A Theory of Financial Media

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Abstract

We present a model of financial media. In our model, firms strategically use the media to communicate corporate announcements to a group of traders, who do not observe announcements directly, but only through media reports. Journalists strategically select which announcements to report to their readers, and this inadvertently incentivizes firms to bias the underlying announcements. In equilibrium, media coverage is tilted towards (i) positive news and (ii) extreme news. The presence of financial journalists renders stock prices inflated but more informative, on average. We provide additional predictions regarding the media's impact on the quality of firm announcements and stock prices.

Keywords: financial journalism, disclosure, bias, price quality.

JEL Classifications: D82, G14, M40

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1 Introduction

Financial media plays an important economic role. A growing body of empirical research shows that financial journalists reach a broad swath of investors, affect trading in financial markets, and help form stock prices (Fang and Peress, 2009; Engelberg and Parsons, 2011; Tetlock, 2011; Peress, 2014; Kaniel and Parham, 2017). Theory, however, provides little insight into their economic role. Hence, our understanding of the equilibrium interactions between the financial media, investors, and firms is somewhat limited.

In this paper, we aim to take a first step in filling this gap by explicitly modeling a *financial journalist* whose strategic actions affect her readers, the actions taken by firms on which she reports, and the asset prices that result. We start with the basic premise that *some* investors (henceforth *readers*) are only exposed to firm announcements if those get reported and written up by financial journalists. Thousands of U.S. firms file 10-K statements with the SEC, free for the world to see, and yet few individual investors have the time to read each statement. For this reason, a financial journalist sifts through the many announcements made by firms and reports on those that she finds to be of greatest value to her readers.

In our model, there is a firm manager, a journalist, and a stock market populated by three kinds of investors. The first are *sophisticated* investors who observe the universe of all firm announcements. The second are *liquidity* traders who trade for reasons unrelated to information. The third are the *readers* of financial media who cannot observe firm announcements directly. They rely exclusively on the journalist for information, and—importantly—*take her at her word*.

The firm manager receives some information and prepares a public announcement. He influences the announcement through *bias*, understanding that this decision affects the impact of the announcement on the stock price as well as the journalist's reporting decision. If the journalist decides to report on the announcement, the readers observe the report and trade on its somewhat biased information. The existing empirical literature has highlighted several channels through which firms can sugarcoat their announcements and mislead investors about firm fundamentals. For instance, Huang et al. (2014) emphasize the tone of words in earnings press releases, while Li (2008) or Bushee et al. (2018) highlight the role of complex language.[1]

[1]The importance of strategic bias has led to a debate about different ways to measure bias. For example, Li (2008) uses the Fog Index to measure the information content of various firm disclosures, while Loughran and McDonald (2014) construct a Readability Index to measure the extent to which a firm disclosure is

The financial journalist plays two roles in our framework. First, she considers each firm announcement and focuses on announcements that yield the greatest informational benefit to her readers. This means that more informative announcements are more likely to get reported. Second, if she chooses to report on a firm, she tries to *clarify* the announcement as thoroughly as possible to minimize her readers' exposure to biased announcements. For example, she can fact-check a dubious statement or she can re-word a sensational passage. Therefore, our financial journalist detects some of the distortions in firm announcements and provides a clearer picture to readers in her news report.

The journalist's optimal decision balances the positive impact from reporting an announcement that has significant informational content against the negative impact from reporting an announcement that is heavily biased. Importantly, this strategic reporting decision influences the firm manager's endogenous decision to bias. The manager chooses the level of bias in the announcement by balancing the positive impact of bias on the stock price, if the announcement gets covered, against its negative impact on the journalist's decision to cover the story. We embed this strategic interaction between the firm manager and the journalist in a standard trading model and solve for the unique reporting and bias equilibrium. This equilibrium generates several key results, some of which confirm existing empirical findings while others give rise to novel empirical predictions.

First, the model generates an equilibrium probability with which the journalist reports news. We find that financial announcements that provide more extreme information, either positive or negative, are more likely to be reported relative to more mundane announcements. Hence, we argue that journalists are more likely to report extreme news, not because they have an incentive to sensationalize, but because mundane news is too costly to clarify relative to the value of reporting it.

Second, negative information is less likely to be reported than positive information. In particular, we find that all good news gets reported with a positive probability, slightly negative news never gets reported, and extremely negative news gets reported with a positive probability which is low. These results stem directly from the strategic actions of the journalist and the firm manager, and occur despite the fact that the arrival of good and bad news is equally likely. Thus, our model predicts that across all firm announcements at a given date those that are more negative would have a lower probability of being reported on because they are expected to contain a higher level of bias and hence be less useful to

informative. These papers demonstrate that firms use language to hide or highlight financial information in their disclosed statements.

readers. While there is evidence in Tetlock (2007) and Garcia (2013) that negative media reports predict stock market returns, our model predictions are specific to *firm-level* news and these, to the best of our knowledge, have not yet been tested.[2]

The third result of our model is that the presence of a journalist induces firms to bias their announcements. This means that a report by the journalist and a bias in the stock price will appear jointly. Intuitively, because the readers of the newspaper trade only based on the information provided by the journalist, the journalist's report encourages them to trade based on a reported announcement that is partially inflated. Hence, these trades result in a stock price that is partially biased and too high, on average. It is important to note that prices become biased when a journalist writes a report, even though the journalist tries to eliminate the manager's bias and chooses not to report announcements which contain too little information because they are too heavily biased.[3]

Fourth, we find that stock price efficiency improves when the journalist reports. This is because the benefit to the readers from the information provided in the report outweighs the cost to them from the bias in that report. The journalist only writes a report if it benefits her readers. This means that the journalist considers the actual content of the firm's announcement as well as the extent to which the firm tries to bias it. The more the firm biases the announcement, the lower is the ability of the journalist to write an article that is useful to her readers.

Fifth, we show that firms have a higher incentive to bias negative (i.e. below-average) news and, perhaps more surprisingly, that they bias more when faced with a highly-skilled journalist. The first result comes from the fact that biasing the announcement reduces the chance that the journalist will write about it in the newspaper. Since the firm wants good news to be reported and bad news not to be reported, it biases more heavily the announcements of negative news. The second result comes from the fact that a higher skilled journalist is generally more likely to write a report and clarify it.

