.417***	0.424***	0.106***	0.109***	0.105***	0.107***
	(0.004)	(0.005)	(0.005)	(0.005)	(0.004)	(0.004)	(0.004)	(0.004)
$\mathrm{SUIT}_{i,t}$		−0.037***	−0.018***	−0.029***		0.054***	0.027***	0.024***
		(0.003)	(0.003)	(0.003)		(0.006)	(0.004)	(0.004)
$\widehat{\gamma}\times\mathrm{SUIT}_{i,t}$		0.052***	0.023***	0.027***		0.054***	0.027***	0.023***
		(0.002)	(0.003)	(0.003)		(0.006)	(0.004)	(0.004)
$\mathrm{DISCL}_{-i,j,t}$	0.163***	0.164***	0.166***	0.164***	0.193***	0.189***	0.190***	0.190***
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.006)	(0.005)
$\mathrm{DISCL}_{i,-j,t}$	0.055***	0.051***	0.059***	0.053***	0.047***	0.041***	0.038***	0.034***
	(0.005)	(0.005)	(0.005)	(0.005)	(0.006)	(0.005)	(0.005)	(0.005)
No. of obs.	144,794	144,410	130,832	144,384	145,609	144,962	131,355	144,936
R^2	0.232	0.238	0.222	0.234	0.048	0.051	0.047	0.047
$\mathrm{SUIT}_{i,t}=$		$1/\mathrm{SIZE}_{i,t}$	$\mathrm{INACCU}_{i,t}$	$\mathrm{STDEV_RET}_{i,t}$		$1/\mathrm{SIZE}_{i,t}$	$\mathrm{INACCU}_{i,t}$	$\mathrm{STDEV_RET}_{i,t}$

forecast inaccuracy ($\mathrm{INACCU}_{i,t}$, defined as the percentage absolute difference between actual earnings-per-share (EPS) and mean analyst EPS forecasts), and stock return volatility ($\mathrm{STDEV_RET}_{i,t}$). Arguably, firms with larger such proxies are likely more opaque in nature, hence potentially more suitable to information discovery and strategic disclosure by sophisticated investors.[36] We then assess the effect of fundamental uncertainty on disclosure intensity by separately allowing such firm-level characteristics (labeled $\mathrm{SUIT}_{i,t}$) to affect $\mathrm{DISCL}_{i,j,t}$ in equation (16) both directly as well as in interaction with $\widehat{\gamma}$, as follows:

$$\mathrm{DISCL}_{i,j,t} = \beta_0 + \beta_1\widehat{\gamma} + \beta_2\mathrm{SUIT}_{i,t} + \beta_3\widehat{\gamma}\times\mathrm{SUIT}_{i,t} + \beta_4\mathrm{DISCL}_{-i,j,t} + \beta_5\mathrm{DISCL}_{i,-j,t} + \delta_y + \delta_q + \varepsilon_{i,j,t}. \tag{17}$$

By construction, larger $\mathrm{SUIT}_{i,t}$ proxies for greater firm-level opacity and suitability to strategic disclosure. Hence, our model predicts that the cross-product coefficient $\beta_3 > 0$, that is, funds with stronger short-term incentives should disclose more often about more suitable firms. We report estimates of

[36]Accordingly, Table 4 suggests that on average, disclosure targets (firms), while unconditionally larger in size (which presumably attracts greater media attention, as noted in Section III.A.1), display marginally more volatile stock returns and less accurate EPS forecasts.

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equation (17) for $\widehat{\gamma}=\widehat{\gamma}_{i,j,t}$ and $\widehat{\gamma}=\widehat{\gamma}_{j,t}$ in columns 2–4 and columns 6–8 of Table 6, respectively. As conjectured by our theory, β_3 is positive and statistically strongly significant in all specifications.[37] The economic significance of these estimates is also nontrivial, although it varies depending on the choice of $\text{SUIT}_{i,t}$ and $\widehat{\gamma}$. For instance, columns 6–8 show that the average effect of a fund's short-termism on its disclosure intensity about a firm is between 21% (β_3 vs β_1: 0.023/0.107) and 50% (0.054/0.109) stronger if that firm's suitability to PBD is 1-standard-deviation larger than its mean.

B. Strategic Disclosure and Liquidity

1. Baseline Regression: Direct Liquidity Effect of Disclosure

Our model postulates that in correspondence with optimal PBD ($\delta=\delta^*$), equilibrium market liquidity of the target asset improves (e.g., relative to the baseline economy with PBT alone: $\lambda_1<\lambda^*$ in Corollary 1) as fundamental information (i.e., about v) in the disclosed signal s of equation (6) at least partially alleviates MM's perceived adverse selection risk more than endowment information (i.e., about e) in s worsens it by weakening PBT's effectiveness (see Section II.C.2 and Figure 7). Accordingly, in the remainder of the article we test for the effect of funds' potentially strategic disclosures in our sample on the liquidity of the disclosed stocks.

To that end, we start with the following baseline regression:

$$\Delta\text{AMIHUD}_{i,t}=\beta_0+\beta_1\Delta\text{DISCL}_{i,t}+\delta'\Delta\text{X}_{i,t}+\delta_y+\delta_q+\varepsilon_{i,t}, \tag{18}$$

where $\text{AMIHUD}_{i,t}$ is Amihud's (2002) measure of firm i's stock price impact (i.e., stock market illiquidity) in quarter t, $\text{DISCL}_{i,t}$ is the number of disclosures made by all funds in the sample about firm i in quarter t, $\text{X}_{i,t}$ is a vector made of three aforementioned firm-level controls also commonly associated with stock illiquidity (inverse firm size, analyst forecast inaccuracy, and stock return volatility, defined in Table 1; e.g., Hasbrouck (2009), Foucault, Pagano, and Röell (2013)), and δ_y and δ_q are year and quarter fixed effects (to control for long-term trends and seasonality in illiquidity). The operator Δ denotes first difference (from the previous quarter's value). First-difference regressions alleviate potential non-stationarity biases due to persistence in firms' level illiquidity (e.g., an average AR(1) coefficient of 0.75 across the funds in our sample; Hamilton (1994)), while accounting for any time-invariant (omitted) factor that may affect both levels of disclosure intensity and illiquidity.[38]

[37]However, estimates for β_2, while always statistically significant, are positive and economically large (as implied by the above discussion of firm-level suitability to PBD) only for $\widehat{\gamma}=\widehat{\gamma}_{j,t}$, suggesting that more (so-defined) suitable firms are disclosed more often only after accounting for broader (i.e., fund level) short-termism. Even in those circumstances, the total effect of a one standard deviation shock to $\text{SUIT}_{i,t}$ on $\text{DISCL}_{i,j,t}$ when short-termism is one standard deviation above its mean (i.e., $\beta_2+\beta_3$ in equation (17)) is always positive (except for $\text{SUIT}_{i,t}=\text{STDEV_RET}_{i,t}$).

