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Forward-Looking and Backward-Looking Disclosure: Investor Disagreement and Market Liquidity

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ABSTRACT

We study how forward-looking and backward-looking disclosures affect investor disagreement, trading volume, and bid-ask spreads. Using a rational-expectations model with common priors, we demonstrate that the same state-informative disclosure can have sharply different effects depending on whether it arrives before or after a relevant managerial action. The key distinction is whether disclosure impacts only beliefs about the consequences of particular firm policies or whether the disclosure also provides information about the policy the firm is likely to choose. When the disclosure arrives first, it plays a forward-looking role: it coordinates investors' beliefs about the action the firm is about to take while leaving heterogeneous beliefs about whether that action matches the state. Disagreement therefore emerges, private information becomes valuable for trade, trading volume rises, and bid-ask spreads widen. When the same disclosure arrives after the firm's action is publicly known, it plays a backward-looking role: it only provides additional public information about whether the observed action was correct, compressing disagreement in expectation. Informed investors remain active before and after a backward-looking disclosure, so volume is unchanged while the adverse-selection component of the spread narrows in expectation. The results imply that theoretical and empirical work on disclosure should distinguish disclosures tied to pending firm decisions from disclosures released after those decisions are made public.

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1 Introduction

Public-firm disclosure is not only about realized outcomes. A substantial share of corporate communication is explicitly forward-looking: firms use MD&A, earnings guidance, conference calls, and related disclosures to discuss expected business conditions, intended responses, and the firm's likely path forward. The textual-disclosure literature documents the economic importance of forward-looking disclosure (Li, 2010; Muslu et al., 2015; Bozanic et al., 2018), and related work studies how changes in MD&A language affect informativeness (Brown and Tucker, 2011). Institutional investors also emphasize the difference between backward-looking disclosure and forward-looking disclosure, and they pay particular attention to path-forward information. In the letter to chief executives at S&P 500 companies and large European corporations[1], the chairman and CEO of BlackRock commented, "*Annual shareholder letters and other communications to shareholders are too often backwards-looking and don't do enough to articulate management's vision and plans for the future. This perspective on the future, however, is what investors and all stakeholders truly need, including, for example, how the company is navigating the competitive landscape, how it is innovating, [...], where it is investing...* "

This paper develops a logic for why forward-looking and backward-looking disclosure may have sharply different effects. The effects of disclosure depend fundamentally on whether the disclosure arrives *before* a pending firm decision or *after* the decision is already announced. A disclosure released before the decision plays a *forward-looking* role: investors use it to anticipate what the firm will do. A disclosure released after the action is already public plays a *backward-looking* role: investors use it only to evaluate the consequences of the chosen action. We show that in a very standard model with rational expectations, common priors, and common interpretation of information, these two roles tend to generate sign-opposing predictions for disagreement and bid-ask spreads and asymmetric predictions for trading volume.

Our analysis highlights the following mechanism. Firm value depends jointly on the state of the world and on a managerial action that either matches or fails to match that state. Investors receive heterogeneous private signals about the state. Before any public disclosure arrives, they may disagree sharply about which state is likely and therefore about which action is appropriate and about which action is likely to be chosen. Even so, they can agree about firm value. The reason is that each investor expects the firm to take the action appropriate to the state she herself thinks is most likely. When the firm's decision

[1] "Here is the letter the world's largest investor, BlackRock CEO Larry Fink, just sent to CEOs everywhere," Business Insider 2 (2016).

is equally accurate across states, investors can therefore share the same expectation of firm value despite receiving different private signals.[2]

A forward-looking disclosure breaks that pre-disclosure consensus. Once the disclosure arrives, investors still disagree about the state, but the disclosure makes the firm's pending action more predictable to all of them. Investors whose private information supports that action become more optimistic about firm value; investors whose private information points in the opposite direction become more pessimistic. Disagreement, therefore, emerges from the initial consensus. If the same disclosure arrives only after the action is already publicly known, it can no longer affect investors' beliefs about what the firm will do. It then functions only as an additional public signal about the state, and Bayesian updating compresses investor valuations toward a common posterior in expectation.

Tracing out this logic, we see that the timing of disclosure has direct market implications. In the forward-looking regime, private signals become more valuable for trading after the disclosure, because they now combine with the public disclosure to determine whether the pending action is likely to be correct. Adverse selection rises, bid-ask spreads widen, and trading volume increases. In the backward-looking regime, valuation gaps and the informational content of private signals contract in expectation. All informed investors remain active before and after the disclosure: volume is unchanged, while expected adverse selection falls and the spread narrows. Expected signed changes in public-information value are small or zero in the benchmark, but realized absolute price reactions and quote-midpoint movements need not be zero.

It is a well-established fact that public announcements, such as those related to a firm's earnings or decisions made at shareholders' meetings, have the potential to significantly increase trading volumes on the stock markets.[3] This empirical regularity is difficult to reconcile with the simplest rational-expectations benchmark in which public information merely substitutes for investors' private information. In such a benchmark, a public announcement reduces the informational advantage associated with private signals and therefore tends to reduce disagreement and informed trading. This tension has motivated a large literature introducing richer forms of investor heterogeneity and information processing to explain substantial trading around public announcements. These models introduce heterogeneous preferences (e.g., due to different trading horizons as in Kondor 2012 and Cespa and Vives 2015, or different risk tolerance as in Kim and Verrecchia 1991b), heterogeneous informa-

[2]Symmetric decision accuracy delivers the especially sharp pre-disclosure consensus result but is not necessary for the broader mechanism. We relax this assumption in Section 5.2.

[3]See, for example, Beaver 1968, Bamber 1983, Kim and Verrecchia 1991b, 1994, Kandel and Pearson 1995, Krinsky and Lee 1996, Fleming and Remolona 1999, Green 2004, Chae 2005, Evans and Lyons 2008, Love and Payne 2008, Bollerslev et al. 2018, Li et al. 2022, Ben-Rephael et al. 2022.

tion quality (Pasquariello and Vega 2007; Banerjee and Green 2015), heterogeneous opinions about how to interpret information (Varian 1989; Harris and Raviv 1993; Kandel and Pearson 1995; Banerjee and Kremer 2010; Bollerslev et al. 2018; Li et al. 2022), or behavioral frictions (e.g., overconfidence as in Odean 1998 and Scheinkman and Xiong 2003). Existing rational-expectations models also show that public announcements can, under some circumstances, increase the value of private information (McNichols and Trueman, 1994; Kim and Verrecchia, 1994, 1997). Our mechanism is distinct. It does not rely on heterogeneous information quality, heterogeneous interpretation, or additional information production around the announcement. Instead, forward-looking disclosure changes how existing private information maps into firm value because it makes a still-pending firm action more predictable.

In this paper, we identify a distinct rational-expectations mechanism through which public disclosure can increase investor disagreement and trading. The key novelty is that firm value is not an exogenous fundamental directly revealed by public and private signals. Instead, value depends on whether a managerial action matches the underlying state, while investors' information concerns that state and, through disclosure, the action the firm is likely to take. We refer to this interaction between beliefs about the state and beliefs about the firm's future decision as the firm's *path-forward*.[4] A public disclosure can therefore reduce disagreement about *which action the firm will take* while increasing disagreement about *whether that action is appropriate for the underlying state*. As a result, the same private information that previously generated little or no disagreement about firm value can become valuable for assessing the consequences of a commonly anticipated action, increasing valuation disagreement and trading.

We do not claim that investors are homogeneous in practice, or that mechanisms based on heterogeneous preferences, information quality, or interpretations do not operate in practice. Our contribution is narrower: even without these additional sources of heterogeneity, a simple learning dynamic can generate substantial trading effects. More importantly for accounting research, this common-prior, common-interpretation benchmark yields an empirically relevant insight: the timing of a disclosure relative to the firm's action is a first-order theoretical distinction with sign-opposing empirical implications for spreads and disagreement. If this mechanism matters in the data, then empirical disclosure research should find that forward-looking and backward-looking disclosures have systematically different effects on disagreement, spreads, and volume.

Related Literature Our paper relates to research on disclosure and liquidity, disagreement

[4] Bond and Eraslan 2010 also consider a model with asymmetric information in which the firm's choice affects its value and show that trading can then generate information to be used by the eventual owner. They thus also have the key ingredient in our conception of the path-forward.

and trading, disclosure timing, and textual measures of forward-looking communication.

A large disclosure literature studies how public information affects information asymmetry and market liquidity. Standard disclosure theory emphasizes that public reporting can reduce informed traders' informational advantage and improve liquidity (Diamond and Verrecchia, 1991); broad reviews include Verrecchia (2001), Healy and Palepu (2001), Beyer et al. (2010), and Leuz and Wysocki (2016). Empirical evidence is broadly consistent with this benchmark: disclosure quality and commitment are associated with lower information asymmetry and narrower spreads (Welker, 1995; Leuz and Verrecchia, 2000), and management forecasts and conference calls can improve the information environment (Coller and Yohn, 1997; Brown et al., 2004). At the same time, announcement-period research shows that public news need not always improve liquidity. McNichols and Trueman (1994) and Kim and Verrecchia (1994, 1997) show that public announcements can make private information or private judgment more valuable. Consistent with heightened adverse selection around announcements, Lee et al. (1993) find wider spreads and lower depths around earnings announcements, while Krinsky and Lee (1996) show that the adverse-selection component of the spread rises even though other spread components decline. Our model connects these two views: post-action disclosure reduces the value of private information and narrows adverse-selection spreads, whereas pre-action disclosure can make private information more valuable by making the pending action predictable.

The paper also contributes to research on disagreement and trading. Differences-of-opinion models explain trading volume and muted price reactions through heterogeneous priors, interpretations, or beliefs (Varian, 1989; Harris and Raviv, 1993; Kandel and Pearson, 1995; Banerjee and Kremer, 2010). Related common-prior models show that public and private information can interact in ways that preserve or create disagreement over economically relevant objects. Kim and Verrecchia (1991b) link announcement-period price and volume reactions to private information; Andreoni and Mylovanov (2012) show that public signals can increase disagreement when public and private information concern different dimensions of the environment; and Kondor (2012) shows that public information can reduce disagreement about fundamentals while increasing disagreement about prices among traders with different horizons. Empirical work likewise documents strong trading responses around public information events (Kandel and Pearson, 1995; Bollerslev et al., 2018; Li et al., 2022). Our mechanism differs from heterogeneous-interpretation explanations because investors share common priors and a common interpretation of information. The disclosure does not lead investors to interpret the same evidence differently. Instead, it makes a pending firm action more predictable and thereby changes how investors' existing private information maps into firm value. Thus, even without additional heterogeneity in priors, information quality, or

interpretation, a simple learning dynamic can generate substantial trading effects. More importantly for accounting research, the timing of disclosure relative to the firm's action emerges as a first-order theoretical distinction, with sign-opposing implications for spreads and disagreement.

A separate literature studies the timing of information releases and their relation to real decisions. Work on anticipated announcements and dynamic disclosure shows that disclosure timing affects trading, learning, and managerial incentives (Kim and Verrecchia, 1991a; Chae, 2005; Acharya et al., 2011; Einhorn and Ziv, 2008; Guttman et al., 2014). Research on real effects and feedback effects studies how accounting information and prices affect firms' decisions (Gao and Liang, 2013; Kanodia and Sapra, 2016). Related analytical work also emphasizes that disclosure can interact with private information production and firms' real decisions rather than merely substitute for private information. Xue and Zheng (2021) study public disclosure when investors communicate private information, while Meng (2015) and Xue (2025) examine the endogenous acquisition of investor information. Guttman and Meng (2021) and Chen et al. (2024) show that disclosure incentives and policies can affect firms' subsequent investment and innovation decisions, and Chen and Petrov (2024) connects reporting choices, informed trading, market feedback, and managerial investment. Our timing question is complementary. We do not ask why a manager chooses a particular disclosure date. Instead, we compare two information structures that hold fixed the disclosure's state informativeness and vary whether the relevant action is still pending. Our analysis compares the same disclosure before and after a publicly observed firm action, yielding opposite predictions for disagreement and adverse-selection spreads.