Finally, in Section 4, we describe many detailed empirical predictions about the time series and the cross section of stock returns as they relate to the presence of journalists. For

[2]In a recent working paper, Niessner and So (2018) show that the financial media is more likely to cover firms who subsequently report negative earnings announcements. This finding is in-line with our model's claim that the media strategically selects what to report on. This tilt is consistent with our model, if negative earnings surprises are more newsworthy than positive earnings surprises.

[3]The model considers a journalist who can lower the level of bias of a reported announcement. This does not mean that the journalist investigates the firm's financial statements and conducts an in-depth analysis, but rather that she is able to highlight the economically important aspects of the firm announcement to her readers.

example, our model suggests that following a journalist report, prices should go up in the short term reflecting a slightly biased price, but then revert back to the true unbiased value. This is consistent to the findings in Tetlock (2011) and others. We provide an economic explanation for this finding and generate more granular implications. As another example, our paper relates to the work of Huberman and Regev (2001) and Tetlock (2011) who show that investors respond to stale news that is reported by the media. While their empirical work implicitly takes the reporting as a given and then argues that investors are irrational, our model offers an alternative interpretation. In particular, our model suggests that a journalist optimally decides to report "stale" news because she believes that her readers have not incorporated this (public) information into their past trading.

In sum, our paper helps to answer questions such as what kind of news should be reported by the financial media? How does the media's presence alter the firm's incentive to release accurate information? Are individual investors better off with media reporting? And what are the implications for stock prices when journalists are present?

The model makes several important assumptions. First, we consider a journalist who makes a reporting decision based on the impact on her readers' ability to trade. This is a benchmark under which the journalist's ability to attract readers depends on whether or not they will view her information as useful in the long term. In the context of financial news this would mean that the information she provides helps readers make better financial decisions which we model as better trading outcomes. Therefore, we follow the existing theoretical literature like Gentzkow and Shapiro (2006) and assume that journalists are primarily concerned about their reputation as providers of accurate and useful information. Importantly, we show that the usefulness of *financial* news differs fundamentally from that of *political* news because readers are able to trade on it.[4]

In a robustness section we consider two alternative objective functions for the journalist. In one extension we allow for an objective which puts some weight on the information content of her report and some weight on its accuracy. Our main findings remain robust to this alternative specification, which captures a more general reputation-based model. The one result that changes is that the presence of the journalist can decrease price efficiency if the journalist's weight on the bias is too small relative to that on information. The second extension allows for a journalist who views readers to be loss averse.[5] We find that in this

[4]We abstract from quid-pro-quo incentives but we do acknowledge that there is some empirical evidence that journalists sometimes pander to the firms on which they report (Dyck and Zingales, 2003; Call et al., 2018; Baloria and Heese, 2018). However, we think that the incentive to report news that is useful to her readers is of first-order importance for the journalist.

[5]There is a large literature which argues that readers suffer from loss aversion and that this explains why

setting the bias to publish good news only survives as long as the loss aversion of readers is small. However, when loss aversion is high then the probability of reporting bad news becomes larger than that of good news. Thus, our model demonstrates that the tendency in financial news to publish more good news than bad is an endogenous phenomenon that can only be overturned with a relatively high loss aversion on the part of readers.

Second, our baseline assumption is that readers are both uninformed and unable to de-bias the firm's report. Hence, the journalist's main role is to *disseminate* and *clarify* existing information. She highlights to her readers a small subset of available information that is of higher importance. Thus, our focus is on the day-to-day reporting that happens in financial newspapers such as the *Wall Street Journal*, rather than on investigative reporting which happens less frequently but usually receives more public attention.[6] In an extension, we allow readers to sometimes observe the firm announcement directly. Since readers are naive, they cannot de-bias the announcement and the bias enters the stock price even if the journalist does not report. We show that the reporting probability increases in the firm's bias if and only if readers are sufficiently likely to observe the firm's signal directly. If not, the journalist's threat not to report still serves as an implicit biasing cost to the firm and our main conclusions continue to hold.

Third, our model also allows for the journalist to clarify firm announcements by attempting to remove as much bias as possible. As discussed earlier, there is a growing body of empirical work suggesting that firms are strategic in writing firm announcements (see e.g., Huang et al., 2014; Bushee et al., 2018). The role of the financial journalist is to detect these distortions and to provide a clearer picture to her readers. However, an alternative formulation of our model is that the journalist simply disseminates information to her readers by pointing them to specific firm announcements (e.g. SEC filings) and lets her readers figure out the informational content of these announcements. This alternative interpretation of our model does not change any of our main results. More formally, in an extension of the model we consider a journalist who is able, at a cost, to write a report which completely eliminates the bias in the firm's announcement. The main finding in this extension is that the firm will now endogenously limit its reported bias in anticipation of the journalist's action. This means that the firm will bias its announcement to a maximum

general media reports focus on bad news ("if it bleeds it leads"). For example, Garz (2014) shows this in the reporting of unemployment news and Soroka et al. (2019) demonstrate that this phenomenon is true across many countries.

[6]There is some empirical evidence suggesting that retail investors buy stocks that are covered in the media (e.g., Barber and Odean, 2008) as well as that stock prices respond to the media's reporting of stale news (e.g., Tetlock, 2011; Drake et al., 2014). Both are consistent with the media's role as a pass-through.

level that discourages the journalist from paying the private cost to undo the bias. Hence, this extension demonstrates more clearly our finding that the expected presence of the journalists provides a benefit to stock prices and to readers, but does not eliminate the incentive of the firm to bias reports.

Our next assumption relates to our definition of *readers*. We think of these readers as partially informed investors similar to strategic retail investors. The literature has termed these traders "credulous" or "blind" in economic contexts like Kartik et al. (2007), Chen (2011), Bolton et al. (2012), and Little (2017). We assume that they take the journalist's report at "face value" for trading purposes. Trading based on the journalist's news article is profitable but is not as profitable as the trades of sophisticated investors (e.g. institutional investors, hedge fund managers, etc.). In particular, we posit a hierarchy in which sophisticated traders have the most information, the readers of the newspaper have some information—the quality of which depends on the article written by the journalist—and liquidity traders trade for reasons unrelated to information. In our setting we find that these readers are better off with a journalists than without, despite the fact that the introduction of a journalist causes firms to increase the degree of bias in their announcements.