[38]In unreported tests, we nonetheless find our inference to be robust to setting all variables in levels (but including firm fixed effects), to taking log differences, or to taking first differences of all variables (including state variables, defined next). Data limitations preclude a comprehensive higher-frequency investigation of the liquidity externalities of mutual funds' PBD; however, replicating our empirical analysis via an event-study methodology at the daily frequency yields qualitatively similar inference; see

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TABLE 7

PBT, PBD, and Market Liquidity

Table 7 reports test results on the effect of PBT and PBD on market liquidity. In particular, we estimate various specifications of the following regression model (see equations (18) and (19)):

$$\begin{aligned}\Delta\text{AMIHUD}_{i,t} = {} & \beta_0 + \beta_1\widehat{\gamma}_{i,t} + \beta_2\Delta\text{DISCL}_{i,t} + \beta_3\Delta\text{DISCL}_{i,t}\times\widehat{\gamma}_{i,t} + \beta_4\Delta\text{DISCL}_{i,t}\times\text{SUIT}_{i,t} + \beta_5\Delta\text{DISCL}_{i,t}\times\widehat{\gamma}_{i,t}\times\text{SUIT}_{i,t}\\ & + \beta_6\Delta\text{PCTTRD}_{i,t} + \beta_7\Delta\text{PCTTRD}_{i,t}\times\widehat{\gamma}_{i,t} + \beta_8\Delta\text{PCTTRD}_{i,t}\times\text{SUIT}_{i,t} + \beta_9\Delta\text{PCTTRD}_{i,t}\times\widehat{\gamma}_{i,t}\times\text{SUIT}_{i,t}\\ & + \beta_{10}\text{SUIT}_{i,t} + \beta_{11}\widehat{\gamma}_{i,t}\times\text{SUIT}_{i,t} + \delta'\Delta X_{i,t} + \delta_y + \delta_q + \varepsilon_{i,t},\end{aligned}$$

where Δ is the first difference operator; $\text{AMIHUD}_{i,t}$ is the quarterly average of daily price impact (i.e., absolute percentage price change per dollar traded); $\text{DISCL}_{i,t}$ is the number of disclosures made about firm i by all sample funds in quarter t; $\widehat{\gamma}_{i,t}$ is defined as the equal-weighted average of the standardized values of five firm-level short-termism proxies in that quarter (flow-performance sensitivity, position pivotalness, churn rate, turnover rate, and the inverse of holding duration), when available; $\text{SUIT}_{i,t}$ is defined as either the inverse of firm size (market capitalization, $\text{SIZE}_{i,t}$), analyst forecast inaccuracy about the firm (deviation of analyst EPS forecasts from the realized EPS, $\text{INACCU}_{i,t}$), or the firm's stock return volatility ($\text{STDEV_RET}_{i,t}$); $\text{PCTTRD}_{i,t}$ is the trading intensity of sample funds, defined as the percentage of firm i's shares traded by all sample funds (relative to its shares outstanding) during quarter t. Details on the construction of all variables are in Table 1. In all specifications, we include in the control vector, $\Delta X_{i,t}$, the following variables: the first difference in inverse firm size, analyst forecast inaccuracy, and the firm's stock return volatility. We also include year fixed effects (δ_y) and quarter fixed effects (δ_q). All variables are winsorized at the 2% and 98% levels and standardized. Standard errors in parentheses are heteroscedasticity-robust and clustered by firm. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

LHS Var.	ΔAMIHUD				
	1	2	3	4	5
$\widehat{\gamma}$			0.011**	0.010*	0.010*
			(0.005)	(0.005)	(0.005)
ΔDISCL	−0.006**		−0.008***		−0.008***
	(0.002)		(0.003)		(0.003)
ΔDISCL × $\widehat{\gamma}$			−0.012**		−0.012**
			(0.006)		(0.006)
ΔPCTTRD		0.017***		0.016***	0.016***
		(0.004)		(0.005)	(0.004)
ΔPCTTRD × $\widehat{\gamma}$				0.011	0.011
				(0.007)	(0.007)
No. of obs.	41,901	41,901	40,095	40,095	40,095
R^2	0.226	0.227	0.224	0.224	0.225

LHS Var.	ΔAMIHUD								
	6	7	8	9	10	11	12	13	14
$\widehat{\gamma}$	−0.011***	0.006	0.006	−0.011***	0.006	0.005	−0.011***	0.006	0.006
	(0.004)	(0.005)	(0.005)	(0.004)	(0.005)	(0.005)	(0.004)	(0.005)	(0.005)
ΔDISCL	−0.021	−0.008***	−0.007**				−0.023	−0.008***	−0.007**
	(0.014)	(0.003)	(0.003)				(0.014)	(0.003)	(0.003)
ΔDISCL×$\widehat{\gamma}$	−0.020**	−0.011**	−0.013**				−0.020**	−0.011**	−0.013**
	(0.008)	(0.005)	(0.007)				(0.008)	(0.005)	(0.007)
ΔDISCL×SUIT	−0.038	−0.002	−0.005				−0.040*	−0.002	−0.005
	(0.024)	(0.003)	(0.004)				(0.024)	(0.003)	(0.004)
ΔDISCL×$\widehat{\gamma}$ × SUIT	−0.045***	−0.006	−0.016**				−0.044***	−0.006	−0.015**
	(0.014)	(0.006)	(0.007)				(0.014)	(0.006)	(0.007)
ΔPCTTRD				0.015***	0.016***	0.012***	0.015***	0.016***	0.013***
				(0.005)	(0.004)	(0.004)	(0.005)	(0.004)	(0.004)
ΔPCTTRD × $\widehat{\gamma}$				0.006	0.011	0.007	0.006	0.011	0.007
				(0.005)	(0.007)	(0.006)	(0.005)	(0.007)	(0.006)
ΔPCTTRD × SUIT				0.037**	0.008	0.015**	0.037**	0.008	0.015**
				(0.015)	(0.006)	(0.006)	(0.014)	(0.006)	(0.006)
ΔPCTTRD × $\widehat{\gamma}$ × SUIT				0.003	0.000	0.016*	0.002	−0.000	0.016*
				(0.015)	(0.010)	(0.009)	(0.015)	(0.010)	(0.009)
SUIT	0.102***	0.027***	0.033***	0.102***	0.027***	0.032***	0.101***	0.027***	0.033***
	(0.009)	(0.007)	(0.006)	(0.009)	(0.007)	(0.006)	(0.009)	(0.007)	(0.006)
$\widehat{\gamma}$ × SUIT	0.021***	0.009	0.004	0.021***	0.010	0.002	0.020***	0.009	0.003
	(0.007)	(0.007)	(0.008)	(0.007)	(0.007)	(0.008)	(0.007)	(0.007)	(0.008)
No. of obs.	40,095	40,095	40,095	40,095	40,095	40,095	40,095	40,095	40,095
R^2	0.238	0.225	0.225	0.237	0.225	0.226	0.239	0.225	0.226
$\text{SUIT}_{i,t}$ =	$1/\text{SIZE}_{i,t}$	$\text{INACCU}_{i,t}$	$\text{STDEV_RET}_{i,t}$	$1/\text{SIZE}_{i,t}$	$\text{INACCU}_{i,t}$	$\text{STDEV_RET}_{i,t}$	$1/\text{SIZE}_{i,t}$	$\text{INACCU}_{i,t}$	$\text{STDEV_RET}_{i,t}$

Table IA-14 in the Supplementary Material (as well as Figure 7a in Ljungqvist and Qian (2016) for boutique hedge fund disclosures).