Finally, the paper relates to the empirical literature on forward-looking corporate communication. Li (2010), Muslu et al. (2015), and Bozanic et al. (2018) develop and apply textual measures of forward-looking disclosure, while Brown and Tucker (2011) studies year-over-year MD&A modifications and their relation to market reactions. These studies show that prospective language is common, measurable, and informative. In Section 6, we provide a theoretical foundation and testable predictions regarding the distinctions between forward-looking and backward-looking disclosures with trading data. Relatedly, Aghamolla et al. (2021) develop a counter-signaling theory of management guidance, a central form of forward-looking corporate disclosure.

The paper proceeds as follows. Section 2 presents the model. Section 3 establishes the belief-updating results for forward-looking and backward-looking disclosures. Section 4 embeds the model in a batch version of a Glosten-Milgrom trading protocol and derives the microstructure implications. Section 5 provides two robustness checks. Section 6 discusses empirical implications and distinguishing tests. Section 7 concludes. All proofs are in the

Appendix.

2 Model

We develop a model of public disclosure and investor disagreement. The model studies a single disclosure event whose *timing relative to a managerial action* determines its economic role. A disclosure that arrives before the action plays a forward-looking role: investors use it to anticipate what the firm will do. The same disclosure can instead play a backward-looking role: when the action is already publicly known, the disclosure only helps investors evaluate whether it was correct. We show that these two roles have opposite effects on investor disagreement, even though the disclosure itself is the same object.

2.1 Environment

There is a firm whose value depends on an underlying state of the world

$$\omega \in \Omega := \{\alpha, \beta\}$$

and on a managerial action

$$k \in K := \{A, B\}.$$

Let the state-matching action be denoted by

$$m(\alpha) = A, \qquad m(\beta) = B.$$

Firm value is binary:

$$x = x(k, \omega) \in \{0, 1\},$$

with

$$x(A, \alpha) = x(B, \beta) = 1, \qquad x(A, \beta) = x(B, \alpha) = 0.$$

In other words, firm value is high if and only if the managerial action matches the state, i.e. if and only if $k = m(\omega)$.

There are n investors, indexed by $i \in N := \{1, \ldots, n\}$. Investors are risk-neutral and share common priors and a common interpretation of information. The common prior is

$$\Pr(\omega = \alpha) = \Pr(\omega = \beta) = \tfrac{1}{2}.$$

At date 1, each investor privately observes an imperfectly informative signal

$$s_i \in \{s_a, s_b\}.$$

Conditional on the state,

$$\Pr(s_i = s_a \mid \omega = \alpha) = q, \qquad \Pr(s_i = s_a \mid \omega = \beta) = 1 - q,$$

where $q \in (1/2, 1)$. Private signals are i.i.d. across investors conditional on ω.

2.2 The disclosure

There is a public disclosure about the state of the world:

$$\hat{s} \in \{\hat{s}_a, \hat{s}_b\},$$

with

$$\Pr(\hat{s} = \hat{s}_a \mid \omega = \alpha) = Q, \qquad \Pr(\hat{s} = \hat{s}_a \mid \omega = \beta) = 1 - Q,$$

where $Q \in (1/2, 1)$. Conditional on ω, the disclosure is independent of investors' private signals.

The disclosure is the same object in both regimes we study: a noisy public signal of the state. What differs between regimes is only *when the disclosure is released relative to the firm's action.*

Remark 1 (Adding Asymmetries)**.** *The main model assumes an equal prior and signal structures that are equally accurate in the two states for technical convenience. We relax these assumptions in Section 5.2.*

2.3 The two regimes

We consider two regimes, distinguished only by the timing of the disclosure relative to the managerial action k.

Forward-looking regime. The disclosure is released first. The firm then takes the action indicated by the disclosure:

$$k = \begin{cases} A & \text{if } \hat{s} = \hat{s}_a, \\ B & \text{if } \hat{s} = \hat{s}_b. \end{cases}$$

Under this rule, the action matches the state with probability

$$\Pr(k = m(\omega) \mid \omega) = Q,$$

reflecting the fact that the firm acts on the information contained in the disclosure. The disclosure plays a forward-looking role because, at the moment it is released, the action has not yet been taken; investors use the disclosure to anticipate what the firm will do.

Remark 2 (Allowing Firm's Decision to Probabilistically Follow Disclosure)**.** *The deterministic decision rule is assumed here for technical convenience rather than necessity. In Section 5.1, we allow the firm to follow the disclosure-indicated action only with probability $\lambda > 1/2$. The central belief and market results continue to hold, with the forward-looking disagreement and spread effects attenuated by the firm's responsiveness.*

Backward-looking regime. The action is taken and publicly observed *before* the disclosure is released. To isolate the effect of disclosure timing, we model the pre-disclosure action as an exogenous state-correlated rule with the same accuracy

$$\Pr(k = m(\omega) \mid \omega) = Q$$

as in the forward-looking regime. Equivalently,

$$\Pr(k = A \mid \omega = \alpha) = \Pr(k = B \mid \omega = \beta) = Q.$$

Conditional on ω, the exogenous action, the later disclosure, and investors' private signals are mutually independent: $\Pr(k, \hat{s}, s_1, \ldots, s_n \mid \omega) = \Pr(k \mid \omega) \Pr(\hat{s} \mid \omega) \prod_{i=1}^{n} \Pr(s_i \mid \omega)$.

The subsequent disclosure then arrives. The disclosure plays a backward-looking role because, at the moment it is released, the action has already been taken and is publicly known; investors use the disclosure only to evaluate whether the already-observed action was correct.

Comparability. Both regimes have the same underlying environment, the same private-signal structure, the same disclosure object, and the same decision accuracy. The two regimes differ only in timing: whether the disclosure arrives before the action is taken, or after the action is publicly known. This design isolates the effect of disclosure timing from differences in what is disclosed or in the decision accuracy associated with the action. The backward-looking regime, in which the action is fixed and observed before the state-informative disclosure arrives, is the standard post-action disclosure benchmark most closely related to the

price-volume and information-processing literature following Kim and Verrecchia (1991b, 1994).

2.4 Timing

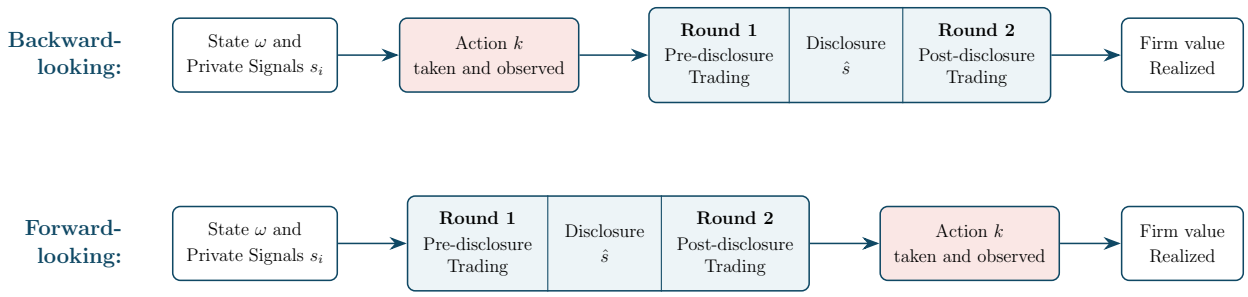

Figure 1: Timing of the two disclosure regimes. Round 1, the public disclosure, and Round 2 form the same disclosure window in both regimes. The only difference is whether the managerial action has already been taken before that disclosure window or remains pending until afterward.

Backward-looking regime.

1. Nature draws $\omega \in \{\alpha, \beta\}$.
2. Investors receive private signals s_i.
3. The firm takes action k, which is publicly observed.
4. Round-1 trading takes place.
5. The public disclosure $\hat{s}$ is released.
6. Round-2 trading takes place.
7. Firm value $x(k, \omega)$ is realized.

Forward-looking regime.

1. Nature draws $\omega \in \{\alpha, \beta\}$.
2. Investors receive private signals s_i.
3. Round-1 trading takes place.
4. The public disclosure $\hat{s}$ is released.

5. Round-2 trading takes place.

6. The firm takes action k, which is publicly observed.

7. Firm value $x(k, \omega)$ is realized.

2.5 Investor valuations and disagreement

Let investor i's valuation of the firm at information set $\mathcal{I}$ be

$$v_i(\mathcal{I}) := \mathbb{E}[x(k, \omega) \mid \mathcal{I}].$$

We measure disagreement by the cross-sectional range of valuations:

$$d(\mathcal{I}) := \max_{i \in N} v_i(\mathcal{I}) - \min_{i \in N} v_i(\mathcal{I}).$$

We index disagreement by regime and trading round. In the forward-looking regime, define

$$d_{F,1} := d\big((s_i)_{i \in N}\big), \qquad d_{F,2}(\hat{s}) := d\big((s_i, \hat{s})_{i \in N}\big).$$

In the backward-looking regime, define

$$d_{B,1}(k) := d\big((s_i, k)_{i \in N}\big), \qquad d_{B,2}(k, \hat{s}) := d\big((s_i, k, \hat{s})_{i \in N}\big).$$

Thus, in both regimes, subscript 1 denotes disagreement immediately before the disclosure, while subscript 2 denotes disagreement immediately afterward.

2.6 Interpretation

The model isolates a simple economic distinction. The disclosure is the same object in both regimes—a noisy public signal of the state. When the disclosure arrives before the firm's action is taken, it simultaneously informs beliefs about the state and coordinates beliefs about what the firm is about to do. When the disclosure arrives after the action is already publicly known, it informs only beliefs about the state; there is no pending action for the disclosure to coordinate beliefs about.

In the model, then, the same state-informative disclosure plays a forward-looking or backward-looking role depending on whether it arrives before or after the relevant action becomes public. In practice, the forward-looking case corresponds to economic news, industry reports, and macroeconomic data released before firms have committed to their response,

as well as management guidance and MD&A communication issued in advance of pending managerial actions. The backward-looking case corresponds to the same kinds of information released after the relevant firm actions are already publicly known—through restatements, post-action segment data, and industry reports that elaborate on the environment in which past decisions were made.

3 Disagreement

Throughout the analysis, we assume at least two investors receive different private signals; otherwise, all disagreement objects are trivially zero. All proofs are in the Appendix.

3.1 Forward-looking pre-disclosure consensus

We begin with beliefs at the moment when investors have received their private signals but before any public information has arrived.

Proposition 1 (Forward-looking pre-disclosure consensus)**.** *At Round 1 in the forward-looking regime, before the forward-looking disclosure is released, all investors assign the same expected value Q to the firm, and thus*

$$d_{F,1} = 0.$$

An investor's expectation of firm value is the probability she assigns to the firm's action matching the state. Because the decision process has the same accuracy Q in each state of the world—the decision is correct with probability Q whether $\omega = \alpha$ or $\omega = \beta$—an investor's expected firm value equals Q regardless of her private signal. Investors disagree sharply about *which* state is likely and *which* action will be taken, yet they agree about firm value.

In Section 5.2, we allow the decision to be correct with different probabilities in the two states. The forward-looking mechanism survives: investors' disagreement still increases in expectation after the forward-looking disclosure is released.

3.2 Forward-looking disclosure generates disagreement

Proposition 2 (Forward-looking disclosure generates disagreement)**.** *In the forward-looking regime, after the disclosure is released, investors with different private signals hold different expectations of firm value:*

$$d_{F,2}(\hat{s}) > 0 \quad \textit{for every disclosure realization } \hat{s}.$$

The mechanism is as follows. The disclosure has two effects on investor beliefs. First, it is informative about ω: a realization $\hat{s} = \hat{s}_a$ raises every investor's posterior on α, though investors with different private signals update to different posteriors. Second, it coordinates beliefs about the pending action: all investors now agree that $k = A$ will be taken, because the firm deterministically follows the disclosure.[5]

The combination of these two effects breaks the pre-disclosure consensus. Before the disclosure, investors disagreed about the state, but each expected the firm's action to match whatever state she thought likely, so each expected high firm value. After the disclosure, investors agree that $k = A$ will be taken, but they still disagree about whether $\omega = \alpha$—and firm value requires the match. An investor whose private signal favored α is now confident the firm will take the correct action; an investor whose private signal favored β is now pessimistic. Consensus on firm value, previously sustained by the fact that each investor expected the firm to match her own favored state, collapses as the disclosure coordinates beliefs on a single action.

3.3 Backward-looking pre-disclosure disagreement

We now turn to the backward-looking regime. Here, the action is taken and publicly observed before any disclosure arrives. The first object of interest is disagreement at the moment just after the action is observed but before the disclosure is released.