Finally, as a benchmark we assume that there is no explicit cost for the firm to bias and that the journalist's reporting cost is symmetric for bad news and good news. Thus, any bias in reporting is purely endogenous. One can think of other formulations in which, for example, biasing negative news is more costly to the firm due to legal considerations, or that not reporting bad news is more costly to the journalist. Although we do not provide a formal analysis of this alternative specification, we do consider it as plausible. Yet we believe that a benchmark model in which all news is equally likely to be reported on is a more reasonable starting point.

Our paper takes a first step towards a more complete understanding of the role of *financial* news. The theoretical work of Mullainathan and Shleifer (2005) explores the incentive of the media to bias news more generally in order to cater to the beliefs of its readers. Gentzkow and Shapiro (2006) focus on the media's political bias. In both of these papers, the journalist chooses to engage in biased reporting optimally. In our equilibrium we also find the existence of a media bias, but in contrast to these papers, we argue that bias in financial reporting occurs *despite* the efforts of the journalist to eliminate it. Furthermore, our model generates two distinct types of media bias.

First, the journalist is more likely to report positive news than negative news (an ex post bias). Second, the firm biases its announcements to make them rosier than the truth (an ex ante bias). Given the unique features of reporting on financial news, our paper also highlights a novel interaction between the journalist's reporting decision and the firm manager's incentive to bias information, which is absent in the work above. Therefore, the specific financial market environment creates novel endogenous forces with non-trivial implications for the media's reporting incentives.

More broadly, our paper contributes to the theoretical literature studying the role of *public information* on stock market trading, price formation, and quality. Building on early contributions like Diamond (1985), Admati and Pfleiderer (1986) or Fishman and Hagerty (1989), several recent papers study the impact of corporate disclosure in a market with sophisticated investors and liquidity traders.[7] For instance, Gao and Liang (2013), Han et al. (2016), and Goldstein and Yang (2019) study the impact of corporate disclosure on private information acquisition and real efficiency. These papers emphasize the delicate interaction between public information provision and private information acquisition. Moreover, Kurlat and Veldkamp (2015) analyze an alternative cost of public information and show that it can lead to a reduction in trading opportunities. In our framework public information is also endogenous. However, unlike the aforementioned papers, we consider a setting where information must be disclosed and could be biased by the firm manager in order to inflate the firm's stock price (see e.g., Goldman and Slezak, 2006; Gao and Zhang, 2018). Further, the strategic choice of whether to "disclose" the information is made by the journalist and this adds an endogenous cost to the manager's bias.

Our paper also relates to models of financial analysts who can be viewed as another type of information intermediary (e.g. Langberg and Sivaramakrishnan, 2010; Einhorn, 2018; Frenkel et al., 2020). In contrast to these papers, our key modeling assumption is that it is the journalist, not the firm, who decides on what corporate announcements should be made public. This results in a very different set of predictions which better match the economic role of an information intermediary who disseminates existing information (the journalist), rather than create new information (the analyst).[8]

The remainder of the paper is organized as follows: Section 2 presents the model setup; Section 3 describes the main results; Section 4 discusses the empirical predictions of the model; Section 5 presents model extensions and Section 6 concludes.

[7]See Goldstein and Yang (2017) for a recent survey of this literature.

[8]It is worth noting the existence of a recent literature studying the role of credit rating agencies (*CRA*s) which is yet another form of an information intermediary. However, papers in this literature, such as Bolton et al. (2012), Fulghieri et al. (2013), Cohn et al. (2013), Frenkel (2015), and Piccolo and Shapiro (2018) focus on the attempt of the *CRA* to manage its reputation as an information provider with its ability to maintain a positive interaction with the firm it is rating.

2 Model

There is a strategic firm manager ("he"), a strategic journalist ("she"), and three types of competitive traders. Figure 1 highlights the journalist and readers, the two novel ingredients in our model. It also highlights the two roles of the journalist: (i) decide whether or not to report an announcement and (ii) clarify (or de-bias) the announcement (should she decide to report it).

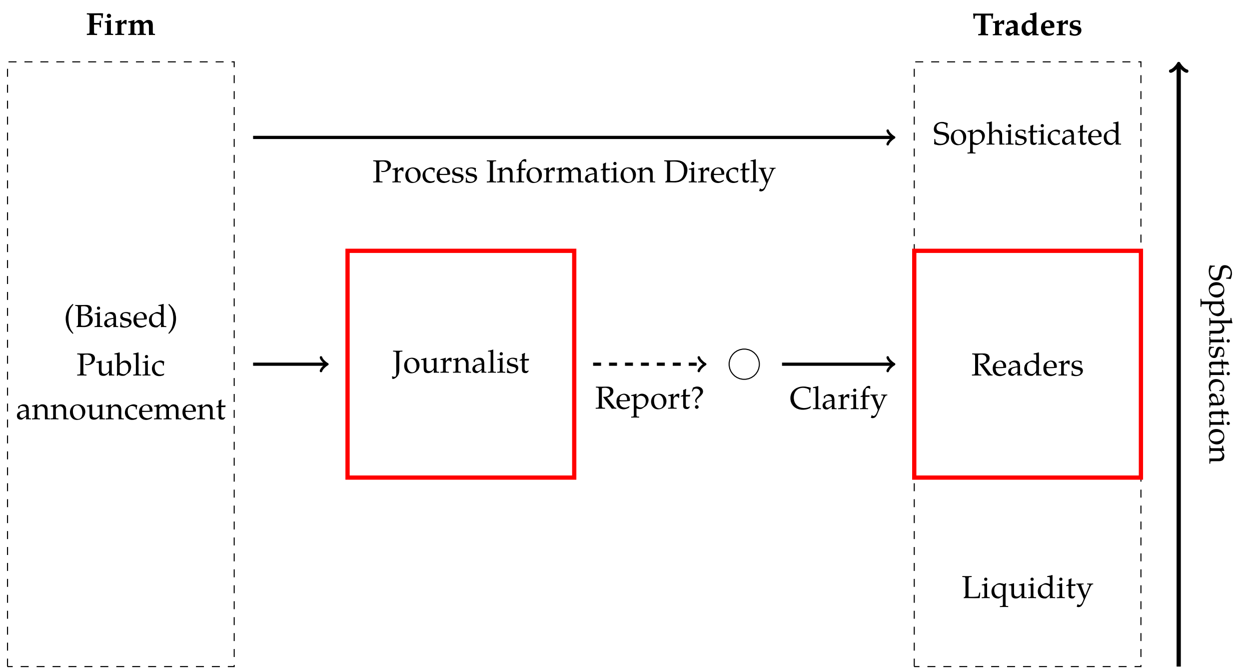

Figure 1: Three Types of Traders. We distinguish sophisticated from less sophisticated traders ("readers") by their ability to process the firm's public announcement.