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In light of Corollary 1, our model predicts that $\beta_1 < 0$ in equation (18): ceteris paribus, an increase in the number of potentially strategic public disclosures should be associated with an improvement in the liquidity of the disclosure target's shares. We report estimates of equation (18) in column 1 of Table 7. As in Table 6, all variables are standardized to ease the interpretation of the corresponding slope coefficients.[39] Consistent with our model, estimated β_1 is negative and statistically significant. The economic magnitude of this effect is, however, small (e.g., a 1-standard-deviation increase in disclosure changes only improves liquidity by less than 1% of its standard deviation (−0.006 in column 1)). The lack of economic significance may be due to several reasons. First, strategic disclosure is only one of the many factors influencing stock liquidity (e.g., shocks to ownership structure, equity issuance, changes in credit rating, earnings announcements, institutional trading, changes in trading platforms and specialist companies, etc.), all of which may cause variation in liquidity that mute the effect of PBD. Second, extant literature suggests that the positive effect of any public news on financial market quality in general, and liquidity in particular, is both conceptually ambiguous (e.g., Kyle (1985) vs. Kim and Verrecchia (1994), (1997)) and usually difficult to capture in the data (see, e.g., Green (2004), Pasquariello and Vaga (2007)).[40] Third, our sample is made of firms in the S&P 1500 universe, all of which are well-established, highly liquid companies, and thus may be less suitable targets for PBD. The evidence in Ljungqvist and Qian (2016) suggests that more intense PBD may take place (with more pronounced effects) in smaller, more opaque and possibly private firms, for which liquidity is significantly lower and market depth and fund holding data are not readily available. Lastly, as noted earlier, strategic disclosures via newspaper articles are relatively infrequent in our sample, and newspapers are only one of the venues through which a fund manager may disclose information. Thus, our measure of disclosure may not fully capture the true intensity of PBD, subjecting equation (18) to attenuation bias.

2. Liquidity Effect of Disclosure and Speculative Short-Termism

The above discussion motivates us to amend equation (18) to distinguish the specific effect of PBD on price formation due to speculative short-termism from that of any fundamental information disclosure, as follows:

[39]Standard errors in Table 7 are heteroscedasticity-robust and clustered by firm. Employing either the usual Huber–White sandwich estimator or two-way clustering by firm and year (to account for any cross-sectional commonality in liquidity within time; e.g., Chordia et al. (2000)) has no effect on our inference.

[40]For instance, the availability of public fundamental information in a Kyle (1985) setting would improve equilibrium market depth by lowering market makers' perceived uncertainty about asset payoff (e.g., λ_1 is increasing in σ_v^2 in equation (9); see also Pasquariello and Vega (2007)). However, Kim and Verrecchia (1994), (1997) argue that the release of public information may instead increase adverse selection risk and worsen liquidity if it leads to greater information heterogeneity among sophisticated market participants. Relatedly, Goldstein and Yang (2019) highlight the potentially negative unintended consequences of the exogenous public disclosure of different types of fundamental information for price informativeness and real efficiency.

$$\begin{aligned}(19)\quad \Delta\text{AMIHUD}_{i,t} = {} & \beta_0 + \beta_1\widehat{\gamma}_{i,t} + \beta_2\Delta\text{DISCL}_{i,t} + \beta_3\Delta\text{DISCL}_{i,t}\times\widehat{\gamma}_{i,t} + \beta_4\Delta\text{DISCL}_{i,t} \\ & \times\text{SUIT}_{i,t} + \beta_5\Delta\text{DISCL}_{i,t}\times\widehat{\gamma}_{i,t}\times\text{SUIT}_{i,t} + \beta_6\Delta\text{PCTTRD}_{i,t} \\ & + \beta_7\Delta\text{PCTTRD}_{i,t}\times\widehat{\gamma}_{i,t} + \beta_8\Delta\text{PCTTRD}_{i,t}\times\text{SUIT}_{i,t} \\ & + \beta_9\Delta\text{PCTTRD}_{i,t}\times\widehat{\gamma}_{i,t}\times\text{SUIT}_{i,t} + \beta_{10}\text{SUIT}_{i,t} + \beta_{11}\widehat{\gamma}_{i,t}\times\text{SUIT}_{i,t} \\ & + \delta'\Delta\text{X}_{i,t} + \delta_y + \delta_q + \varepsilon_{i,t},\end{aligned}$$

where $\widehat{\gamma}_{i,t}$ is our firm-quarter level composite index of speculative short-termism (see Section III.B.6), while $\text{SUIT}_{i,t}$ is any of the three quarterly proxies for firm-level fundamental uncertainty (hence, suitability to disclosure) described in Section IV.A (inverse firm size, analyst forecast inaccuracy, and stock return volatility). Proposition 2, Corollary 1, and Conclusion 3 imply that the liquidity effect of the potentially strategic disclosures in our sample should be more pronounced (i.e., greater $\lambda^* - \lambda_1$) when so is speculative short-termism (larger γ), especially when firms' fundamental uncertainty is high (and PBD may be more valuable); thus, we expect the interaction coefficients between changes in disclosure intensity and firm-level speculative short-termism (β_3), suitability to disclosure (β_4), and their cross-product (β_5) in equation (19) to be negative.[41]

Lastly, equation (19) also accounts for any correlation between stock-level illiquidity and a measure of intensity of speculative trading, $\text{PCTTRD}_{i,t}$, defined as the percentage trading volume of all sample funds in firm i (relative to its shares outstanding) during quarter t, either directly or in interaction with speculative short-termism, suitability to PBD, or both. (More) informed speculation in Kyle (1985) makes the market for the traded asset (more) illiquid in equilibrium, especially when liquidity provision is hampered by greater fundamental uncertainty, suggesting that both $\beta_6 > 0$ and $\beta_8 > 0$ in equation (19). However, empirically, it is challenging to separate informed trading and short-term-driven (hence uninformative) PBT in any such aggregate proxy for sophisticated trading intensity (i.e., firm-level fund portfolio rebalancing activity) as $\text{PCTTRD}_{i,t}$. Accordingly, (more) PBT may instead improve asset liquidity by mitigating adverse selection risk (Bhattacharyya and Nanda (2013)), especially when speculative short-termism, fundamental uncertainty, or