Proposition 3 (Backward-looking pre-disclosure disagreement)**.** *In the backward-looking regime, once the action k is publicly observed but before the disclosure is released, investors with different private signals disagree about firm value:*

$$d_{B,1}(k) > 0 \quad \textit{for each realization } k \in \{A, B\}.$$

Once investors observe $k = A$, they learn that the firm's decision process—which has accuracy Q—favored action A. This is informative about the state: α is more likely than β. But this inference is differential across investor types. An investor whose private signal s_a already favored α updates to a strong posterior on α; an investor whose private signal s_b disagreed updates to a more modest posterior. Because firm value conditional on $k = A$ is determined by whether $\omega = \alpha$, these differing state-posteriors translate into differing valuations. Disagreement emerges from the observation of the action.

[5] In Section 5.1, we relax the assumption that the firm always follows its disclosure to take the action and show the results are robust.

3.4 Backward-looking disclosure compresses disagreement

Proposition 4 (Backward-looking disclosure compresses disagreement)**.** *In the backward-looking regime, the release of the disclosure compresses post-action disagreement in expectation. For each realized action $k \in \{A, B\}$,*

$$\mathbb{E}[d_{B,2}(k, \hat{s}) \mid k] < d_{B,1}(k),$$

where the expectation is taken over the distribution of $\hat{s}$ conditional on k.

This is the standard Bayesian compression result applied to the post-action information set. Once the action is fixed and publicly observed, investors' valuations differ only because their private signals generate different posterior beliefs about whether the observed action matches the state. The subsequent disclosure provides additional public information about the state and therefore contracts the expected cross-sectional gap between investors' posteriors.[6]

3.5 The forward-backward asymmetry

Propositions 2, 3, and 4 together deliver the paper's central comparative claim.

Corollary 1 (Forward-backward asymmetry)**.** *The same state-informative disclosure has opposite effects on investor disagreement depending on when it arrives relative to the firm's action:*

(i) When the disclosure arrives before the action (forward-looking role), it generates disagreement where there was none: $d_{F,2}(\hat{s}) > 0 = d_{F,1}$ for every $\hat{s}$.

(ii) When the disclosure arrives after the action is publicly known (backward-looking role), it compresses existing post-action disagreement in expectation: $\mathbb{E}[d_{B,2}(k, \hat{s}) \mid k] < d_{B,1}(k)$ for each k.

A forward-looking disclosure creates disagreement. A backward-looking disclosure compresses it in expectation. The disclosure itself is the same object in both cases—a noisy public signal of the state with precision Q. The difference in effect comes entirely from the timing of the disclosure relative to the firm's action.

The economic content of this result is that disclosure's effect on disagreement is not a property of the disclosure alone but of the interaction between the disclosure and the decision

[6] At the realization level, the effect depends on whether the disclosure confirms or contradicts the observed action. A confirming disclosure strictly compresses disagreement, whereas a contradicting disclosure strictly expands it. Averaging over disclosure realizations yields the strict expected compression in the proposition.

environment in which it arrives. When a pending decision can still respond to the disclosure, the disclosure coordinates beliefs about what the firm will do, which generates disagreement about firm value. When the decision is already fixed and publicly known, the coordination channel is absent, and the disclosure only compresses beliefs about the state.

3.6 Numerical illustration

To make the asymmetry of Corollary 1 quantitatively concrete, we report closed-form values of the disagreement measures for illustrative parameter values. We fix the private-signal precision at $q = 0.65$ and vary the disclosure precision Q. Table 1 reports $d_{F,2}(\hat{s}_a)$, $d_{B,1}(A)$, $\mathbb{E}[d_{B,2}(A, \hat{s}) \mid k = A]$, and the in-expectation compression $d_{B,1}(A) - \mathbb{E}[d_{B,2}(A, \hat{s}) \mid k = A]$.

Table 1: Disagreement across regimes at $q = 0.65$.

Q	$d_{F,2}(\hat{s}_a)$	$d_{B,1}(A)$	$\mathbb{E}[d_{B,2}(A, \hat{s}) \mid k = A]$	Compression
0.60	0.289	0.289	0.279	0.010
0.70	0.256	0.256	0.221	0.034
0.75	0.230	0.230	0.184	0.046
0.80	0.198	0.198	0.145	0.054
0.90	0.115	0.115	0.067	0.048

Note. Values computed from the closed-form expressions in the proofs of Propositions 2–4. The compression column reports $d_{B,1}(A) - \mathbb{E}[d_{B,2}(A, \hat{s}) \mid k = A]$, the in-expectation reduction in disagreement caused by the backward-looking disclosure. Symmetric values obtain for $\hat{s}_b$ and $k = B$.

Two patterns in the table are worth noting. First, the backward-looking compression is strictly positive at every $Q > 1/2$, confirming Proposition 4. Quantitatively, the compression is modest at low disclosure precision—about 3.6% of the pre-disclosure disagreement at $Q = 0.60$—but substantial at moderate precision: 20% at $Q = 0.75$, 27% at $Q = 0.80$, and 42% at $Q = 0.90$. The absolute magnitude of the compression is non-monotone in Q: it rises with Q in the intermediate range and attenuates as Q approaches 1, because the pre-disclosure disagreement $d_{B,1}(A)$ itself shrinks when the observed action is nearly fully informative about the state.

Second, $d_{F,2}(\hat{s}_a) = d_{B,1}(A)$ in this symmetric benchmark because the two objects place investors in the same one-public-signal, one-private-signal information structure; the difference between regimes is what the next disclosure does. At $Q = 0.75$, post-disclosure disagreement in the forward-looking regime exceeds expected post-disclosure disagreement in the backward-looking regime by $0.230 - 0.184 = 0.046$, a 25% difference relative to the backward regime. This belief-level gap motivates the market-microstructure predictions developed in Section 4: adverse-selection spreads respond to valuation dispersion when both informed

types trade, while trading volume responds discretely to whether private information creates profitable buy or sell incentives.

4 Trading Volume and Bid-Ask Spreads

The belief-updating results of Section 3 have direct implications for observable market outcomes. We now embed the model in a Glosten-Milgrom trading protocol (Glosten and Milgrom (1985)), in which a competitive market maker sets bid and ask prices based on the adverse-selection risk posed by informed traders. This framework translates the forward-backward asymmetry of Corollary 1 into predictions about trading volume, prices, and bid-ask spreads.

4.1 Market structure

There are n informed investors (the same investors as in Section 3) and $y > 0$ noise traders. Trading takes place in anonymous batch rounds. The market microstructure follows Glosten and Milgrom (1985); in each round, before observing that round's orders, a competitive risk-neutral market maker posts an ask price P^{buy} and a bid price P^{sell} at which she stands ready to fill orders. Quotes are fixed within the round, and the market maker clears all orders at the posted prices. The market maker does not update quotes within the batch after observing individual orders. Each informed investor can submit an order to buy one share, sell one share, or hold. Each noise trader submits exactly one one-share order, buying with probability $1/2$ and selling with probability $1/2$, independently of all information. Order identity is anonymous, so the market maker cannot distinguish informed from noise orders at the point of execution. Expected noise volume is therefore y, with $y/2$ expected buy orders from noise traders and $y/2$ expected sell orders from noise traders.

Zero-profit pricing by order side implies that in each round,

$$P^{\text{buy}} = \mathbb{E}[x \mid \text{buy order}, \mathcal{H}], \qquad P^{\text{sell}} = \mathbb{E}[x \mid \text{sell order}, \mathcal{H}],$$

where $\mathcal{H}$ denotes the market maker's public information, which contains the public action and/or disclosure. The bid-ask spread is

$$\text{Spread} := P^{\text{buy}} - P^{\text{sell}}.$$

In equilibrium, an informed investor buys when her expected firm value strictly exceeds the ask, sells when it is strictly below the bid, and holds otherwise. Investors buy at the ask

and sell at the bid, and thus the bid-ask spread is endogenous and the market maker breaks even in equilibrium.

We consider two trading rounds, with the positions of the rounds relative to the disclosure and the action differing across regimes. In both regimes, round 1 is the moment just before the disclosure event and round 2 is just after the disclosure event. The only difference between these two regimes is whether the disclosure is about an action that the firm has already taken before the disclosure event (and thus backward-looking) or the disclosure is about an action that the firm will take after the disclosure event (and thus forward-looking). This timing convention allows a clean comparison of how disclosure affects volume and spreads in the two regimes.

4.2 Forward-looking regime: spreads widen, volume increases

In the forward-looking regime, by Proposition 1, investors with different private signals hold the same expectation of firm value at this stage, $v_i = Q$. The market maker, facing only noise orders in equilibrium, posts

$$P_1^{\text{buy}} = P_1^{\text{sell}} = Q,$$

so the round-1 spread is zero. Informed investors' valuations coincide with both quotes, and thus they hold.

By round 2, the disclosure has been released. By Proposition 2, investors with different private signals now hold different valuations. The market maker, aware that informed buy orders are more likely to come from investors whose private signal agrees with the disclosure and informed sell orders from investors whose private signal disagrees, faces adverse selection. To break even, the market maker posts a positive spread.

Proposition 5 (Forward-looking trading)**.** *In the forward-looking regime:*

(i) In round 1, informed investors do not trade; expected volume equals the noise-trader baseline y, and the bid-ask spread is zero.

(ii) In round 2, all informed investors trade on the basis of whether their private signal agrees with the disclosure: s_a-investors buy if $\hat{s} = \hat{s}_a$ and sell if $\hat{s} = \hat{s}_b$; s_b-investors trade in the opposite direction.

(iii) Expected trading volume strictly increases from y in round 1 to $n + y$ in round 2.

(iv) The bid-ask spread strictly widens from zero in round 1 to a positive adverse-selection spread in round 2.

Part (iv) is one key microstructure implication. Standard intuition holds that public disclosures should narrow adverse-selection spreads by reducing information asymmetry. Krinsky and Lee (1996) document that the adverse-selection component of spreads rises around earnings announcements, which has been treated as a puzzle for the simplest disclosure benchmark. Our model provides a potential explanation: in the forward-looking regime, private signals become *more* valuable after the disclosure, not less, because they now combine with the public signal to determine the profitability of trade. Before the disclosure, private signals are payoff-irrelevant for trade (by Proposition 1, all informed investors agree on firm value); after the disclosure, private signals gain trading value by identifying whether the pending action matches the state. The spread widens accordingly.

4.3 Backward-looking regime: spreads narrow in expectation

The backward-looking regime yields the opposite spread pattern. In round 1, the action k is already publicly known but the disclosure has not yet arrived. By Proposition 3, investors with different private signals hold different valuations at this stage, generating informed trading and adverse selection; the market maker posts a positive spread.

In round 2, the disclosure arrives. By Proposition 4, expected post-disclosure disagreement is strictly smaller than pre-disclosure disagreement: the disclosure compresses informed valuations toward a common posterior in expectation. Once the market maker updates both the posterior mean and the expected signal composition of informed traders, adverse selection falls in expectation and the spread narrows.

For the statement below, write p for the public posterior probability of the state that matches the observed action. For concreteness, if $k = A$, then $p = \Pr(\omega = \alpha \mid \mathcal{H})$. Define

$$\mu_a(p) := (1-q) + (2q-1)p, \qquad \mu_b(p) := q - (2q-1)p,$$

where $\mu_a(p)$ and $\mu_b(p)$ are the market maker's expected fractions of s_a- and s_b-investors conditional on the public posterior p. Also define

$$\pi_a(p) := \frac{qp}{qp + (1-q)(1-p)}, \qquad \pi_b(p) := \frac{(1-q)p}{(1-q)p + q(1-p)}.$$

Both informed types strictly trade at every relevant interior posterior. The side-wise zero-profit spread as a function of p is

$$S(p) = n(2q-1)p(1-p)\left[\frac{1}{n\mu_a(p) + y/2} + \frac{1}{n\mu_b(p) + y/2}\right].$$

Proposition 6 (Backward-looking trading)**.** *In the backward-looking regime with observed action k:*

(i) At every relevant public history in both rounds, all informed investors trade. When $k = A$, s_a-investors buy and s_b-investors sell; when $k = B$, the directions are reversed. For $k = A$, the round-1 public posterior is $\rho = \Pr(\omega = \alpha \mid k = A) = Q$, and the market maker posts

$$P_1^{buy} = \frac{\mu_a(\rho) n \pi_a(\rho) + (y/2)\rho}{\mu_a(\rho) n + y/2}, \qquad P_1^{sell} = \frac{\mu_b(\rho) n \pi_b(\rho) + (y/2)\rho}{\mu_b(\rho) n + y/2}.$$

The spread satisfies $Spread_1 = S(\rho) > 0$.