2.1 Model setup

There are four dates $t \in \{0, 1, 2, 3\}$ and two assets, one risk-free and the other risky. The risk-free asset serves as the numeraire and is in unlimited supply. The risky asset is in zero net supply and pays a uniformly-distributed liquidating dividend $d \sim U[0, \overline{d}]$ with $\overline{d} \in (0, \infty)$ at $t = 3$.[9] We will often refer to the mean of the payoff as $\mu_d \equiv \frac{\overline{d}}{2}$, to its variance as $\sigma_d^2 \equiv \frac{\overline{d}^2}{12}$, and to the de-meaned payoff as $\delta \equiv d - \mu_d \sim U[-\mu_d, \mu_d]$. Claims to d

[9]We rely on this specific distribution to obtain tractable, closed-form solutions. We expect our results to be robust to a wide range of bounded distributions.

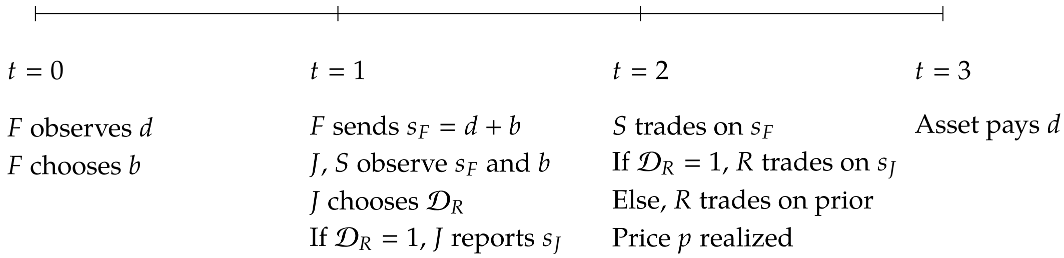

Figure 2: Timeline for the main model.

are traded at the equilibrium price p at $t = 2$. The model features three types of traders: (i) a unit mass of sophisticated traders ("S"), (ii) a mass $\chi > 0$ of less sophisticated readers ("R"), and (iii) a unit mass of liquidity traders ("L"). All traders are risk-neutral and trade competitively. In addition to these three types of traders, there is also a firm manager ("F") and a journalist ("J"). Figure 1 summarizes the key model elements and Figure 2 provides a timeline for the main model.

Bias

At $t = 0$, the firm's manager observes a perfect signal about the future payoff d and issues a potentially biased public signal given as:[10]

$$s_F = d + b. \tag{1}$$

The public signal is therefore correlated with the firm's future payoff and can be interpreted as a public announcement such as an earnings report or a press release. Importantly, the manager is also able to bias the signal about d through his choice $b \in [0, \overline{b}]$ with $\overline{b} \in (0, \infty)$, which inflates the signal about the firm's future payoff.[11] We interpret the manager's bias quite generally as any activity he can use to hide bad information or to emphasize good information. In the context of our model, we associate bias with overly positive signals.[12] As mentioned in the introduction, the existing empirical literature has,

[10] All of our results are robust to the alternative assumption that the firm manager only receives a noisy signal about d or that the payoff contains an additional, unpredictable component. Moreover, given that the manager always receives a signal about d, he does not have an incentive to withhold negative news due to the well-known unraveling result (see e.g., Grossman, 1981; Milgrom, 1981).

[11] In our model, the firm manager does not have an incentive to deflate the public signal. Thus, the assumption that b is non-negative is not binding.

[12] We could alternatively model the firm's bias through its impact on the *precision* of the announcement. In this case, the firm could add noise to an unfavorable signal in order to lower the market's perception of d.

for instance, highlighted the use of tone management and complex language in corporate announcements rather than of outright manipulation.

The upper limit on the firm's bias ($\bar{b}$) can be interpreted as the highest degree of bias the firm can choose without violating the law or appearing not credible. We do not interpret the firm manager's bias as *illegal* manipulation or fraud but rather as a tool to mislead some traders in the market. To highlight the underlying mechanism as cleanly as possible, we do not add an explicit cost to bias.[13]

We follow the existing information manipulation literature such as Goldman and Slezak (2006) or Gao and Zhang (2018) and assume that the manager chooses b to maximize the firm's expected stock price, $\mathbb{E}[p|\mathcal{I}_F]$.[14] The manager's information set includes the firm's future payoff and the degree of bias, $\mathcal{I}_F = \{d, b\}$.

Reporting decision

The journalist observes the firm's signal s_F and the manager's choice of b at $t = 1$. It follows that she can retrieve the firm's future payoff from $s_F - b = d$. Based on this information set the journalist has to decide whether to report on the firm ($\mathcal{D}_R = 1$) or not ($\mathcal{D}_R = 0$). If the journalist decides to report, she issues a public signal s_J that partially offsets the firm's bias. Otherwise, she does not issue a report:

$$s_J = \begin{cases} s_F - \alpha b = d + \beta & \text{if } \mathcal{D}_R = 1 \\ \emptyset & \text{if } \mathcal{D}_R = 0 \end{cases} \tag{2}$$

with $\alpha \in [0, 1)$ and $\beta \equiv (1 - \alpha)b$. The journalist's report is observed by all agents, but as we will show below, only readers rely on s_J in their trading decision. The constant α captures the journalist's skill or attention that is necessary to de-bias the firm's signal for the public. In the limit $\alpha \to 1$, the firm's biased signal is fully clarified, i.e. $\beta = 0$, and the readers become perfectly informed about the future payoff. The lower α the higher the *residual bias* β in s_J.

To keep the model tractable, we take the journalist's skill, α, as given in the main model and defer the analysis of an extension with endogenous skill acquisition to Section 5.3. The assumption that the journalist cannot de-bias the firm's signal perfectly captures several

We view our approach as a more implicit, but also more tractable, approach which is qualitatively identical.

[13] All of our main results are robust to the introduction of a quadratic bias cost, $\frac{c_b}{2}b^2$.