[41]Specifically, in the model with PBT and PBD of Section II.B, the improvement in liquidity from PBD ($\lambda^* - \lambda_1$) is always increasing in fundamental uncertainty (σ_v^2), but is only increasing in speculative short-termism (γ) when endowment uncertainty (σ_e^2) is small and especially so when MM's adverse selection risk is more severe (higher σ_v^2); see, for example, Figure 7. Intuitively, a higher γ has two opposite effects on $\lambda^* - \lambda_1$. On the one hand, the speculator becomes more willing to disclose private fundamental information in her signal in order to pump the equilibrium price in the direction of her endowment e (e.g., lower δ^* in Figure 2), alleviating MM's adverse selection risk more relative to the baseline economy with PBT of Section II.A (greater $\lambda^* - \lambda_1$), and particularly so when such risk is perceived to be high (i.e., at higher σ_v^2). On the other hand, the speculator also trades more on her endowment (i.e., engages in more PBT) to pursue her more important short-term objective, reducing the fundamental information content of the aggregate order flow and improving equilibrium market depth (lower λ^* and λ_1; see also Bhattacharyya and Nanda (2013)), but more so when PBD is not otherwise available (lower $\lambda^* - \lambda_1$). Figure 7 suggests that the former effect generally prevails on the latter (yielding our conjecture that $\beta_3, \beta_4, \beta_5 < 0$ in equation (19)) unless σ_e^2 is high. High endowment uncertainty is however less plausible in our sample since (as noted earlier) U.S. equity market participants learn about fund holdings, albeit with some delay, and those holdings tend not to vary greatly over our sample period (e.g., an average AR(1) coefficient of 0.45 across all firm-fund pairs); in addition, as we discuss next, we explicitly control for funds' trading activity (which may include PBT) in equation (19).

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both are greater, unless if at least partly substituted by PBD (as in Proposition 2), thus making both the proportion of PBT in the $\text{PCTTRD}_{i,t}$ and the sign of its effect on illiquidity via speculative short-termism (β_7 and β_9 in equation (19)) ambiguous.

We report estimates of various specifications of equation (19) in columns 2–14 of Table 7. This evidence provides further support for our theory. First, estimated β_3, β_4, and β_5 are nearly always both negative and statistically significant (except when $\text{SUIT}_{i,t} = \text{INACCU}_{i,t}$, which is noisiest in correspondence with nontrivial disclosure intensity; see, e.g., Table 4). Intuitively, these coefficients imply that the first-order negative relationship between illiquidity and firm-level strategic disclosures in column 1 (i.e., $\beta_2 < 0$ in equation (19)) is stronger when funds (are measured to) display greater short-term concerns, especially when firm-level fundamental uncertainty is greater (making firms more suitable to disclosure by funds), consistent with the aforementioned predictions in Corollary 1 and Conclusion 3. For instance, according to column 3, the liquidity improvement accompanying those disclosures is, on average, 50% larger (β_3 vs. β_2: $-0.012/-0.008$) when short-termism ($\widehat{\gamma}_{i,t}$) is 1-standard-deviation above its mean, amounting to a total of 2% of sample-wide firm-quarter illiquidity variation ($\beta_2 + \beta_3 = -0.008 - 0.012$). Columns 6–8 further show that these effects are between over 40% ($\beta_4 + \beta_5$ vs. $\beta_2 + \beta_3$: $(-0.002 - 0.006)/(-0.008 - 0.011)$) and more than 200% stronger ($(-0.038 - 0.045)/(-0.021 - 0.020)$) when firms are 1-standard-deviation more suitable to disclosure than the mean.

Second, accounting for speculative trading intensity (measured by firm-level fund portfolio rebalancing, $\text{PCTTRD}_{i,t}$) does not affect our inference: Estimated β_2, β_3, β_4, and β_5 remain both economically and statistically significant in columns 5 and 12–14 of Table 7, e.g., amounting to a total decrease in firm-level illiquidity of as much as 13% of its sample-wide variation in correspondence with 1-standard-deviation greater disclosure intensity ($\beta_2 + \beta_3 + \beta_4 + \beta_5 = -0.023 - 0.020 - 0.040 - 0.044$ in Column 12).

Lastly, the relationship between such fund-level trading activity in a firm and its stock illiquidity is also consistent with our model. In particular, estimates of β_6 and β_8 are positive and statistically significant in most specifications, while estimates of β_7 and β_9 are mostly small and statistically insignificant. For instance, columns 2 and 9–14 of Table 7 suggest that (a 1-standard-deviation) greater firm-level fund trading intensity is accompanied by (up to nearly 2% (0.017) standard deviation) worse firm-level liquidity, especially (by as much as almost 4% (0.037)) when firm-level fundamental uncertainty is large (i.e., when MM's perceived adverse selection risk from liquidity provision is presumably higher) consistent with our model. However, any PBT in fund portfolio rebalancing activity and its potential substitution with PBD may offset this effect, especially in light of the aforementioned increasingly strict SEC enforcement of regulation prohibiting PBT over our sample period (see Section IV.A); accordingly, we find $\widehat{\gamma}_{i,t}$ to have an insignificant net impact on the relationship between illiquidity and trading in columns 4 and 9–14.

In short, the analysis in Tables 6 and 7 indicates that the potentially strategic disclosure activity of equity mutual funds about U.S. stocks is both positively related to those funds' estimated short-termism as well as negatively related to those stocks' price impact of trading. These findings are consistent with the notion

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that such disclosure activity may reflect speculators' attempts at short-term price manipulation and so have nontrivial effects on the quality of price formation in financial markets, as postulated by our model.

V. Conclusions

In this article, we model and provide evidence of sophisticated speculators' strategic public disclosure of private information. First, we develop a model of strategic speculation based on Kyle (1985) and show that when a speculator is (at least partially) short-term oriented, voluntary disclosure of private information is optimal. We model disclosure as a signal that depends positively on two pieces of a speculator's private information (asset fundamentals and her initial endowment in that asset). Intuitively, a positive (negative) endowment shock leads to a more positive (negative) signal realization, which, in turn, may be interpreted by uninformed market participants (the market makers) as a positive (negative) fundamental shock, resulting in equilibrium price changes in the same direction as the endowment shock. Thus, strategic disclosure yields a positive correlation between a speculator's initial endowment in an asset and its short-term price, boosting her portfolio value and her overall value function. Additionally, we show that strategic disclosure has important implications for the quality of the affected market. In particular, relative to the non-disclosure case, market depth increases, as the adverse selection risk faced by the dealership sector is mitigated (and prices are more efficient) in the presence of such an (at least partially) informative disclosure in equilibrium.