(ii) In round 2, the valuation gap around the public posterior compresses in expectation. For example, for $k = A$,

$$\mathbb{E}[\pi_a(p') - p' \mid k] = (\pi_a(\rho) - \rho)\tau(\pi_a(\rho), Q),$$

with the analogous expression for $p' - \pi_b(p')$, where

$$\tau(\pi, Q) := \frac{Q(1-Q)}{Q(1-Q)[\pi^2 + (1-\pi)^2] + \pi(1-\pi)[Q^2 + (1-Q)^2]} < 1.$$

(iii) The expected adverse-selection component of the bid-ask spread strictly narrows from round 1 to round 2:

$$\mathbb{E}[S(p') \mid k] < S(\rho).$$

(iv) Pointwise, the spread narrows when the disclosure confirms the observed action and widens when it contradicts the observed action. Averaging over disclosure realizations yields the strict expected narrowing in part (iii).

(v) Total expected trading volume equals $n + y$ in both rounds and after every disclosure realization. Hence a backward-looking disclosure leaves volume unchanged in the benchmark.

The mechanism is the standard post-action compression dynamic applied to a market-microstructure setting. Before the disclosure, informed investors with different private signals hold different posteriors on ω (Proposition 3), which drives adverse selection and widens the spread. When the disclosure arrives, it provides a noisy public signal of ω, compressing investor posteriors toward a common mean in expectation. The proof of Proposition 6

accounts for the fact that the market maker also updates the expected composition of the informed trader pool after the disclosure.

4.4 The trading asymmetry

Propositions 5 and 6 together yield the paper's central microstructure claim.

Corollary 2 (Trading asymmetry)**.** *The same state-informative disclosure has asymmetric effects on market outcomes depending on when it arrives relative to the firm's action:*

- *Trading volume rises from y to $n + y$ after a forward-looking disclosure and remains equal to $n + y$ after a backward-looking disclosure.*
- *The bid-ask spread widens after a forward-looking disclosure and narrows in expectation after a backward-looking disclosure.*

This is the empirically testable counterpart of Corollary 1. The spread prediction is particularly sharp: the model predicts not just that spreads move differently after the two types of disclosure, but that they move in *opposite directions*. Such sign-opposing spread predictions provide a direct cross-sectional test against classes of heterogeneity-based alternatives that predict spread widening after disclosures that induce interpretive dispersion regardless of the disclosure's timing position.

4.5 Price dynamics

It is useful to distinguish the value implied by public information from the quote midpoint. Let

$$V^{\text{pub}}(\mathcal{H}) := \mathbb{E}[x \mid \mathcal{H}]$$

denote the firm's public-information value, that is, its expected payoff conditional only on publicly available information, and let

$$M(\mathcal{H}) := \frac{P^{\text{buy}} + P^{\text{sell}}}{2}$$

denote the simple quote midpoint. In the presence of asymmetric adverse selection, $M(\mathcal{H})$ need not equal $V^{\text{pub}}(\mathcal{H})$, even though both bid and ask satisfy side-wise zero-profit pricing.

In the forward-looking regime, the pre-disclosure public-information value equals Q. After either disclosure realization, the disclosure determines the action, and the public probability that the action matches the state remains Q. Thus V^{pub} does not move with the disclosure.

The quote midpoint, however, can move away from Q because the buy side and sell side face different adverse-selection risks.

In the backward-looking regime, after observing $k = A$ but before the disclosure, the public-information value is $\Pr(\omega = \alpha \mid k = A) = Q$. A confirming disclosure moves the public posterior to

$$\frac{Q^2}{Q^2 + (1-Q)^2},$$

whereas a contradicting disclosure moves it to $1/2$. The expected signed change in public-information value is zero by the martingale property of Bayesian posteriors, but realized absolute price changes need not be small. Accordingly, the model's sharpest price-related implication is not that all price responses are muted, but that spread responses differ sharply across regimes even when expected signed public-information-value changes are limited.

4.6 Numerical illustration

To make the market-microstructure asymmetry quantitatively vivid, we use an illustrative calibration and compute the predicted trading outcomes in closed form. We set investor signal precision $q = 0.65$ and disclosure precision $Q = 0.75$, reflecting modest private information and a moderately informative disclosure. We take $n = 10$ informed investors and $y = 4$ noise traders per round.

Table 2 reports expected trading volume, bid-ask spreads, quote midpoints, and public-information values in the two regimes at each trading round.

Table 2: Market outcomes across regimes (computed from closed-form expressions).

Outcome	Forward-Looking	Backward-Looking
Round 1 expected volume	4 (noise only)	14 (informed + noise)
Round 2 expected volume	14	14
Change in volume	+10	0
Round 1 bid-ask spread	0.000	0.163
Round 2 expected bid-ask spread	0.163	0.130
Change in expected spread	+0.163	−0.033
Round 1 quote midpoint	0.750	0.741
Round 2 expected quote midpoint	0.741	0.746
Round 1 public-information value	0.750	0.750
Round 2 expected public-information value	0.750	0.750

Note. Parameter values: $q = 0.65$, $Q = 0.75$, $n = 10$, and $y = 4$. Volume is the total expected orders per trading round. Spread is $P^{\text{buy}} - P^{\text{sell}}$. The quote midpoint is $(P^{\text{buy}} + P^{\text{sell}})/2$. Backward-looking regime round-2 values are averaged over disclosure realizations $\hat{s}$ given observed action k, with the market maker updating the expected private-signal composition after the disclosure.

The numerical contrast is clear. In the forward-looking regime, volume rises sharply from round 1 (only noise traders trade) to round 2 (all informed traders join), and the spread widens from zero to a positive adverse-selection spread. In the backward-looking regime, all informed investors strictly trade both before and after the disclosure, so volume is unchanged across rounds, while the expected spread narrows as informed valuations converge toward the public posterior.

The table also shows why public-information values and quote midpoints should be separated. Expected public-information value is unchanged across the disclosure event in both regimes, but quote midpoints need not equal public-information values because buy and sell orders carry different adverse-selection risks.

Figure 2 plots the equilibrium closed-form change in bid-ask spread as a function of the disclosure precision Q, for both regimes. The forward-looking spread change is positive and decreasing in Q: as the disclosure becomes nearly perfectly informative, both private-signal types become nearly certain that the disclosure-induced action is correct, so post-disclosure disagreement and adverse selection shrink. The backward-looking spread change is negative and non-monotone: compression is weak when Q is close to $1/2$, strongest at intermediate precision, and attenuates as Q approaches one.

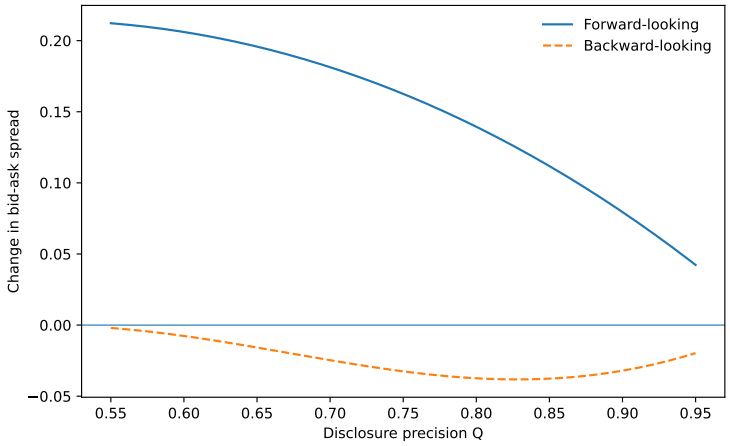

Figure 2: Change in bid-ask spread from round 1 to round 2 as a function of disclosure precision Q, for forward-looking and backward-looking regimes. Other parameters: $q = 0.65$, $n = 10$, and $y = 4$.

Forward-looking regime. The solid curve is strictly positive across the entire range $Q \in (0.55, 0.95)$ and monotonically decreasing. At high Q, the disclosure-induced action is almost certainly correct, leaving less room for post-disclosure private information to generate adverse selection. At modest disclosure precision ($Q \in [0.65, 0.80]$), the predicted spread

widening is substantial—approximately 0.14 to 0.20 in probability units.

Backward-looking regime. The dashed curve is strictly negative across the plotted range. Its magnitude peaks at intermediate Q, around $Q \approx 0.82$ under the closed-form equilibrium calculation, and attenuates at both extremes. At Q near 1/2, the disclosure is barely informative and has little compression effect; at Q near 1, the round-1 spread is already compressed because the observed action is nearly fully informative about the state, leaving little further room for the disclosure to compress.

Sign reversal. The two curves lie on opposite sides of zero throughout the plotted range. This is the paper's central spread prediction visualized: the sign of the spread response to disclosure is determined by disclosure timing relative to the firm's pending action. The spread changes are substantial in the model's normalized probability units even at modest disclosure precision.

5 Robustness Checks

5.1 Robustness I: Allowing Firm's Decision to Probabilistically Follow Forward-looking Disclosure

The benchmark assumes that the firm deterministically follows the disclosure: $k = A$ after $\hat{s}_a$ and $k = B$ after $\hat{s}_b$. This assumption is analytically convenient but stronger than necessary. We now show that the main forward-looking mechanism survives when the disclosure only partially predicts the firm's action.

Let $\lambda \in [1/2, 1]$ measure the firm's responsiveness to the disclosure. In the forward-looking regime, suppose

$$\Pr(k = A \mid \hat{s}_a) = \Pr(k = B \mid \hat{s}_b) = \lambda,$$

and

$$\Pr(k = B \mid \hat{s}_a) = \Pr(k = A \mid \hat{s}_b) = 1 - \lambda.$$

The deterministic benchmark is the special case $\lambda = 1$. The case $\lambda = 1/2$ corresponds to a firm whose action is unresponsive to the disclosure. We assume that the residual randomization in the action is independent of ω and of investors' private signals conditional on $\hat{s}$.

The firm's unconditional action accuracy is then

$$\bar{Q}(\lambda, Q) := \lambda Q + (1-\lambda)(1-Q) = \frac{1}{2} + (2\lambda - 1)\left(Q - \frac{1}{2}\right).$$

For comparability, in the backward-looking regime the exogenous action is assumed to satisfy

$$\Pr(k = m(\omega) \mid \omega) = \bar{Q}(\lambda, Q),$$

where $m(\alpha) = A$ and $m(\beta) = B$.

Proposition 7 (Partial responsiveness)**.** *Suppose both private-signal types are represented and the forward-looking action is partially responsive to the disclosure with responsiveness parameter $\lambda \in [1/2, 1]$.*

(i) Before the disclosure, investors agree about firm value:

$$v_i = \bar{Q}(\lambda, Q) \quad \textit{for all } i.$$

(ii) After a forward-looking disclosure but before the action is observed, disagreement is

$$d_{F,2}(\hat{s}; \lambda) = (2\lambda - 1) d_{F,2}(\hat{s}; 1).$$

Hence forward-looking disclosure generates disagreement if and only if $\lambda > 1/2$.

(iii) In the backward-looking regime, the later disclosure still compresses post-action disagreement in expectation:

$$\mathbb{E}[d_{B,2}(k, \hat{s}) \mid k] < d_{B,1}(k)$$

for every realized action k, whenever $Q > 1/2$.

(iv) For any $\lambda > 1/2$, all forward-looking informed investors strictly trade after the disclosure. Letting $S_F(\lambda)$ denote the forward-looking post-disclosure spread,

$$S_F(\lambda) = (2\lambda - 1) S_F(1) > 0.$$

Forward-looking volume rises from y to $n + y$. In the comparable backward-looking regime, volume remains $n + y$ and the expected spread strictly narrows.

5.2 Robustness II: Asymmetric Priors and Information Accuracy

The benchmark assumes an equal prior and signal structures that are equally accurate in the two states. We now relax these assumptions.