[14] The manager's desire to maximize the future stock price can reflect concerns for managerial reputation as in Narayanan (1985) and Scharfstein and Stein (1990) or managerial myopia as in Stein (1989).

realistic frictions such as imperfect knowledge of the firm's bias, quid-pro-quo incentives, or time constraints that prevent the journalist from achieving a perfectly accurate report. In line with the empirical evidence in Gurun and Butler (2012) and Ahern and Sosyura (2014), the firm is able to affect the "tone" of its news coverage through b which is part of the residual bias $\beta = (1 - \alpha)b$ in the journalist's report.

It should be noted that in contrast to some of the existing literature, such as Mullainathan and Shleifer (2005) or Gentzkow and Shapiro (2006), the journalist does not have an incentive to "sensationalize" the firm's report, i.e. to add a "media bias" to the firm's signal. We rather view the journalist as a benevolent transmitter of information who tries to report as accurately as possible on the firm. In Section 5.1, we study alternative media objectives and show that our main results are robust to a wide range of realistic assumptions.

Furthermore, the journalist and sophisticated traders observe the firm's actual bias b which precludes the usual "signal-jamming" effect (see e.g., Stein, 1989). We deliberately deviate from this literature in which b is perfectly backed out from the biased signal in equilibrium. Our goal is to emphasize the journalist's imperfect ability to fully de-bias the firm's signal for her readers. Thus, the journalist is not able to communicate a fully-clarified signal to her readers even though she understands the degree of bias in the firm's signal (s_F). This friction leads to the residual noise β in the journalist's report (s_J). We interpret s_F as a multi-dimensional signal containing informative pieces, captured by d, and biased pieces, captured by b. The journalist is aware of the size of both components but finds it difficult to communicate "the truth" to her readers. Alternatively, one can interpret β as the *readers'* residual bias: the journalist decomposes s_F into d and b or highlights a firm announcement to her readers who are unable to remove all biased pieces from s_F.

The journalist's audience is represented by the second group of traders labeled "readers." The measure of this group (χ) can be interpreted as a proxy for the journalist's readership. The other two types of traders do not rely on the journalist's report. Sophisticated traders are endowed with superior information about the firm's payoff, based on s_F, and cannot learn any additional information from the journalist's signal. Liquidity traders trade for exogenous reasons that are assumed to be independent of the firm's payoff and the journalist's signal.

Assumption 1 (Journalist's objective) *The journalist's reporting decision is made to maximize the readers' expected utility net of a private reporting cost $c \sim U[0, \bar{c}]$ with $\bar{c} \in (0, \infty)$.*

Two factors determine the journalist's decision to report. The first factor is the anticipated utility gain for her readers and the second is her opportunity cost. We capture the first factor by the increase in the expected utility of readers through the journalist's reporting:

$$\Delta_R \equiv \mathbb{E}[U_R|\mathcal{D}_R = 1, \mathcal{I}_J] - \mathbb{E}[U_R|\mathcal{D}_R = 0, \mathcal{I}_J] \tag{3}$$

with $\mathcal{I}_J = \{s_F, b, s_J\}$. Note that the journalist's information set is strictly finer than that of the readers, which only contains s_J. The increase in expected utility in equation (3) can be interpreted as the average long-run gain in trading profits that a reader obtains by reading the journalist's report. We compute this utility gain based on the journalist's information set, which captures the idea of a long-run reputation game, similar to Mullainathan and Shleifer (2005) or Gentzkow and Shapiro (2006).

The second factor that influences the journalist's reporting decision is an independent stochastic opportunity cost $c \sim U[0, \bar{c}]$ with $\bar{c} \in (0, \infty)$. This cost can be interpreted as the journalist's utility from reporting on a different topic, such as another firm, and $\bar{c}$ governs the average appeal of these alternative stories.[15] The introduction of an opportunity cost allows us to capture the fact that not all corporate announcements can be reported on the front page. If a certain announcement lacks credibility or simply confirms a widely held view, it should be in the best interest of the reader to shift the focus to a different story.[16]

It follows that the journalist's reporting strategy can be summarized as follows:

$$\mathcal{D}_R = \begin{cases} 1 & \text{if } \Delta_R > c \\ 0 & \text{if } \Delta_R \leq c. \end{cases} \tag{4}$$

The journalist compares the increase in the expected utility of readers with her opportunity cost.[17]

[15] A straightforward way to endogenize c would be to consider a multi-firm setup. A capacity constraint on the journalist would then force her to report on the firm that creates the greater benefit for her readers.

[16] In line with this intuition, Fang and Peress (2009) document that even among NYSE stocks over 25% are not covered (by four major newspapers) in a typical year.

[17] As mentioned earlier, we could model the journalist's cost c as a function of the underlying news d. In order to avoid any "baked-in" asymmetries, we keep the distribution of c constant. Section 5.1 discusses an alternative setting, in which the journalist has a greater incentive to report negative news.

Trading decision

At $t = 2$, sophisticated traders and readers submit asset demand schedules conditional on the stock price to maximize their expected trading profits $x(d - p)$. To keep their demands finite we also introduce a quadratic trading cost $\frac{\kappa}{2}x^2$ with $\kappa > 0$ as in Pouget et al. (2017) and Banerjee et al. (2018).[18] Putting these two pieces together, we can write the utility function for sophisticated traders and readers as:

$$U_i = x_i(d - p) - \frac{\kappa}{2}x_i^2 \tag{5}$$

with $i \in \{S, R\}$. It follows that the optimal demand for these two types is

$$x_i = \frac{1}{\kappa}(\mathbb{E}[d|\mathcal{I}_i] - p) \tag{6}$$

where $\mathcal{I}_i$ denotes the information set of type $i \in \{S, R\}$. Sophisticated traders observe the firm's signal, its bias, and the journalist's report: $\mathcal{I}_S = \{s_F, b, s_J\}$. Readers have to rely solely on the journalist's report: $\mathcal{I}_R = \{s_J\}$.[19]

Sophisticated traders are perfectly informed in our model. They observe the firm's signal s_F and the degree of bias b. They are able to retrieve the realization of the firm's payoff d from the signal. It follows from equation (6) that their optimal demand is given by:

$$x_S = \frac{1}{\kappa}(d - p). \tag{7}$$

Each sophisticated trader observes the mispricing of the firm's stock $(d - p)$ and trades against it. The convex trading cost prevents these traders from taking extremely large positions and generates a limit to arbitrage. This effect is represented by the constant factor $\frac{1}{\kappa}$ in the sophisticated traders' optimal demand. The lower the trading cost, the higher the traders' aggressiveness to exploit mispricing.