We provide supportive empirical evidence in the context of the U.S. equity mutual fund industry between 2005 and 2014. We first show that stock market participants are cognizant of (i.e., stock returns are sensitive to) those funds' potentially strategic non-anonymous disclosures (measured by their relevant interviews in the main business press). We then find that funds' stronger short-term incentives (measured by three novel composite indices) are associated with more frequent such disclosures, a pattern that is most pronounced for target firm-level characteristics (namely small size, inaccurate analyst EPS forecasts, and high stock return volatility) that plausibly make strategic disclosure more effective. We also find that i) these disclosures in target firms are accompanied by liquidity improvements of their stocks and ii) this effect is stronger if speculative short-termism is more severe, and especially so if those disclosures are expected to have a greater impact on market beliefs and stock prices (such as when firm-level fundamental uncertainty is greater), consistent with our model.

Overall, our novel analysis contributes to an emerging literature bridging the gap between the conventional wisdom that information is valuable only if kept private and the not uncommon observation that sophisticated financial market participants voluntarily, non-anonymously, and possibly strategically disclose information to the public. These insights are important both for academics' and practitioners' understanding of the process of price formation in financial markets in the presence of information asymmetry as well as for policy-makers' efforts at regulating the availability of information in those markets.

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Appendix

Proof of Proposition 2. Conjecture that the MM's pricing strategy takes the following form:

$$P_1 = P_0 + \lambda_1(\omega - \overline{\omega}) + \lambda_2(s - \overline{s}). \tag{A-1}$$

After observing v and e, the speculator's expected date $t = 1$ price is

$$\mathrm{E}[P_1 | v, e, D = 1, \delta] = P_0 + \lambda_1(x - \overline{x}) + \lambda_2(s - \overline{s}). \tag{A-2}$$

Plug this into her objective function:

$$\mathrm{E}[W | v, e, D = 1, \delta] = \gamma e[\lambda_1(x - \overline{x}) + \lambda_2(s - \overline{s})] + (1 - \gamma)[x(v - P_0 - \lambda_1(x - \overline{x}) - \lambda_2(s - \overline{s}))]. \tag{A-3}$$

This leads to the first-order condition:

$$\frac{\partial}{\partial x}\mathrm{E}[W | v, e, D = 1, \delta] = \gamma e \lambda_1 + (1 - \gamma)[v - P_0 + \lambda_1 \overline{x} - \lambda_2(s - \overline{s}) - 2\lambda_1 x] = 0. \tag{A-4}$$

Thus, defining $\beta = \frac{\gamma}{1-\gamma}$, there is

$$x^*(v, e) = \beta \overline{e} + \frac{\beta\lambda_1 - \delta\lambda_2}{2\lambda_1}(e - \overline{e}) + \frac{1 - (1 - \delta)\lambda_2}{2\lambda_1}(v - P_0). \tag{A-5}$$

The equilibrium is a fixed point: If the speculator optimizes with respect to the conjectured pricing rule (A-1) and the MM make inferences (according to the Bayesian rule) based on the speculator's optimization, then the MM's expected liquidation value must be consistent with the conjectured pricing rule, that is,

$$P_1 = \mathrm{E}[v | s, \omega, D = 1, \delta]. \tag{A-6}$$

With normality, the conditional expectation can be expressed as

$$\mathrm{E}[v | s, \omega, D = 1, \delta] = P_0 + \sigma_v^2 \begin{bmatrix} 1 - \delta \\ 1 - (1 - \delta)\lambda_2 \end{bmatrix}' \times A^{-1} \times \begin{bmatrix} s - \overline{s} \\ 2\lambda_1(\omega - \overline{\omega}) \end{bmatrix}, \tag{A-7}$$

where

$$A = \begin{bmatrix} \delta^2\sigma_e^2 + (1 - \delta)^2\sigma_v^2 & \delta(\beta\lambda_1 - \delta\lambda_2)\sigma_e^2 + (1 - \delta)(1 - (1 - \delta)\lambda_2)\sigma_v^2 \\ \delta(\beta\lambda_1 - \delta\lambda_2)\sigma_e^2 + (1 - \delta)(1 - (1 - \delta)\lambda_2)\sigma_v^2 & (\beta\lambda_1 - \delta\lambda_2)^2\sigma_e^2 + (1 - (1 - \delta)\lambda_2)^2\sigma_v^2 + 4\lambda_1^2\sigma_z^2 \end{bmatrix}. \tag{A-8}$$

Jointly solving equation (A-1) and equation (A-7) leads to

$$\lambda_1 = \frac{1}{\sqrt{\alpha^2\beta^2 + 4\frac{\sigma_z^2}{\sigma_v^2} + 4\alpha^2\frac{\sigma_z^2}{\sigma_e^2}}}, \tag{A-9}$$

and

$$\lambda_2 = -\frac{\lambda_1}{\delta}\left(\beta - \frac{4\lambda_1\sigma_z^2}{\left(\frac{1}{\alpha} - \beta\lambda_1\right)\sigma_e^2}\right). \tag{A-10}$$

■

Proof of Proposition 3. Proof of part 1. In an equilibrium with disclosure, the speculator's ex ante expected value function is (e.g., Grossman and Stiglitz (1980), Vives (2008), Chapter 4)

$$\text{(A-11)} \qquad \mathrm{E}\{E[W|v,e,D=1,\delta]\} = \mathrm{E}[W|D=1,\delta] = \gamma \mathrm{E}[(P_1-P_0)e|D=1,\delta] + (1-\gamma)\mathrm{E}[x^*(v-P_1)|D=1,\delta],$$

by the law of iterated expectations. Substituting x^* and P_1 of equations (7) and (8) into equation (A-11) and simplifying leads to

$$\text{(A-12)} \qquad \mathrm{E}[W|D=1,\delta] = (1-\gamma)\lambda_1\sigma_z^2\frac{1+\alpha\beta\lambda_1}{1-\alpha\beta\lambda_1},$$

where λ_1 is given by equation (9).

Proof of part 2. In a baseline equilibrium, the speculator's ex ante expected value function is

$$\text{(A-13)} \qquad \mathrm{E}\{E[W|v,e,D=0]\} = \mathrm{E}[W|D=0] = \gamma \mathrm{E}[(P_1-P_0)e|D=0] + (1-\gamma)\mathrm{E}[x^*(v-P_1)|D=0],$$

by the law of iterated expectations. Substituting x^* and P_1 of equations (2) and (3) into equation (A-13) and simplifying leads to

$$\text{(A-14)} \qquad \mathrm{E}[W|D=0] = \frac{1-\gamma}{4\lambda^*}\left(\sigma_v^2+\beta^2\lambda^{*2}\sigma_e^2\right),$$

where λ^* is given by equation (4).