Allow the prior $\Pr(\omega = \alpha)$ to be any number in $(0, 1)$. Let private signals satisfy

$$\Pr(s_a \mid \alpha) = q_\alpha, \qquad \Pr(s_a \mid \beta) = q_\beta, \qquad 1 > q_\alpha > q_\beta > 0,$$

and let the public disclosure satisfy

$$\Pr(\hat{s}_a \mid \alpha) = Q_\alpha, \qquad \Pr(\hat{s}_b \mid \beta) = Q_\beta, \qquad Q_\alpha, Q_\beta \in (1/2, 1).$$

Private signals and the disclosure remain conditionally independent given the state.

In the forward-looking regime, the firm chooses A after $\hat{s}_a$ and B after $\hat{s}_b$, as in the main model. For comparability, in the backward-looking regime suppose

$$\Pr(k = A \mid \alpha) = Q_\alpha, \qquad \Pr(k = B \mid \beta) = Q_\beta,$$

and maintain conditional independence of the action, the later disclosure, and investors' private signals given the state.

Proposition 8 (Asymmetric priors and information accuracy)**.** *Suppose both private-signal types are represented.*

(i) Before any public information arrives,

$$d\big((s_i)_{i\in N}\big) = |Q_\alpha - Q_\beta| \times \left[\Pr(\alpha \mid s_a) - \Pr(\alpha \mid s_b)\right].$$

In the forward-looking regime, this object is $d_{F,1}$. Hence pre-disclosure consensus holds if and only if $Q_\alpha = Q_\beta$. An asymmetric prior or asymmetric private-signal precision does not by itself break consensus.

(ii) If $Q_\alpha \geq Q_\beta$, then

$$d_{F,2}(\hat{s}_a) > d_{F,1}.$$

If $Q_\beta \geq Q_\alpha$, then

$$d_{F,2}(\hat{s}_b) > d_{F,1}.$$

Consequently,

$$\max\left\{d_{F,2}(\hat{s}_a), d_{F,2}(\hat{s}_b)\right\} > d_{F,1}$$

for every $Q_\alpha, Q_\beta \in (1/2, 1)$.

(iii) Fix any $Q \in (1/2, 1)$. *When* (Q_α, Q_β) *is sufficiently close to* (Q, Q), *both disclosure realizations strictly increase disagreement:*

$$d_{F,2}(\hat{s}_a) > d_{F,1}, \qquad d_{F,2}(\hat{s}_b) > d_{F,1}.$$

(iv) The forward-looking disclosure strictly increases disagreement in expectation:

$$\mathbb{E}_{\hat{s}}[d_{F,2}(\hat{s})] > d_{F,1},$$

where the expectation is taken over the unconditional distribution of $\hat{s}$.

(v) In the backward-looking regime, the later disclosure continues to compress post-action disagreement in expectation:

$$\mathbb{E}[d_{B,2}(k, \hat{s}) \mid k] < d_{B,1}(k)$$

for every realized action k.

Part (i) identifies the role of symmetric disclosure accuracy in the benchmark. Conditional on state α, the disclosure-induced action is correct with probability Q_α; conditional on state β, it is correct with probability Q_β. When these probabilities are equal, investors' different beliefs about the state do not translate into different expected firm values before the disclosure. When they differ, investors disagree before the disclosure because one state is associated with a more accurate eventual action than the other.

Parts (ii) and (iii) show that exact pre-disclosure consensus is not necessary for the forward-looking mechanism. With arbitrary asymmetry, at least one disclosure realization strictly increases disagreement. If the asymmetry is sufficiently small, both realizations do so. The benchmark therefore gives the especially sharp zero-to-positive result, but the broader positive-to-more-positive disagreement result holds on an open set of asymmetric information structures.

Part (iv) strengthens the realization-level statements. A single realization can lower disagreement relative to the now-positive pre-disclosure level $d_{F,1}$—this is why part (ii) is one-sided—but on average across realizations the forward-looking disclosure strictly raises disagreement, for every interior prior and every admissible asymmetric information structure. Stated in expectation, the forward-looking mechanism therefore requires no qualification. The proof also reveals a unified structure behind parts (iv) and (v): in both regimes, expected

post-disclosure disagreement equals the relevant pre-disclosure posterior gap rescaled by (an average of) a single contraction factor $T(\cdot)$, defined in the proof in the Appendix. In the backward-looking regime, the pre-disclosure benchmark is that posterior gap itself, so $T < 1$ delivers compression. In the forward-looking regime, the pre-disclosure benchmark is the strictly smaller valuation gap $d_{F,1}$, and $T > |Q_\alpha - Q_\beta|$ delivers expansion. The same disclosure thus raises expected disagreement when the action is pending and lowers it when the action is already public—an in-expectation counterpart, under full asymmetry, of Corollary 1.

The backward-looking result, part (v), is more robust still. Once the action is fixed and observed, an investor's valuation is simply her posterior probability that the observed action matches the state. An additional informative public signal then contracts the expected gap between private posteriors even when the prior and both private- and public-signal likelihoods are asymmetric.

Corollary 3 (Forward-looking volume under small asymmetry)**.** *For this corollary only, suppose informed investors incur a fixed order-submission cost $\varepsilon > 0$. Fix an interior prior, $q_\alpha > q_\beta$, $Q \in (1/2, 1)$, n, and $y > 0$. There exists a neighborhood of $Q_\alpha = Q_\beta = Q$ such that, for every (Q_α, Q_β) in that neighborhood, there is a nonempty interval of fixed trading costs for which no informed investor trades before the forward-looking disclosure, whereas all informed investors trade after either disclosure realization. Expected volume therefore rises from y in Round 1 to $n+y$ in Round 2, and the bid-ask spread widens from zero to a positive level.*

The corollary clarifies the volume implication when asymmetric disclosure accuracy creates modest pre-disclosure disagreement. Pre-disclosure trading gains are small, while post-disclosure gains remain bounded away from zero. An intermediate ε therefore prevents trade before the disclosure but permits it afterward.

Corollary 4 (Backward-looking market outcomes under asymmetric information)**.** *Asymmetric priors and signal likelihoods do not overturn the backward-looking market results. The results from the main model carry over; all informed investors trade before and after the disclosure, volume remains $n+y$, and the expected adverse-selection spread strictly narrows.*

The preceding results yield a simple hierarchy. The equal prior and state-symmetric private signals are primarily expositional assumptions. State-symmetric disclosure accuracy delivers exact pre-disclosure consensus and, under zero fixed trading costs, the sharp forward-looking volume jump. When disclosure accuracy differs across states, the disclosure still raises disagreement after at least one realization globally and after both realizations locally. With an intermediate fixed trading cost, the forward-looking volume increase is locally

preserved as well. The backward-looking expected compression of disagreement and spreads is robust throughout.

6 Empirical Connections and Implications

In this section, we first explain how the mechanism helps rationalize several documented announcement-period patterns. We then state empirical predictions that follow from the distinction between forward-looking and backward-looking disclosures and briefly discuss how future research might test them.

6.1 Connecting the model to empirical patterns

A large empirical literature documents substantial trading responses around public information events. Kandel and Pearson (1995), Bollerslev et al. (2018), and Li et al. (2022), among others, report high post-announcement trading volume and, in their respective settings, price movements that can appear modest relative to the amount of trade. These patterns have often been interpreted as difficult to reconcile with simple rational-expectations models in which public information reduces the value of private information. Our model identifies a common-prior channel through which the opposite can occur. When a disclosure bears on a pending firm action, it makes that action more predictable while investors retain different private information about whether the action is appropriate. Private information can therefore become more valuable for trade after the public disclosure, generating disagreement and elevated volume without requiring heterogeneous priors or heterogeneous interpretations.

The model also speaks to announcement-period liquidity. Krinsky and Lee (1996) show that the adverse-selection component of the bid-ask spread increases around earnings announcements even though other spread components need not move in the same direction. In the forward-looking regime, our model produces precisely this type of increase: the disclosure makes the pending action predictable and thereby increases the informational content of investors' private signals for firm value. In the backward-looking regime, the same state-informative disclosure instead compresses valuations and narrows the adverse-selection component of the spread in expectation. The distinction therefore helps reconcile evidence of announcement-period spread widening with the conventional view that public information should improve liquidity.

Finally, the model clarifies why substantial trading and adverse-selection responses need not be accompanied by a large average signed price response. In the forward-looking benchmark, the public probability that the disclosure-induced action matches the state remains

equal to the disclosure accuracy, so public-information value does not move with the realization of the disclosure. In the backward-looking regime, confirming and contradicting disclosures move the public posterior in opposite directions and cancel in expectation by the martingale property of Bayesian posteriors. These statements concern average signed changes in public-information value; they do not imply that absolute returns, price volatility, or quote-midpoint movements are small in every realization.

Taken together, the model provides a unified rational-expectations explanation for three patterns that sometimes appear jointly around public announcements: high trading volume, increased adverse selection, and a limited average signed price response. The explanation is not intended to apply to every disclosure event. It applies most directly when the information changes beliefs about a firm action that remains pending when the disclosure arrives.

6.2 Testable predictions

The model yields several predictions that depend on whether a disclosure precedes or follows the relevant firm action.

Prediction 1: action-relative disagreement and trading. Forward-looking disclosures should be more likely than backward-looking disclosures to increase valuation disagreement and informed trading. In the forward-looking regime, the disclosure converts heterogeneous private information about the state into heterogeneous valuations of a common anticipated action. In the backward-looking benchmark, all informed investors trade both before and after the disclosure, so volume is unchanged even though expected disagreement and adverse selection fall. A future test could link disclosure events to identifiable firm actions and compare market responses according to whether the action was still pending or already public when the information arrived.

Prediction 2: sign-opposing adverse-selection responses. The model's sharpest market prediction concerns the adverse-selection component of trading costs. That component widens following a forward-looking disclosure and narrows in expectation following a backward-looking disclosure. Measures of price impact, the permanent component of effective spreads, or other informed-trading measures map more directly into this prediction than the total quoted or effective spread.

Prediction 3: disagreement about actions need not coincide with disagreement about value. Before the public disclosure, investors can disagree about the state and about the action the firm should take while nevertheless holding similar valuations of the

firm. The disclosure can then make the firm's likely action sufficiently predictable that this preexisting path-forward disagreement becomes valuation disagreement and trading demand. This prediction suggests that empirical measures of disagreement about specific corporate choices may contain information not captured by analyst-forecast dispersion or investor disagreement about stock value. Surveys, analyst commentary, investor communications, or textual discussions tied to identifiable corporate decisions could be used to examine whether disagreement about the appropriate action becomes more strongly associated with valuation disagreement and trading after an action-coordinating disclosure.

Prediction 4: the role of action predictability. The partial-responsiveness extension shows that forward-looking disagreement and spread widening are attenuated when the disclosure only weakly predicts the firm's subsequent action. These effects should therefore be stronger in settings in which disclosed information is expected to have a substantial influence on what the firm does next. Historical follow-through, managerial discretion, or other measures of action predictability may provide useful cross-sectional moderators. Volume rises whenever $\lambda > 1/2$, and therefore does not vary smoothly with responsiveness; the continuous comparative static applies most directly to disagreement and the adverse-selection spread. This prediction concerns the strength of the disclosure-action link rather than linguistic forward-lookingness alone.

The broader empirical implication of the model is classificatory. Disclosure studies commonly organize information events by venue, topic, mandatory versus voluntary status, or textual characteristics. Our analysis identifies an additional dimension: whether the payoff-relevant firm action is still pending when the disclosure arrives. Disclosures that look similar in content or informativeness can have different market effects because they occupy different positions relative to the firm's action. The test does not require that forward-looking and backward-looking disclosures be physically separated into different filings—they routinely appear together in the same 10-K. What matters is the *relative weight* of the two types of content across filings, subject to the caveat that the model's pure-regime predictions are being mapped into a mixed-content empirical setting.

7 Conclusion

We have shown that the effect of a public disclosure on investor disagreement depends on when it arrives relative to the firm's actions. A disclosure that arrives before a pending managerial action plays a forward-looking role: it coordinates investors' beliefs about what the firm will do while leaving their beliefs about whether that action is correct heterogeneous.

This activates informed trading and widens bid-ask spreads in a common-prior rational-expectations model. The same disclosure arriving after the relevant action is already publicly known plays a backward-looking role: it provides additional public information about whether the observed action was correct, compresses disagreement in expectation, leaves informed trading volume unchanged (it remains high before and after the backward-looking disclosure), and narrows adverse-selection spreads in expectation.