Assumption 2 (Readers' observed signals) *Readers do not observe the firm's signal directly. They only observe the journalist's report and cannot remove any residual bias from it.*

[18]We could alternatively use a mean-variance objective function for these two types of traders at the cost of less tractable equilibrium expressions. Our qualitative results are robust to this alternative objective.

[19]It should also be noted that both types can condition their demands on the equilibrium stock price but do not infer any information from it. Since readers act as if they received a perfect signal about the payoff, they do not have an incentive to learn information from the stock price. Sophisticated traders observe d and do not have to learn additional information about the payoff.

Readers differ from sophisticated traders in two ways.[20] First, they do not observe the firm's announcement (signal) and depend on the journalist to write a report in order to receive additional information about d. Their expectation of d is conditional on $s_J = d + \beta$ if the journalist reports ($\mathcal{D}_R = 1$) or just conditional on prior information if she does not report ($\mathcal{D}_R = 0$). In other words, the journalist acts as an information intermediary and transmits information from the firm to a group of non-sophisticated traders.

In actual markets, these types of traders might be overwhelmed by the amount of information provided by firms and they rely on a journalist to determine the relevance and substance of these signals. Empirically, there is ample evidence that corporate announcements require media coverage to reach parts of the market and that media reporting *per se* matters for traders, see e.g. Huberman and Regev (2001), Engelberg and Parsons (2011), and Tetlock (2011).

The second difference between readers and sophisticated traders is that readers are not able to further de-bias the journalist's signal. They believe that this signal is accurate – $b = 0$ or $\alpha = 1$, such that $\beta = 0$ – and treat s_J as a perfect signal of d. Our modeling of readers as credulous or trusting traders follows the existing theoretical literature such as Chen (2011) and Bolton et al. (2012) and seems to be particularly suitable in the context of financial news. For instance, Ahern and Sosyura (2014) provide empirical evidence that some investors do not fully account for "sensationalism" in financial media and are thus systematically fooled by an upward bias, just as in our setting. Readers can therefore be interpreted as a hybrid of informed traders, who trade based on informative signals, and noise or liquidity traders, who trade based on non-fundamental information. Using equation (6), we can write their equilibrium demand as

$$x_R = \begin{cases} \frac{1}{\kappa}(s_J - p) & \text{if } \mathcal{D}_R = 1 \\ \frac{1}{\kappa}(\mu_d - p) & \text{if } \mathcal{D}_R = 0. \end{cases} \tag{8}$$

If the journalist reports, their conditional expectation of d is equal to s_J. Readers treat the journalist's report as an unbiased signal of the firm's future payoff and set their conditional expectation of d equal to s_J. This means that the reliance on s_J exposes the

[20]For simplicity, we focus on a single trading round. However, one could also imagine that readers receive the reported signal with a lag relative to sophisticated traders. All of our main results are robust to this alternative setting, as long as the stock price does not fully incorporate the firm's fundamental when the journalist decides whether to cover the firm. See Foucault et al. (2016) or Dugast and Foucault (2018) for alternative theoretical settings.

readers to new information as well as to β and hence creates the incentive for the firm to bias their public signal. If the journalist does not report, then readers rely on prior information and the expectation of d is equal to the prior mean μ_d.[21]

In addition to sophisticated traders and readers, there is also a unit continuum of liquidity traders with exogenous net demand u. We assume that u is drawn from a zero-mean, continuous distribution with finite variance σ_u^2. Furthermore, u is orthogonal to all other random variables in the model. Liquidity traders trade for non-fundamental reasons and add additional noise to the equilibrium stock price. Even though no trader has an incentive to learn from the stock price, liquidity traders play an important role in our model because they allow the more sophisticated traders to make positive trading profits in equilibrium.

The market clearing condition sets the asset demands of the three types equal to the fixed zero supply:[22]

$$x_S + \chi x_R + u = 0. \tag{9}$$

Our equilibrium concept is that of sub-game perfection.[23]

Definition 1 *An equilibrium consists of (i) a trading policy by sophisticated traders and readers, (ii) a reporting policy by the journalist, and (iii) a bias policy by the firm manager such that:*

1. *The sophisticated traders' demand x_S maximizes $\mathbb{E}[U_S|\mathcal{I}_S]$;*
2. *The readers' demand x_R maximizes $\mathbb{E}[U_R|\mathcal{I}_R]$ and they believe $\beta = 0$;*
3. *The journalist's reporting policy $\mathcal{D}_R \in \{0, 1\}$ maximizes $\mathcal{D}_R\Delta_R + (1 - \mathcal{D}_R)c$;*
4. *The manager's bias policy $b \in [0, \bar{b}]$ maximizes $\mathbb{E}[p|\mathcal{I}_F]$; if indifferent he always chooses the smallest b.*

[21]It is straightforward to allow for a distorted prior expectation $\widehat{\mu}_d \neq \mu_d$ for readers such that this group would be overly optimistic or pessimistic without the journalist's report.

[22]The assumption that the asset is in zero net supply is without loss of generality in our setting due to the traders' risk neutrality.

[23]Technically, information is incomplete because the journalist has private information about her opportunity cost, and therefore our equilibrium concept should be that of sub-game perfect Bayesian Nash-equilibrium. However, neither the sophisticated traders' nor the readers' demands for the risky asset depend on the journalist's opportunity cost, so we can, without loss of generality, consider the game one of complete information and take sub-game perfection as our equilibrium concept.

2.2 Financial market equilibrium

As a first step, we solve for the financial market equilibrium at $t = 2$ and take the journalist's reporting decision ($t = 1$) and the manager's bias decision ($t = 0$) as given. We solve for these two equilibrium choices afterwards in Section 3.