Proof of part 3. To establish weak inequality, it suffices to show that there exist a signal weight $\widehat{\delta}$ such that

$$\text{(A-15)} \qquad \mathrm{E}\left[W|D=1,\widehat{\delta}\right] = \mathrm{E}[W|D=0].$$

Consider the following candidate:

$$\text{(A-16)} \qquad \widehat{\delta} = \frac{1}{1+\widehat{\alpha}},$$

where

$$\text{(A-17)} \qquad \widehat{\alpha} = \lambda^*\beta\frac{\sigma_e^2}{\sigma_v^2} = \beta\sqrt{\frac{\sigma_v^2}{\beta^2\sigma_e^2+4\sigma_z^2}}\frac{\sigma_e^2}{\sigma_v^2}.$$

Substituting the expression for $\widehat{\alpha}$ into equations (12) and (13) establishes equality between the speculator's ex ante expected value function in the baseline and signaling equilibria.

To establish strict inequality, it is helpful to characterize the shape of the speculator's ex ante expected value function $\mathrm{E}[W|D=1,\delta]$. Differentiating $\mathrm{E}[W|D=1,\delta]$ with respect to δ, there is

$$\text{(A-18)} \quad \frac{\partial \mathrm{E}[W|D=1,\delta]}{\partial\delta} = (1-\gamma)\sigma_z^2\frac{2\alpha}{\delta^2}\lambda_1^3\frac{1+\alpha\beta\lambda_1}{1-\alpha\beta\lambda_1}\left[-\frac{4\beta}{\alpha}\frac{\sigma_z^2}{\sigma_v^2}\frac{\lambda_1}{1-\alpha^2\beta^2\lambda_1^2}+\frac{1}{2}\left(\beta^2+4\frac{\sigma_z^2}{\sigma_e^2}\right)\right],$$

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where $\alpha = \frac{1-\delta}{\delta}$ is given by equation (11). Since $(1-\gamma)\sigma_z^2 \frac{2\alpha}{\delta^2}\lambda_1^3 \frac{1+\alpha\beta\lambda_1}{1-\alpha\beta\lambda_1} > 0$, the sign of $\frac{\partial \mathrm{E}[W|D=1,\delta]}{\partial\delta}$ depends on the sign of the terms in the brackets on the right-hand side of equation (A-18). These terms can be rewritten as

$$\text{(A-19)} \quad -\frac{4\beta}{\alpha}\frac{\sigma_z^2}{\sigma_v^2}\frac{\lambda_1}{1-\alpha^2\beta^2\lambda_1^2} + \frac{1}{2}\left(\beta^2 + 4\frac{\sigma_z^2}{\sigma_e^2}\right) = -4\beta\frac{\sigma_z^2}{\sigma_v^2}\frac{1}{\alpha\lambda_1\left[4\frac{\sigma_z^2}{\sigma_v^2} + 4\alpha^2\frac{\sigma_z^2}{\sigma_e^2}\right]} + \frac{1}{2}\left(\beta^2 + 4\frac{\sigma_z^2}{\sigma_e^2}\right).$$

It is straightforward to see that the expression in equation (A-19) increases in α (both $\alpha\lambda_1$ and $4\frac{\sigma_z^2}{\sigma_v^2} + 4\alpha^2\frac{\sigma_z^2}{\sigma_e^2}$ increase in α) and thus decreases in δ. It then follows that the speculator's ex ante expected value function $\mathrm{E}[W|D=1,\delta]$ is either monotonically increasing or decreasing in δ or first increasing and then decreasing in δ.

Next, evaluate equation (A-18) at $\widehat{\delta}$. There is

$$\text{(A-20)} \quad \left.\frac{\partial \mathrm{E}[W|D=1,\delta]}{\partial\delta}\right|_{\delta=\widehat{\delta}} = -(1-\gamma)\sigma_z^2\frac{\widehat{\alpha}}{\widehat{\delta}^2}\lambda_1^3\frac{1+\alpha\beta\lambda_1}{1-\alpha\beta\lambda_1}\left(\beta^2 + 4\frac{\sigma_z^2}{\sigma_e^2}\right)\frac{2\sigma_z^2}{2\sigma_z^2 + \beta^2\sigma_e^2} < 0.$$

Additionally, letting $\check{\delta} = \frac{\sigma_v}{\sigma_v+\sigma_e}$ so that $0 < \check{\delta} < \widehat{\delta}$, it can then be shown that, $\left.\frac{\partial \mathrm{E}[W|D=1,\delta]}{\partial\delta}\right|_{\delta=\check{\delta}} \geq 0$. The signs of $\frac{\partial \mathrm{E}[W|D=1,\delta]}{\partial\delta}$ at $\widehat{\delta}$ and $\check{\delta}$ lead to three implications. First, $\mathrm{E}[W|D=1,\delta]$ is first increasing and then decreasing in δ. Second, equations (A-15) and (A-20) imply that the speculator is strictly better off from disclosing a signal with a properly chosen δ. Finally, letting δ^* denote the optimal signal weight that maximizes $\mathrm{E}[W|D=1,\delta]$, there is $0 < \check{\delta} \leq \delta^* \leq \widehat{\delta} < 1$ ■.

Proof of Corollary 1. Proof of part 1. As we show in Section IA-VI of the Supplementary Material, $\lambda_1 = \frac{\tilde{\sigma}_v}{2\sqrt{\beta^2\tilde{\sigma}_e^2 + \sigma_z^2}}$. Thus the facts that $\tilde{\sigma}_v^2$ increases with δ and that $\tilde{\sigma}_e^2$ decreases with δ imply λ_1 is increasing in δ (see equations (IA-13) and (IA-14)).

Proof of part 2. If the speculator commits to the signal weight $\delta = \widehat{\delta}$ (equation (A-16)), it is straightforward to show that the price impact in the signaling equilibrium equates the price impact in the baseline equilibrium, $\lambda_1 = \lambda^*$. It then follows immediately from part 1 of Corollary 1 that part 2 holds.

Proof of part 3. We have shown in the proof of Proposition 3 that a necessary condition for the speculator to be strictly better-off from committing to disclose a signal is $\delta < \widehat{\delta}$, where $\widehat{\delta}$ is given by equation (A-16). In addition, because λ_1 is increasing in δ and $\lambda_1 = \lambda^*$ when $\delta = \widehat{\delta}$, $\lambda_1 < \lambda^*$ if and only if $\delta < \widehat{\delta}$. Therefore, $\lambda_1 < \lambda^*$ whenever the signal weight δ is such that the speculator is better-off by disclosing a signal. ■.

Supplementary Material

To view supplementary material for this article, please visit http://doi.org/10.1017/S0022109023000200.

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References

Admati, A., and P. Pfleiderer. "Selling and Trading on Information in Financial Markets." *American Economic Review*, 78 (1988), 96–103.

Agarwal, V.; W. Jiang; Y. Tang; and B. Yang. "Uncovering Hedge Fund Skill from the Portfolio Holdings They Hide." *Journal of Finance*, 68 (2013), 739–83.