The central message of the paper is not that heterogeneity-based explanations of the volume-disagreement-spread nexus are wrong, but that they are not necessary for these qualitative patterns. Some facts that motivated those explanations can be generated in a rational-expectations model with common priors and common interpretive frameworks, once the timing of disclosure relative to pending firm actions is taken seriously. Disclosure's effect on disagreement is not a property of the disclosure alone; it is a property of the interaction between the disclosure and the decision environment in which it arrives.

Our results suggest several directions for future work. On the theoretical side, the framework extends naturally to sequences of disclosures, disclosures of information generated in the process of corporate governance (e.g., shareholder voting), and settings in which the firm strategically chooses when to disclose. On the empirical side, our predictions call for tests that separate disclosures tied to pending actions from disclosures released after actions are public, and then relate the differential market response to measures of disclosure specificity, firm discretion, and baseline information asymmetry.

More broadly, our analysis suggests that the debate over whether rational-expectations models with common-prior investors can accommodate the empirical patterns of trading around public announcements should be conducted at a more granular level. The question is not whether any disclosure can generate disagreement in such a model—the answer is yes—but which disclosures can and which cannot, and what observable features of disclosures predict their effects. Disclosure timing relative to pending firm actions is one such feature. Others likely exist, and mapping them out is the natural next step for the research program this paper is part of.

A Proofs

Preliminaries: two lemmas

The proofs below rest on two identities about Bayesian updating in the binary-state binary-signal setting.

For notational convenience in the proofs, let

$$Q_{\hat{s}}^{\omega} := \Pr(\hat{s} \mid \omega).$$

Thus $Q_{\hat{s}_a}^{\alpha} = Q_{\hat{s}_b}^{\beta} = Q$ and $Q_{\hat{s}_a}^{\beta} = Q_{\hat{s}_b}^{\alpha} = 1 - Q$. Also let $Q' := 1 - Q$.

Lemma 1 (Pointwise updating identity)**.** *Let $\pi, \rho \in (0,1)$ denote two posteriors on $\omega = \alpha$ held prior to observing the disclosure $\hat{s}$. Let*

$$D_{\pi}(\hat{s}) := \pi Q_{\hat{s}}^{\alpha} + (1-\pi) Q_{\hat{s}}^{\beta},$$

and define $D_{\rho}(\hat{s})$ analogously. After observing $\hat{s}$, the Bayesian-updated posteriors $\pi^{post}(\hat{s})$ and $\rho^{post}(\hat{s})$ satisfy

$$\pi^{post}(\hat{s}) - \rho^{post}(\hat{s}) = (\pi - \rho) \cdot \frac{Q_{\hat{s}}^{\alpha} Q_{\hat{s}}^{\beta}}{D_{\pi}(\hat{s}) \cdot D_{\rho}(\hat{s})}.$$

Proof. By Bayes' rule, $\pi^{\text{post}}(\hat{s}) = \pi Q_{\hat{s}}^{\alpha} / D_{\pi}(\hat{s})$, and likewise for ρ^{post}. Therefore

$$\pi^{\text{post}}(\hat{s}) - \rho^{\text{post}}(\hat{s}) = \frac{\pi Q_{\hat{s}}^{\alpha}}{D_{\pi}(\hat{s})} - \frac{\rho Q_{\hat{s}}^{\alpha}}{D_{\rho}(\hat{s})} = Q_{\hat{s}}^{\alpha} \cdot \frac{\pi D_{\rho}(\hat{s}) - \rho D_{\pi}(\hat{s})}{D_{\pi}(\hat{s}) D_{\rho}(\hat{s})}.$$

Expanding the numerator,

$$\pi D_{\rho}(\hat{s}) - \rho D_{\pi}(\hat{s}) = \pi[\rho Q_{\hat{s}}^{\alpha} + (1-\rho) Q_{\hat{s}}^{\beta}] - \rho[\pi Q_{\hat{s}}^{\alpha} + (1-\pi) Q_{\hat{s}}^{\beta}] = Q_{\hat{s}}^{\beta}(\pi - \rho),$$

yielding the stated identity. □

Lemma 2 (Compression factor)**.** *For any $\pi \in (0,1)$,*

$$\tau(\pi, Q) := \sum_{\hat{s}} \frac{Q_{\hat{s}}^{\alpha} Q_{\hat{s}}^{\beta}}{D_{\pi}(\hat{s})} = \frac{Q(1-Q)}{Q(1-Q)[\pi^2 + (1-\pi)^2] + \pi(1-\pi)[Q^2 + (1-Q)^2]}.$$

Moreover, $\tau(\pi, Q) < 1$ whenever $Q \neq 1/2$.

Proof. Using $Q_{\hat{s}_a}^{\alpha} Q_{\hat{s}_a}^{\beta} = QQ'$ and $Q_{\hat{s}_b}^{\alpha} Q_{\hat{s}_b}^{\beta} = Q'Q$,

$$\tau(\pi, Q) = QQ' \left[\frac{1}{D_{\pi}(\hat{s}_a)} + \frac{1}{D_{\pi}(\hat{s}_b)} \right] = \frac{QQ' \cdot [D_{\pi}(\hat{s}_a) + D_{\pi}(\hat{s}_b)]}{D_{\pi}(\hat{s}_a) D_{\pi}(\hat{s}_b)}.$$

Since $D_\pi(\hat{s}_a) + D_\pi(\hat{s}_b) = 1$, this simplifies to

$$\tau(\pi, Q) = \frac{QQ'}{D_\pi(\hat{s}_a) D_\pi(\hat{s}_b)}.$$

Expanding the product,

$$D_\pi(\hat{s}_a) D_\pi(\hat{s}_b) = [\pi Q + (1-\pi)Q'][\pi Q' + (1-\pi)Q] = QQ'[\pi^2 + (1-\pi)^2] + \pi(1-\pi)(Q^2 + Q'^2),$$

yielding the stated form of τ.

For $\tau(\pi, Q) < 1$, the inequality is equivalent to

$$QQ' < QQ'[\pi^2 + (1-\pi)^2] + \pi(1-\pi)(Q^2 + Q'^2).$$

Using $1 - [\pi^2 + (1-\pi)^2] = 2\pi(1-\pi)$ and dividing by $\pi(1-\pi) > 0$, this becomes

$$2QQ' < Q^2 + Q'^2,$$

which rearranges to $(Q - Q')^2 > 0$. This holds strictly whenever $Q \neq 1/2$. □

Proof of Proposition 1

Proof. Let $p(s) := \Pr(\omega = \alpha \mid s)$ denote an investor's posterior on $\omega = \alpha$ given private signal s. Her expectation of firm value before any public disclosure is

$$v(s) = \Pr(k = m(\omega) \mid s) = p(s) \Pr(k = A \mid \omega = \alpha) + (1 - p(s)) \Pr(k = B \mid \omega = \beta).$$

In both regimes, the decision accuracy is $\Pr(k = m(\omega) \mid \omega) = Q$ in each state. Therefore

$$v(s) = p(s)Q + (1 - p(s))Q = Q,$$

independent of s. This holds for every investor, so initial disagreement is zero in both regimes and, in particular, $d_{F,1} = 0$. □

Proof of Proposition 2

Proof. Fix $\hat{s} = \hat{s}_a$; the case $\hat{s} = \hat{s}_b$ is symmetric. Under the forward-looking decision rule $k = A$ whenever $\hat{s} = \hat{s}_a$, so conditional on $\hat{s} = \hat{s}_a$ we have $k = A$ with certainty. Firm value

is then $x = 1$ iff $\omega = \alpha$, and investor i's valuation is

$$v_i(s_i, \hat{s}_a) = \Pr(\omega = \alpha \mid s_i, \hat{s}_a).$$

By Bayes' rule,

$$\Pr(\omega = \alpha \mid s_a, \hat{s}_a) = \frac{qQ}{qQ + (1-q)(1-Q)},$$

whereas

$$\Pr(\omega = \alpha \mid s_b, \hat{s}_a) = \frac{(1-q)Q}{(1-q)Q + q(1-Q)}.$$

Since $q > 1/2$ and $Q > 1/2$, the first expression exceeds the second. Therefore the two valuations differ and $d_{F,2}(\hat{s}_a) > 0$. □

Proof of Proposition 3

Proof. Fix $k = A$; the case $k = B$ is symmetric. Firm value conditional on $k = A$ is $x = 1$ iff $\omega = \alpha$, so investor i's valuation after observing $(s_i, k = A)$ is

$$v_i(s_i, k = A) = \Pr(\omega = \alpha \mid s_i, k = A).$$

Using the conditional-independence assumption in the backward-looking regime together with $\Pr(k = A \mid \omega = \alpha) = Q$ and $\Pr(k = A \mid \omega = \beta) = 1 - Q$, Bayes' rule gives

$$\Pr(\omega = \alpha \mid s_a, k = A) = \frac{qQ}{qQ + (1-q)(1-Q)},$$

and

$$\Pr(\omega = \alpha \mid s_b, k = A) = \frac{(1-q)Q}{(1-q)Q + q(1-Q)}.$$

Since $q > 1/2$, the first exceeds the second, so $d_{B,1}(A) > 0$. □

Proof of Proposition 4

Proof. Fix $k = A$; the case $k = B$ follows by the same argument. Define post-action posteriors

$$\pi_s := \Pr(\omega = \alpha \mid s, k = A), \qquad s \in \{s_a, s_b\}, \qquad \rho := \Pr(\omega = \alpha \mid k = A).$$

By Proposition 3, $\pi_{s_a} > \rho > \pi_{s_b}$, and $d_{B,1}(A) = \pi_{s_a} - \pi_{s_b} > 0$. Lemma 1 preserves the posterior ordering after each disclosure realization, so $d_{B,2}(A, \hat{s}) = \pi^{\text{post}}_{s_a}(\hat{s}) - \pi^{\text{post}}_{s_b}(\hat{s})$.

Decompose the total gap as

$$\pi_{s_a} - \pi_{s_b} = (\pi_{s_a} - \rho) + (\rho - \pi_{s_b}).$$

Apply Lemma 1 to the upper gap and take expectations over the public distribution $\Pr(\hat{s} \mid k = A) = D_\rho(\hat{s})$:

$$\mathbb{E}[\pi^{\text{post}}_{s_a} - \rho^{\text{post}} \mid k = A] = (\pi_{s_a} - \rho) \sum_{\hat{s}} \frac{Q^\alpha_{\hat{s}} Q^\beta_{\hat{s}}}{D_{\pi_{s_a}}(\hat{s})} = (\pi_{s_a} - \rho)\tau(\pi_{s_a}, Q).$$

Similarly,

$$\mathbb{E}[\rho^{\text{post}} - \pi^{\text{post}}_{s_b} \mid k = A] = (\rho - \pi_{s_b})\tau(\pi_{s_b}, Q).$$

Summing and using Lemma 2,

$$\mathbb{E}[d_{B,2}(A, \hat{s}) \mid k = A] = (\pi_{s_a} - \rho)\tau(\pi_{s_a}, Q) + (\rho - \pi_{s_b})\tau(\pi_{s_b}, Q) < \pi_{s_a} - \pi_{s_b} = d_{B,1}(A).$$

To establish the realization-level statement in the footnote, write log odds and let

$$A_q := \log \frac{q}{1-q}, \qquad B_Q := \log \frac{Q}{1-Q}.$$

After observing $k = A$, the two investor-type log odds are centered at B_Q:

$$\ell_a = B_Q + A_q, \qquad \ell_b = B_Q - A_q.$$

A confirming disclosure $\hat{s}_a$ shifts both log odds by $+B_Q$, so the center becomes $2B_Q$. A contradicting disclosure $\hat{s}_b$ shifts both log odds by $-B_Q$, so the center becomes zero. Let $\sigma(z) := 1/(1 + e^{-z})$ and define

$$g(c) := \sigma(c + A_q) - \sigma(c - A_q).$$

Then post-action disagreement before the disclosure is $g(B_Q)$, disagreement after a confirming disclosure is $g(2B_Q)$, and disagreement after a contradicting disclosure is $g(0)$. The function g is even, and for $c > 0$,

$$g'(c) = \sigma'(c + A_q) - \sigma'(c - A_q) < 0,$$

because σ' is even and strictly decreasing in $|z|$, and $|c + A_q| > |c - A_q|$. Hence

$$g(0) > g(B_Q) > g(2B_Q).$$

Thus a contradicting disclosure strictly expands probability-space disagreement, while a confirming disclosure strictly compresses it. The proposition establishes that averaging over disclosure realizations nevertheless yields strict expected compression. □

Proof of Corollary 1

Proof. Part (i) follows from Proposition 1, which gives $d_{F,1} = 0$, and Proposition 2, which gives $d_{F,2}(\hat{s}) > 0$ for every $\hat{s}$. Part (ii) follows from Proposition 3, which gives $d_{B,1}(k) > 0$ for every k, and Proposition 4, which gives $\mathbb{E}[d_{B,2}(k, \hat{s}) \mid k] < d_{B,1}(k)$. □

Proof of Proposition 5

Proof. In round 1, Proposition 1 gives valuation Q for every informed investor. If informed investors do not trade, all submitted orders are noise orders, and buy and sell orders contain identical information. Zero-profit pricing therefore gives

$$P_1^{\text{buy}} = P_1^{\text{sell}} = Q.$$

Buying or selling at Q yields zero expected surplus. Under the convention that an informed investor holds when indifferent, no informed investor trades. Expected volume is y, and the spread is zero.