We plug in the optimal demands for sophisticated traders and readers into the market clearing condition to solve for the equilibrium stock price p as a function of the journalist's reporting decision $\mathcal{D}_R$:

$$p = \begin{cases} d + \frac{\chi}{1+\chi}\beta + \frac{\kappa}{1+\chi}u & \text{if } \mathcal{D}_R = 1 \\ d - \frac{\chi}{1+\chi}\delta + \frac{\kappa}{1+\chi}u & \text{if } \mathcal{D}_R = 0. \end{cases} \tag{10}$$

In addition to the journalist's reporting decision $\mathcal{D}_R$, the equilibrium stock price also depends on the firm's residual bias β. If the journalist does not cover the firm, the stock price cannot depend on the firm's bias because sophisticated traders can de-bias the firm's signal perfectly, readers solely rely on their prior information about d, and liquidity demand is not affected by the public signal. In this case, the stock price reflects information about the payoff d with noise u and the signal-noise ratio in p is inversely proportional to the trading cost parameter κ. Furthermore, the price is an unbiased predictor of the future payoff as

$$\mathbb{E}[p|\mathcal{D}_R = 0] = \mathbb{E}[d] = \mu_d. \tag{11}$$

If the journalist reports, her readers base their equilibrium demand on $s_J = d + \beta$. As a result, the residual bias in the journalist's signal affects the equilibrium stock price. This bias is multiplied by a factor $\frac{\chi}{1+\chi}$ that increases in the mass of readers (χ). At the same time, the journalist's report also provides readers with an informative signal about d, which is reflected in the fact that the term $-\frac{\chi}{1+\chi}\delta$ disappears if $\mathcal{D}_R = 1$. As a result, the readers' reliance on the journalist's signal leads to an upward bias in the stock price

$$\mathbb{E}[p|\mathcal{D}_R = 1] = \mu_d + \frac{\chi}{1+\chi}\beta \geq \mu_d = \mathbb{E}[p|\mathcal{D}_R = 0]. \tag{12}$$

Next, we compute the expected utility for sophisticated traders and readers at $t = 1$. We take an expectation of U_i conditional on all public signals at $t = 1$: the firm's bias (b), the journalist's reporting decision ($\mathcal{D}_R$), and the firm's payoff (d):

$$\mathbb{E}_1[U_i] = \mathbb{E}_1\left[x_i(d-p) - \frac{\kappa}{2}x_i^2\right] \tag{13}$$

with $i \in \{R, S\}$. Then, we substitute the optimal demands derived in (7) and (8) into the equilibrium price in (10).

Lemma 1 (Expected utilities) *Conditional on $t = 1$ information, the expected utilities for readers and sophisticated traders are given by:*

$$\mathbb{E}\left[U_R|\mathcal{I}_J\right] = \frac{\kappa\sigma_u^2}{2(1+\chi)^2} - K_0\left(\mathcal{D}_R\beta^2 + (1-\mathcal{D}_R)\delta^2\right) \tag{14}$$

and

$$\mathbb{E}\left[U_S|\mathcal{I}_S\right] = \frac{\kappa\sigma_u^2}{2(1+\chi)^2} + \frac{\chi^2}{1+2\chi}K_0\left(\mathcal{D}_R\beta^2 + (1-\mathcal{D}_R)\delta^2\right). \tag{15}$$

where $\beta = (1-\alpha)b$, $\delta = d - \mu_d$, and $K_0 \equiv \frac{1+2\chi}{2\kappa(1+\chi)^2}$.
Proof: *See Appendix A.1.1.*

Lemma 1 provides closed-form solutions for the sophisticated traders' and readers' expected utility. We can see from the term $\frac{\kappa\sigma_u^2}{2(1+\chi)^2}$ that both types benefit from the presence of liquidity traders. Moreover, when there is a news report, the firm's residual bias β affects the two types differentially. On the one hand, readers are misled by this bias and obtain lower trading profits. On the other hand, sophisticated traders benefit from it because they can trade against the readers' over-optimism, which is caused by their blind trust in the journalist's partially-biased signal.

It is important to note that we compute the readers' expected utility under the information set of the *journalist* rather than that of the *readers*. This expected utility can be interpreted as the readers' average *realized* trading profits in the long run. Note also, that the readers' expected profits from following the journalist's report are not necessarily positive because the report is partially biased.

While reader profits may not necessarily be positive, they do have to be larger than their profits from trading on their priors, in equilibrium. The reason being that, when the journalist decides whether to report or not, she compares the change in R's long-run trading profits from reporting to the privately-observed opportunity cost c. Evaluating R's expected utility at $\mathcal{D}_R = 1$ and $\mathcal{D}_R = 0$, we can compute this change as:

$$\Delta_R = K_0\left(\delta^2 - \beta^2\right). \tag{16}$$

The change in the readers' expected utility comprises three terms: (i) a constant factor $K_0 = \frac{1+2\chi}{2\kappa(1+\chi)^2}$ that depends on the journalist's readership χ and the trading cost parameter

κ; (ii) the squared deviation of the payoff from its unconditional mean δ^2; and (iii) the squared residual bias β^2 in the journalist's report. In particular, we can see that the journalist's decision to report on the firm does not necessarily increase the readers' expected utility. On the one hand, they benefit from an informative report because it allows them to trade on an informative signal about d instead of just the prior mean. Such a signal is more beneficial if the realized payoff deviates substantially from the mean.

On the other hand, the journalist's report also exposes readers to the residual bias which reduces their expected utility relative to the no-reporting scenario. We will show below that these two opposing forces are crucial for our main results. In particular, they lead to a non-trivial reporting policy for the journalist and bias policy for the firm manager.

The expression for the readers' utility gain in equation (16) emphasizes the journalist's two primary goals in our setting. On the one hand, she wants to cover firms with fundamentals that deviate from the readers' prior assessment. On the other hand, she also wants to provide accurate information with as little bias as possible. The latter channel is similar to that in Gentzkow and Shapiro (2006) who assume that the media firm wants to build a reputation as a provider of accurate information. However, in their setting our first channel is reversed because the readers have an endogenous preference for news that *conforms* to their prior expectations.[24] It should be noted that readers have a preference for extreme news in our model because they use the journalist's report in their trading decision which is absent in the aforementioned papers.

3 Equilibrium Bias and Reporting

In this section, we endogenize the journalist's reporting and the firm's bias decision. To isolate the effect of the journalist we solve a benchmark model first in which we set the journalist's reporting choice to zero. In our analysis, we will focus on positive and normative implications of the journalist's and the firm's decisions. We capture the normative consequences by reader welfare, defined as their ex ante expected utility conditioned on all public $t = 0$ information, $\mathbb{E}[U_R]$.