Amihud, Y. "Illiquidity and Stock Returns: Cross-Section and Time-Series Effects." *Journal of Financial Markets*, 5 (2002), 31–56.

Amihud, Y.; H. Mendelson; and B. Lauterbach. "Market Microstructure and Securities Values: Evidence from the Tel Aviv Stock Exchange." *Journal of Financial Economics*, 45 (1997), 365–390.

Appel, I., and V. Fos. "Short Campaigns by Hedge Funds." Working Paper, University of Virginia (2022).

Back, K., and J. Zender. "Auctions of Divisible Goods: On the Rationale for the Treasury Experiment." *Review of Financial Studies*, 6 (1993), 733–764.

Baker, M., and J. Wurgler. "Investor Sentiment and the Cross-Section of Stock Returns." *Journal of Finance*, 61 (2006), 1645–1680.

Banerjee, S.; T. Kim; and V. Mangla. "Conceal to Coordinate." Working Paper, Rady School of Management (2018).

Becht, M.; J. Franks; J. Grant; and H. F. Wagner. "Returns to Hedge Fund Activism: An International Study." *Review of Financial Studies*, 30 (2017), 2933–2971.

Benabou, R., and G. Laroque. "Using Privileged Information to Manipulate Markets: Insiders, Gurus, and Credibility." *Quarterly Journal of Economics*, 107 (1992), 921–958.

Bernhardt, D.; R. J. Davies; and J. Spicer. "Long-Term Information, Short-Lived Securities." *Journal of Futures Markets*, 26 (2006), 466–502.

Bharath, S. T.; P. Pasquariello; and G. Wu. "Does Asymmetric Information Drive Capital Structure Decisions?" *Review of Financial Studies*, 22 (2009), 3211–3243.

Bhattacharyya, S., and V. Nanda. "Portfolio Pumping, Trading Activity and Fund Performance." *Review of Finance*, 17 (2013), 885–919.

Brav, A.; W. Jiang; F. Partnoy; and R. Thomas. "Hedge Fund Activism, Corporate Governance, and Firm Performance." *Journal of Finance*, 63 (2008), 1729–1775.

Brown, K.; W. Van Harlow; and L. Starks. "Of Tournaments and Temptations: An Analysis of Managerial Incentives in the Mutual Fund Industry." *Journal of Finance*, 51 (1996), 85–110.

Carhart, M.; R. Kaniel; D. Musto; and A. Reed. "Leaning for the Tape: Evidence of Gaming Behavior in Equity Mutual Funds." *Journal of Finance*, 57 (2002), 661–693.

Chen, Joseph, Eric Hughson, and Neal Stoughton. "Strategic Mutual Fund Tournaments." Working Paper, University of California, Davis (2018).

Chevalier, J. A., and G. D. Ellison. "Risk Taking by Mutual Funds as a Response to Incentives." *Journal of Political Economy*, 105 (1997), 1167–200.

Chevalier, J. A., and G. D. Ellison. "Career Concerns of Mutual Fund Managers." *Quarterly Journal of Economics*, 114 (1999), 389–432.

Chordia, T.; R. Roll; and A. Subrahmanyam. "Commonality in Liquidity." *Journal of Financial Economics*, 56 (2000), 3–28.

Cooper, S. K.; J. C. Groth; and W. E. Avera. "Liquidity, Exchange Listing, and Common Stock Performance." *Journal of Economics and Business*, 37 (1985), 19–33.

Crawford, S. S.; W. R. Gray; and A. E. Kern. "Why Do Fund Managers Identify and Share Profitable Ideas?" *Journal of Financial and Quantitative Analysis*, 52 (2017), 1903–1926.

Crawford, V., and J. Sobel. "Strategic Information Transmission." *Econometrica*, 50 (1982), 1431–1451.

Cremers, M., and A. Pareek. "Short-Term Trading and Stock Return Anomalies: Momentum, Reversal, and Share Issuance." *Review of Finance*, 19 (2014), 1649–1701.

De Long, J. B.; A. Shleifer; L. H. Summers; and R. J. Waldmann. "Noise Trader Risk in Financial Markets." *Journal of Political Economy*, 98 (1990), 703–738.

Del Guercio, D., and P. Tkac. "The Determinants of the Flow of Funds of Managed Portfolios: Mutual Funds vs. Pension Funds." *Journal of Financial and Quantitative Analysis*, 37 (2002), 523–557.

Dow, J., and G. Gorton. "Arbitrage Chains." *Journal of Finance*, 49 (1994), 819–849.

Duong, T. X., and F. Meschke. "The Rise and Fall of Portfolio Pumping Among U.S. Mutual Funds." *Journal of Corporate Finance*, 60 (2020), 101530.

Elton, E., and M. Gruber. "Mutual Funds." In *Financial Markets and Asset Pricing: Handbook of Economics and Finance*, G. M. Constantinides, M. Harris, and R. M. Stultz, eds. North-Holland: Elsevier (2013), 1011–1061.

Epstein, L., and S. Zin. "Substitution, Risk Aversion, and the Temporal Behavior of Consumption and Asset Returns: A Theoretical Framework." *Econometrica*, 57 (1989), 937–969.