Now consider round 2 and fix $\hat{s} = \hat{s}_a$; the case $\hat{s}_b$ is symmetric. The public posterior is $p = \Pr(\omega = \alpha \mid \hat{s}_a) = Q$. Define

$$\mu_a(p) = (1 - q) + (2q - 1)p, \qquad \mu_b(p) = q - (2q - 1)p,$$

and

$$\pi_a(p) = \Pr(\omega = \alpha \mid s_a, \hat{s}_a) = \frac{qp}{qp + (1 - q)(1 - p)},$$

$$\pi_b(p) = \Pr(\omega = \alpha \mid s_b, \hat{s}_a) = \frac{(1 - q)p}{(1 - q)p + q(1 - p)}.$$

Since $q > 1/2$ and $p \in (0, 1)$, $\pi_a(p) > p > \pi_b(p)$. If s_a-investors buy and s_b-investors sell,

zero-profit side-wise prices are

$$P^{\text{buy}}(p) = \frac{n\mu_a(p)\pi_a(p) + (y/2)p}{n\mu_a(p) + y/2}, \qquad P^{\text{sell}}(p) = \frac{n\mu_b(p)\pi_b(p) + (y/2)p}{n\mu_b(p) + y/2}.$$

The buy-side and sell-side gains are

$$\pi_a(p) - P^{\text{buy}}(p) = \frac{y/2}{n\mu_a(p) + y/2}[\pi_a(p) - p] > 0,$$

and

$$P^{\text{sell}}(p) - \pi_b(p) = \frac{y/2}{n\mu_b(p) + y/2}[p - \pi_b(p)] > 0.$$

Because $y > 0$, both gains are strictly positive. Thus the stated trading pattern is a strict equilibrium: all s_a-investors buy and all s_b-investors sell. Expected volume is $n + y$, strictly above the round-1 volume y. Moreover, $P^{\text{buy}}(p) > p > P^{\text{sell}}(p)$, so the round-2 spread is strictly positive. Since the round-1 spread is zero, the spread strictly widens. □

Proof of Proposition 6

Proof. Fix $k = A$; the case $k = B$ is symmetric after relabeling states and actions. At any public history with posterior $p \in (0, 1)$, the type-specific valuations satisfy

$$\pi_a(p) > p > \pi_b(p).$$

If s_a-investors buy and s_b-investors sell, the zero-profit quotes are

$$P^{\text{buy}}(p) = \frac{n\mu_a(p)\pi_a(p) + (y/2)p}{n\mu_a(p) + y/2}, \qquad P^{\text{sell}}(p) = \frac{n\mu_b(p)\pi_b(p) + (y/2)p}{n\mu_b(p) + y/2}.$$

The corresponding gains are

$$\pi_a(p) - P^{\text{buy}}(p) = \frac{y/2}{n\mu_a(p) + y/2}[\pi_a(p) - p] > 0,$$

and

$$P^{\text{sell}}(p) - \pi_b(p) = \frac{y/2}{n\mu_b(p) + y/2}[p - \pi_b(p)] > 0.$$

Because $y > 0$, both informed types strictly trade at every relevant posterior. In round 1, $p = \rho = \Pr(\omega = \alpha \mid k = A) = Q$. In round 2, p equals either the confirming posterior or the contradicting posterior, both of which lie in $(0, 1)$. This proves the participation statement in part (i), and the round-1 quote formulas follow by setting $p = \rho$. It also proves part (v):

every informed investor and every noise trader submits one order in each round, so expected volume is $n + y$ in every branch.

Part (ii) follows directly from Lemmas 1 and 2, exactly as in the proof of Proposition 4.

For part (iii), let $a := 2q - 1 > 0$ and $c := y/2$. Since all informed investors trade at every relevant posterior, the equilibrium spread is

$$S(p) = P^{\text{buy}}(p) - P^{\text{sell}}(p).$$

Using the quote formulas,

$$S(p) = \frac{n\mu_a(p)[\pi_a(p) - p]}{n\mu_a(p) + c} + \frac{n\mu_b(p)[p - \pi_b(p)]}{n\mu_b(p) + c}.$$

The identities

$$\mu_a(p)[\pi_a(p) - p] = ap(1-p), \qquad \mu_b(p)[p - \pi_b(p)] = ap(1-p)$$

give

$$S(p) = nap(1-p)\left[\frac{1}{n\mu_a(p) + c} + \frac{1}{n\mu_b(p) + c}\right].$$

Let $z := p - 1/2$, $C := n/2 + c$, and $D := na$. Since $\mu_a(p) = 1/2 + az$ and $\mu_b(p) = 1/2 - az$,

$$S(p) = \frac{2naC(1/4 - z^2)}{C^2 - D^2 z^2}.$$

Differentiating twice with respect to p (equivalently, with respect to z) yields

$$S''(p) = -\frac{naC(4C^2 - D^2)(C^2 + 3D^2 z^2)}{(C^2 - D^2 z^2)^3} < 0,$$

because $2C = n + y > D = na$. Thus S is strictly concave on the relevant domain.

The post-disclosure public posterior p' is a martingale:

$$\mathbb{E}[p' \mid k = A] = \rho.$$

Since the disclosure is informative for $Q > 1/2$, p' is non-degenerate. Jensen's inequality and strict concavity therefore imply

$$\mathbb{E}[S(p') \mid k = A] < S(\rho),$$

which proves part (iii).

For part (iv), after observing $k = A$, a confirming disclosure moves the posterior from $\rho = Q$ to

$$p_C = \frac{Q^2}{Q^2 + (1-Q)^2} > Q,$$

while a contradicting disclosure moves it to

$$p_X = \frac{Q(1-Q)}{Q(1-Q) + (1-Q)Q} = \frac{1}{2}.$$

The expression above for $S(p)$ is symmetric around $1/2$ and strictly decreasing in $|p - 1/2|$. Hence confirmation narrows the spread and contradiction widens it. Part (iii) shows that the expected effect is nevertheless a strict narrowing. □

Proof of Corollary 2

Proof. Immediate from Propositions 5 and 6. □

Proof of Proposition 7

Proof. First consider the pre-disclosure valuation. Conditional on $\omega = \alpha$, the probability that the firm takes the correct action is

$$\Pr(k = A \mid \omega = \alpha) = \lambda Q + (1-\lambda)(1-Q) = \bar{Q}.$$

Conditional on $\omega = \beta$, the probability that the firm takes the correct action is also

$$\Pr(k = B \mid \omega = \beta) = \lambda Q + (1-\lambda)(1-Q) = \bar{Q}.$$

Therefore, for any private signal s,

$$v(s) = \Pr(k = m(\omega) \mid s) = \Pr(\omega = \alpha \mid s)\bar{Q} + \Pr(\omega = \beta \mid s)\bar{Q} = \bar{Q}.$$

This proves part (i).

For part (ii), fix $\hat{s} = \hat{s}_a$. Let

$$\pi_a^Q = \Pr(\omega = \alpha \mid s_a, \hat{s}_a) = \frac{qQ}{qQ + (1-q)(1-Q)}$$

and

$$\pi_b^Q = \Pr(\omega = \alpha \mid s_b, \hat{s}_a) = \frac{(1-q)Q}{(1-q)Q + q(1-Q)}.$$

An investor with posterior π values the firm at

$$v(\pi, \hat{s}_a) = \lambda\pi + (1-\lambda)(1-\pi) = (1-\lambda) + (2\lambda-1)\pi.$$

Hence

$$v(s_a, \hat{s}_a) - v(s_b, \hat{s}_a) = (2\lambda-1)(\pi_a^Q - \pi_b^Q).$$

The case $\hat{s} = \hat{s}_b$ is symmetric. Since $\pi_a^Q > \pi_b^Q$ whenever $q > 1/2$ and $Q > 1/2$, and both private-signal types are represented, forward-looking disclosure generates strict disagreement exactly when $\lambda > 1/2$.

For part (iii), in the backward-looking regime the observed action has accuracy $\bar{Q}$. After observing $k = A$, define

$$\rho := \Pr(\omega = \alpha \mid k = A) = \bar{Q},$$

$$\pi_a := \Pr(\omega = \alpha \mid s_a, k = A) = \frac{q\bar{Q}}{q\bar{Q} + (1-q)(1-\bar{Q})},$$

and

$$\pi_b := \Pr(\omega = \alpha \mid s_b, k = A) = \frac{(1-q)\bar{Q}}{(1-q)\bar{Q} + q(1-\bar{Q})}.$$

The later disclosure has precision Q. Applying Lemmas 1 and 2 to the upper and lower gaps around ρ, we get

$$\mathbb{E}[d_{B,2}(A, \hat{s}) \mid k = A] = (\pi_a - \rho)\tau(\pi_a, Q) + (\rho - \pi_b)\tau(\pi_b, Q),$$

where $\tau(\pi, Q) < 1$ for $Q > 1/2$. Therefore

$$\mathbb{E}[d_{B,2}(A, \hat{s}) \mid k = A] < (\pi_a - \rho) + (\rho - \pi_b) = \pi_a - \pi_b = d_{B,1}(A).$$

The case $k = B$ is symmetric.

For part (iv), after $\hat{s}_a$ the public valuation is

$$v_\lambda^{\text{pub}} = (1-\lambda) + (2\lambda-1)Q,$$

and the two informed valuations are

$$v_{a,\lambda} = (1-\lambda) + (2\lambda-1)\pi_a^Q, \qquad v_{b,\lambda} = (1-\lambda) + (2\lambda-1)\pi_b^Q.$$

Thus every valuation and the public mean are obtained from the deterministic benchmark by the same affine transformation. The side-wise zero-profit quotes inherit that transformation,

so

$$P^{\text{buy}}_{F,\lambda} = (1-\lambda) + (2\lambda-1)P^{\text{buy}}_{F,1}, \qquad P^{\text{sell}}_{F,\lambda} = (1-\lambda) + (2\lambda-1)P^{\text{sell}}_{F,1}.$$

Consequently,

$$S_F(\lambda) = P^{\text{buy}}_{F,\lambda} - P^{\text{sell}}_{F,\lambda} = (2\lambda-1)S_F(1).$$

For $\lambda > 1/2$, the informed trading gains are the corresponding deterministic gains multiplied by $2\lambda - 1 > 0$, so all informed investors strictly trade after the disclosure; before disclosure they hold by indifference. Forward-looking volume therefore rises from y to $n + y$. In the backward-looking regime, the initial public posterior is $\bar{Q}$. The zero-fixed-cost argument in Proposition 6 implies full informed participation at every posterior, and the same strict-concavity/Jensen argument gives

$$\mathbb{E}[S(p') \mid k] < S(\bar{Q}).$$

Backward-looking volume remains $n + y$. □

Proof of Proposition 8

Proof. Throughout, let $r := \Pr(\omega = \alpha) \in (0,1)$ denote the prior and

$$p_a := \Pr(\alpha \mid s_a), \qquad p_b := \Pr(\alpha \mid s_b).$$

Because $q_\alpha > q_\beta$ and the prior is interior, the monotone-likelihood-ratio property gives

$$p_a > r > p_b.$$

In this section's environment, the generic disclosure likelihoods take the values

$$Q^{\alpha}_{\hat{s}_a} = Q_\alpha, \qquad Q^{\beta}_{\hat{s}_a} = 1 - Q_\beta, \qquad Q^{\alpha}_{\hat{s}_b} = 1 - Q_\alpha, \qquad Q^{\beta}_{\hat{s}_b} = Q_\beta.$$