Foucault, T.; M. Pagano; and A. Röell, *Market Liquidity: Theory, Evidence, and Policy*. Oxford: Oxford University Press (2013).
Gallagher, D. R.; P. Gardner; and P. L. Swan. "Portfolio Pumping: An Examination of Investment Manager Quarter-End Trading and Impact on Performance." *Pacific-Basin Finance Journal*, 17 (2009), 1–27.
Gaspar, J.-M.; M. Massa; and P. Matos. "Shareholder Investment Horizons and the Market for Corporate Control." *Journal of Financial Economics*, 76 (2005), 135–165.
Gentzkow, M., and J. M. Shapiro. "Media Bias and Reputation." *Journal of Political Economy*, 114 (2006), 280–316.
Glode, V.; C. C. Opp; and X. Zhang. "Voluntary Disclosure in Bilateral Transactions." *Journal of Economic Theory*, 175 (2018), 652–688.
Goldman, E., and S. L. Slezak. "Delegated Portfolio Management and Rational Prolonged Mispricing." *Journal of Finance*, 58 (2003), 283–311.
Goldstein, I.; Y. Xiong; and L. Yang. "Information Sharing in Financial Markets." Working Paper, University of Pennsylvania (2021).
Goldstein, I., and L. Yang. "Good Disclosure, Bad Disclosure." *Journal of Financial Economics*, 131 (2019), 118–138.
Gormley, T. A.; Z. Kaplan; and A. Verma. "More Informative Disclosures, Less Informative Prices? Portfolio and Price Formation around Quarter-Ends." *Journal of Financial Economics*, 146 (2022), 665–688.
Gormley, T. A., and D. A. Matsa. "Common Errors: How to (and Not to) Control for Unobserved Heterogeneity." *Review of Financial Studies*, 27 (2014), 617–661.
Goto, S.; M. Watanabe; and Y. Xu. "Strategic Disclosure and Stock Returns: Theory and Evidence from U.S. Cross-Listing." *Review of Financial Studies*, 22 (2009), 1585–1620.
Green, T. C. "Economic News and the Impact of Trading on Bond Prices." *Journal of Finance*, 59 (2004), 1201–1233.
Greenwood, R., and M. Schor. "Investor Activism and Takeovers." *Journal of Financial Economics*, 92 (2009), 362–375.
Grossman, S., and J. Stiglitz. "On the Impossibility of Informationally Efficient Markets." *American Economic Review*, 70 (1980), 393–408.
Hamilton, J. D. *Time Series Analysis*. Princeton, NJ: Princeton University Press (1994).
Han, B., and L. Yang. "Social Networks, Information Acquisition, and Asset Prices." *Management Science*, 59 (2013), 1444–1457.
Hasbrouck, J. "Trading Costs and Returns for U.S. Equities: Estimating Effective Costs from Daily Data." *Journal of Finance*, 64 (2009), 1445–1477.
Hertzberg, A. "A Theory of Disclosure in Speculative Markets." *Management Science*, 64 (2017), 5787–5806.
Hu, G.; R. D. McLean; J. Pontiff; and Q. Wang. "The Year-End Trading Activities of Institutional Investors: Evidence from Daily Trades." *Review of Financial Studies*, 27 (2014), 1593–1614.
Huang, J.; C. Sialm; and H. Zhang. "Risk Shifting and Mutual Fund Performance." *Review of Financial Studies*, 24 (2011), 2575–2616.
Ippolito, R. A. "Consumer Reaction to Measures of Poor Quality: Evidence from the Mutual Fund Industry." *Journal of Law and Economics*, 35 (1992), 45–70.
Kacperczyk, M.; C. Sialm; and L. Zheng. "Unobserved Actions of Mutual Funds." *Review of Financial Studies*, 21 (2008), 2379–2416.
Kahraman, B. "Publicizing Arbitrage." *Journal of Financial and Quantitative Analysis*, 56 (2021), 789–820.
Kamenica, E., and M. Gentzkow. "Bayesian Persuasion." *American Economic Review*, 101 (2011), 2590–2615.
Kim, O., and R. E. Verrecchia. "Market Liquidity and Volume Around Earnings Announcements." *Journal of Accounting and Economics*, 17 (1994), 41–67.
Kim, O., and R. E. Verrecchia. "Pre-Announcement and Event-Period Private Information." *Journal of Accounting and Economics*, 24 (1997), 395–419.
Korajczyk, R. A., and R. Sadka. "Pricing the Commonality Across Alternative Measures of Liquidity." *Journal of Financial Economics*, 87 (2008), 45–72.
Kovbasyuk, S., and M. Pagano. "Advertising Arbitrage." *Review of Finance*, 26 (2022), 799–827.
Kurlat, P., and L. Veldkamp. "Should We Regulate Financial Information?" *Journal of Economic Theory*, 158 (2015), 697–720.
Kyle, A. "Continuous Auctions and Insider Trading." *Econometrica*, 53 (1985), 1315–1335.
Lakonishok, J.; A. Shleifer; R. Thaler; and R. Vishny. "Window Dressing by Pension Fund Managers." *American Economic Review Papers and Proceedings*, 81 (1991), 227–231.

https://doi.org/10.1017/S0022109023000200 Published online by Cambridge University Press

Lettau, M., and A. Madhavan. "Exchange-Traded Funds 101 for Economists." *Journal of Economic Perspectives*, 32 (2018), 135–154.
Liu, Y. "Why Do Large Investors Disclose Their Information?" Working Paper, Shanghai University of Finance and Economics (2017).
Ljungqvist, A., and W. Qian. "How Constraining Are Limits to Arbitrage?" *Review of Financial Studies*, 29 (2016), 1975–2028.
Musto, D. "Investment Decisions Depend on Portfolio Disclosures." *Journal of Finance*, 54 (1999), 935–952.
Pasquariello, P. "Market Frictions in Domestic and International Financial Markets." Unpublished Ph.D. Thesis, Stern School of Business, New York University (2003).
Pasquariello, P. "Agency Costs and Strategic Speculation in the U.S. Stock Market." *Review of Corporate Finance Studies*, forthcoming (2023).
Pasquariello, P., and C. Vega. "Informed and Strategic Order Flow in the Bond Markets." *Review of Financial Studies*, 20 (2007), 1975–2019.
Pasquariello, P., and C. Vega. "The On-the-Run Liquidity Phenomenon." *Journal of Financial Economics*, 92 (2009), 1–24.
Petersen, M. A. "Estimating Standard Errors in Finance Panel Data Sets: Comparing Approaches." *Review of Financial Studies*, 22 (2009), 435–480.
Schmidt, D. "Stock Market Rumors and Credibility." *Review of Financial Studies*, 33 (2020), 3804–3853.
Schwarz, C. G., and M. E. Potter. "Revisiting Mutual Fund Portfolio Disclosure." *Review of Financial Studies*, 29 (2016), 3519–3544.
SEC. "SEC Charges Minneapolis-Based Hedge Fund Manager with Bilking Investors and Portfolio Pumping." (2014) Available at https://www.sec.gov/news/press-release/2014-187 Accessed on March 21, 2023.
SEC. "Exchange-Traded Funds, Final Rule 6c-11." (2019) Available at https://www.sec.gov/rules/final/2019/33-10695.pdf Accessed on March 21, 2023.
Shi, Z. "The Impact of Portfolio Disclosure on Hedge Fund Performance." *Journal of Financial Economics*, 126 (2017), 36–53.
Shin, H. S. "Disclosures and Asset Returns." *Econometrica*, 71 (2003), 105–133.
Shleifer, A., and R. Vishny. "The Limits of Arbitrage." *Journal of Finance*, 52 (1997), 35–55.
Sirri, E., and P. Tufano. "Costly Search and Mutual Fund Flows." *Journal of Finance*, 53 (1998), 1589–1622.
Van Bommel, J. "Rumors." *Journal of Finance*, 58 (2003), 1499–1520.
Vives, X. *Information and Learning in Markets*. Princeton, NJ: Princeton University Press (2008).
Warner, J. B., and J. S. Wu. "Why Do Mutual Fund Advisory Contracts Change? Performance, Growth, and Spillover Effects." *Journal of Finance*, 66 (2011), 271–306.
Wermers, R. "Mutual Fund Performance: An Empirical Decomposition into Stock-Picking Talent, Style, Transactions Costs, and Expenses." *Journal of Finance*, 55 (2000), 1655–1703.

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