Lemma 1 uses only the generic likelihoods $Q^{\omega}_{\hat{s}}$ and therefore applies verbatim. For $\pi \in (0,1)$, define

$$T(\pi) := \sum_{\hat{s}} \frac{Q^{\alpha}_{\hat{s}} Q^{\beta}_{\hat{s}}}{D_\pi(\hat{s})} = \frac{Q_\alpha(1-Q_\beta)}{\pi Q_\alpha + (1-\pi)(1-Q_\beta)} + \frac{(1-Q_\alpha)Q_\beta}{\pi(1-Q_\alpha) + (1-\pi)Q_\beta}.$$

Two properties of T are used below. First, since $Q_\alpha > 1/2 > 1-Q_\beta$ and $Q_\beta > 1/2 > 1-Q_\alpha$, each denominator is a strict convex combination lying strictly below its larger endpoint:

$D_\pi(\hat{s}_a) < Q_\alpha$ and $D_\pi(\hat{s}_b) < Q_\beta$. Hence

$$T(\pi) > \frac{Q_\alpha(1-Q_\beta)}{Q_\alpha} + \frac{(1-Q_\alpha)Q_\beta}{Q_\beta} = 2 - Q_\alpha - Q_\beta > |Q_\alpha - Q_\beta|,$$

where the final inequality holds because $\max\{Q_\alpha, Q_\beta\} < 1$. Second, direct computation gives

$$1 - T(\pi) = \frac{\pi(1-\pi)\,(Q_\alpha + Q_\beta - 1)^2}{[\pi Q_\alpha + (1-\pi)(1-Q_\beta)]\,[\pi(1-Q_\alpha) + (1-\pi)Q_\beta]} > 0,$$

so $T(\pi) < 1$, because $Q_\alpha + Q_\beta > 1$.

Part (i). Before any public information arrives, the eventual action is correct with probability Q_α in state α and Q_β in state β. Hence an investor with private signal s values the firm at

$$v(s) = Q_\beta + (Q_\alpha - Q_\beta)\Pr(\alpha \mid s).$$

Taking the difference across the two signal types yields the stated expression. Since $p_a > p_b$, the pre-disclosure range is zero if and only if $Q_\alpha = Q_\beta$.

Post-disclosure disagreement. After $\hat{s}_a$, action A will be taken, so each investor's valuation equals her posterior probability of state α. After $\hat{s}_b$, action B will be taken, so each valuation equals her posterior probability of state β; the valuation ordering across types is reversed, but the cross-sectional range again equals the gap between the two types' posteriors on α. In both cases, therefore, Lemma 1 applied to the pair (p_a, p_b) gives

$$d_{F,2}(\hat{s}) = (p_a - p_b)\,\frac{Q^\alpha_{\hat{s}} Q^\beta_{\hat{s}}}{D_{p_a}(\hat{s})\,D_{p_b}(\hat{s})} \qquad \text{for each realization } \hat{s}.$$

This expression is used in parts (ii) and (iv).

Part (ii). Suppose $Q_\alpha \geq Q_\beta$ and take $\hat{s} = \hat{s}_a$, so that $Q^\alpha_{\hat{s}_a} Q^\beta_{\hat{s}_a} = Q_\alpha(1-Q_\beta)$. Since $D_{p_a}(\hat{s}_a) < Q_\alpha$ and $D_{p_b}(\hat{s}_a) < Q_\alpha$,

$$\frac{d_{F,2}(\hat{s}_a)}{p_a - p_b} > \frac{Q_\alpha(1-Q_\beta)}{Q_\alpha^2} = \frac{1-Q_\beta}{Q_\alpha} > Q_\alpha - Q_\beta,$$

where the last inequality follows from

$$1 - Q_\beta - Q_\alpha(Q_\alpha - Q_\beta) = (1-Q_\alpha)(1 + Q_\alpha - Q_\beta) > 0.$$

Using part (i), $d_{F,2}(\hat{s}_a) > (Q_\alpha - Q_\beta)(p_a - p_b) = d_{F,1}$.

If instead $Q_\beta \geq Q_\alpha$, take $\hat{s} = \hat{s}_b$, so that $Q^\alpha_{\hat{s}_b} Q^\beta_{\hat{s}_b} = (1-Q_\alpha)Q_\beta$. Since both denominators

are strictly smaller than Q_β,

$$\frac{d_{F,2}(\hat{s}_b)}{p_a - p_b} > \frac{1 - Q_\alpha}{Q_\beta} > Q_\beta - Q_\alpha,$$

where the last inequality follows from

$$1 - Q_\alpha - Q_\beta(Q_\beta - Q_\alpha) = (1 - Q_\beta)(1 + Q_\beta - Q_\alpha) > 0.$$

Hence $d_{F,2}(\hat{s}_b) > d_{F,1}$. In every case at least one of the two conditional statements applies, which proves the displayed maximum inequality.

Part (iii). At $Q_\alpha = Q_\beta = Q$, part (i) gives $d_{F,1} = 0$, whereas both post-disclosure disagreement measures are strictly positive. All posterior and valuation expressions are continuous in (Q_α, Q_β). Hence both strict inequalities continue to hold in an open neighborhood of (Q, Q).

Part (iv). At Round 1 of the forward-looking regime, no public information has arrived, so the disclosure's distribution is unconditional:

$$\Pr(\hat{s}) = rQ^\alpha_{\hat{s}} + (1 - r)Q^\beta_{\hat{s}} = D_r(\hat{s}).$$

For each $\hat{s}$, $D_\pi(\hat{s})$ is affine in π, and $p_b < r < p_a$. Therefore

$$D_r(\hat{s}) = \theta D_{p_a}(\hat{s}) + (1 - \theta)D_{p_b}(\hat{s}), \qquad \theta := \frac{r - p_b}{p_a - p_b} \in (0, 1),$$

with the same θ for both realizations. Dividing by $D_{p_a}(\hat{s})D_{p_b}(\hat{s})$,

$$\frac{D_r(\hat{s})}{D_{p_a}(\hat{s})D_{p_b}(\hat{s})} = \frac{\theta}{D_{p_b}(\hat{s})} + \frac{1 - \theta}{D_{p_a}(\hat{s})}.$$

Combining with the post-disclosure expression above and summing over $\hat{s}$,

$$\mathbb{E}\big[d_{F,2}(\hat{s})\big] = (p_a - p_b) \sum_{\hat{s}} D_r(\hat{s}) \, \frac{Q^\alpha_{\hat{s}} Q^\beta_{\hat{s}}}{D_{p_a}(\hat{s})D_{p_b}(\hat{s})} = (p_a - p_b)\big[\theta \, T(p_b) + (1 - \theta) \, T(p_a)\big].$$

Since $T(\pi) > |Q_\alpha - Q_\beta|$ for every $\pi \in (0, 1)$, the bracketed average exceeds $|Q_\alpha - Q_\beta|$, and part (i) yields

$$\mathbb{E}\big[d_{F,2}(\hat{s})\big] > |Q_\alpha - Q_\beta| \, (p_a - p_b) = d_{F,1}.$$

Part (v). Fix $k = A$; the case $k = B$ follows by the same argument. Write, for this part

only,

$$\pi_a := \Pr(\alpha \mid s_a, k = A), \qquad \rho := \Pr(\alpha \mid k = A), \qquad \pi_b := \Pr(\alpha \mid s_b, k = A).$$

The monotone-likelihood-ratio property implies $\pi_a > \rho > \pi_b$, and $d_{B,1}(A) = \pi_a - \pi_b$. By conditional independence of the action and the disclosure given the state, the disclosure's distribution given the Round-1 public information is

$$\Pr(\hat{s} \mid k = A) = \rho Q_{\hat{s}}^{\alpha} + (1 - \rho) Q_{\hat{s}}^{\beta} = D_{\rho}(\hat{s}).$$

Apply Lemma 1 to the pair (π_a, ρ) and take expectations with these weights; the factor $D_{\rho}(\hat{s})$ in the weights cancels the factor $D_{\rho}(\hat{s})$ in the denominator of Lemma 1:

$$\mathbb{E}\left[\pi_a^{\text{post}} - \rho^{\text{post}} \,\middle|\, k = A\right] = (\pi_a - \rho) \sum_{\hat{s}} \frac{Q_{\hat{s}}^{\alpha} Q_{\hat{s}}^{\beta}}{D_{\pi_a}(\hat{s})} = (\pi_a - \rho)\, T(\pi_a),$$

and, similarly,

$$\mathbb{E}\left[\rho^{\text{post}} - \pi_b^{\text{post}} \,\middle|\, k = A\right] = (\rho - \pi_b)\, T(\pi_b).$$

Because Lemma 1 preserves the ordering of posteriors, $d_{B,2}(A, \hat{s}) = \pi_a^{\text{post}}(\hat{s}) - \pi_b^{\text{post}}(\hat{s})$. Summing the two gaps and using $T(\cdot) < 1$,

$$\mathbb{E}\left[d_{B,2}(A, \hat{s}) \,\middle|\, k = A\right] = (\pi_a - \rho)T(\pi_a) + (\rho - \pi_b)T(\pi_b) < (\pi_a - \rho) + (\rho - \pi_b) = d_{B,1}(A).$$

□

Proof of Corollary 3

Proof. At $Q_{\alpha} = Q_{\beta} = Q$, informed investors agree about firm value before the disclosure. If they do not trade, both quotes equal the public-information value, and every informed investor's gross gain from submitting an order is zero.

After either forward-looking disclosure realization, the two private-signal types have different valuations. Under the candidate equilibrium in which the high-valuation type buys and the low-valuation type sells, positive noise trading implies that the ask lies strictly below the high valuation and the bid lies strictly above the low valuation. Thus every informed type has a strictly positive gross trading gain after either disclosure realization. Let $g > 0$ be the smallest of these post-disclosure gains at $Q_{\alpha} = Q_{\beta} = Q$.

All pre-disclosure valuations, post-disclosure valuations, and side-wise zero-profit quotes are continuous in (Q_{α}, Q_{β}). Therefore, when (Q_{α}, Q_{β}) is sufficiently close to (Q, Q), the

largest pre-disclosure gross gain is less than $g/3$, while the smallest post-disclosure gross gain remains greater than $2g/3$. Any

$$\varepsilon \in (g/3, 2g/3)$$

then makes holding strictly optimal for both informed types before the disclosure and trading strictly optimal for both types afterward. Expected volume rises from y to $n + y$, and the spread rises from zero to a positive level. □

Proof of Corollary 4

Proof. Fix an observed action and let $p \in (0, 1)$ be the market maker's public posterior on state α. Under asymmetric private-signal precision, the equilibrium adverse-selection spread is

$$S(p) = n(q_\alpha - q_\beta)p(1-p) \times \left[\frac{1}{n[pq_\alpha + (1-p)q_\beta] + y/2} + \frac{1}{n[p(1-q_\alpha) + (1-p)(1-q_\beta)] + y/2}\right].$$

The same expression applies after either observed action because the symmetric matching payoff only reverses which private-signal type buys and which sells.

Each informed type has a valuation strictly on one side of the public value. Because $y > 0$, each side-wise quote lies strictly between the relevant informed valuation and the public value. Thus all informed investors trade at every relevant public posterior, and volume remains $n + y$.

It remains to show expected spread compression. For positive a and $a + b$,

$$\frac{d^2}{dp^2}\left[\frac{p(1-p)}{a+bp}\right] = -\frac{2a(a+b)}{(a+bp)^3} < 0.$$

Applying this identity to each of the two terms in $S(p)$ shows that S is strictly concave on $(0, 1)$. The public posterior after the later disclosure is a nondegenerate martingale. Therefore, Jensen's inequality gives

$$\mathbb{E}[S(p') \mid k] < S(\mathbb{E}[p' \mid k]),$$

which is the pre-disclosure spread conditional on the observed action. □

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