To gauge the positive asset pricing implications, we rely on the commonly-used concepts of *price drift*, which measures the over- or under-reaction of the stock price, and *price quality*, which measures the informational content of the price. We formally define both

[24]In Mullainathan and Shleifer (2005) a similar effect arises from a confirmatory cognitive bias of readers.

concepts next.[25]

Definition 2 (Price Drift) *Price drift is defined as the expected deviation of the price from the asset's payoff:*

$$\Omega(\delta) \equiv \mathbb{E}\left[p|\delta\right] - \left(\mu_d + \delta\right).$$

This measure captures the extent to which the asset is over-priced on average, i.e. for a given payoff realization and after integrating over the distribution of the random variables c and u. We can plug in the expression for p derived in equation (10) to write $\Omega(\delta)$ as a function of the residual bias β and δ:

$$\Omega = \frac{\chi}{1+\chi}\left[\mathbb{P}\left(\mathcal{D}_R = 1|\delta,\beta\right)\beta - \mathbb{P}\left(\mathcal{D}_R = 0|\delta,\beta\right)\delta\right]. \tag{17}$$

Hence, our model can generate a drift in the asset price if and only if there is a positive mass of readers, $\chi > 0$. In this case, the asset price can deviate from the true payoff for two reasons. The first reason is the residual bias in the journalist's report. The impact of this component increases in the reporting probability. The second reason is the deviation of the payoff from its mean. This channel only matters if traders have to rely on their prior information such that its impact is proportional to the probability of *not* reporting.

Definition 3 (Price Quality) *Price quality is defined as the negative expected squared deviation of the price from the asset's payoff:*

$$\Lambda(\delta) \equiv -\mathbb{E}\left[(\mu_d + \delta - p)^2|\delta\right].$$

Our measure of price quality $\Lambda(\delta)$ corresponds to the mean-squared error of the equilibrium stock price considered by Banerjee et al. (2018) and Frenkel et al. (2020). Again, we can plug in the expression for p derived in equation (10) to write price quality as a function of β and δ:

$$\Lambda = -\frac{\chi^2}{(1+\chi)^2}\left[\frac{\kappa^2}{\chi^2}\sigma_u^2 + \mathbb{P}\left(\mathcal{D}_R = 0|\delta,\beta\right)\delta^2 + \mathbb{P}\left(\mathcal{D}_R = 1|\delta,\beta\right)\beta^2\right]. \tag{18}$$

We can thus see that price quality can be lowered through three distinct channels. The first factor is captured by $\frac{\kappa^2}{\chi^2}\sigma_u^2$ and represents liquidity demand, which is orthogonal to the firm's fundamental. The second and the third factor are specific to our setting

[25]Note that the expectation for both measures is taken over the (independent) random variables c and u.

and reflected by $\mathbb{P}\left(\mathcal{D}_R = 0|\delta, \beta\right)\delta^2$ and $\mathbb{P}\left(\mathcal{D}_R = 1|\delta, \beta\right)\beta^2$, respectively. Therefore, price quality is negatively affected by the residual bias in the journalist's report (β) and the deviation of the asset payoff from its mean (δ). Since β only affects p if the journalist reports, while δ only affects p when she does not report and readers trade on their prior, the impact of these two factors depends on the endogenous reporting probability.

3.1 An Economy without a Journalist

To understand the incremental impact of the media in our model, we first consider a world without a journalist ($\mathcal{D}_R = 0$). In this benchmark scenario readers have to rely on their prior information about the payoff because they do not observe the firm's signal. It follows from equation (10) that the equilibrium price in this model is given by

$$p^{no-J} = \mu_d + \frac{\delta + \kappa u}{1 + \chi} \tag{19}$$

and does not depend on the firm's bias because (i) sophisticated traders are able to remove b from s_F, (ii) readers do not observe s_F, and (iii) liquidity traders trade for exogenous reasons.

Proposition 1 (No-Journalist Benchmark) *Without the journalist ($\mathcal{D}_R = 0$), there exists a unique equilibrium in which:*

1. *The firm's equilibrium bias is given by:*

$$b^{no-J} = 0. \tag{20}$$

2. *Readers' ex ante expected utility is given by:*

$$\mathbb{E}\left[U_R^{no-J}\right] = \frac{\kappa^2\sigma_u^2 - (1+2\chi)\sigma_d^2}{2\kappa(1+\chi)^2}. \tag{21}$$

3. *Sophisticated traders' ex ante expected utility is given by:*

$$\mathbb{E}\left[U_S^{no-J}\right] = \frac{\kappa^2\sigma_u^2 + \chi^2\sigma_d^2}{2\kappa(1+\chi)^2}. \tag{22}$$

4. *The expected stock price is given by:*

$$\mathbb{E}\left[p^{no-J}\right] = \mu_d. \tag{23}$$

5. *Price drift is given by:*

$$\Omega^{no-J} = -\frac{\chi}{1+\chi}\delta. \tag{24}$$

6. *Price quality is given by:*

$$\Lambda^{no-J} = \frac{-(\kappa^2\sigma_u^2 + \chi^2\delta^2)}{(1+\chi)^2}, \tag{25}$$

where σ_d^2 denotes the ex ante payoff variance and $\delta = d - \mu_d$.
Proof: *See Appendix A.1.2.*

Proposition 1 summarizes the results in our benchmark scenario without a journalist. As shown above, the equilibrium price p^{no-J} does not depend on the firm's bias in this setting. Thus, the firm manager has no incentive to bias and chooses $b^{no-J} = 0$. The ex ante expected utilities for readers and sophisticated traders depend on four parameters: (i) the trading cost (κ), (ii) the mass of readers (χ), (iii) the variance of liquidity demand (σ_u^2), and (iv) the payoff variance (σ_d^2). The sophisticated traders' superior information is reflected in a higher ex ante expected utility, $\mathbb{E}\left[U_S^{no-J}\right] > \mathbb{E}\left[U_R^{no-J}\right]$. Even though the firm's expected stock price is equal to the expected payoff, there is a non-zero price drift for a given δ. In particular, the asset is over-priced (under-priced) if $\delta < 0$ ($\delta > 0$) because readers always trade on the ex ante mean μ_d in the absence of a journalist. Finally, price quality is inversely proportional to sophisticated traders' ex ante expected utility, in expectation. More specifically, price quality decreases in the trading cost parameter κ, liquidity variance σ_u^2, and the deviation of d from the mean, δ. The impact of χ is ambiguous and equal to the sign of $\kappa^2\sigma_u^2 - \chi\delta^2$. Loosely speaking, increasing the mass of readers increases price quality if readers are more sophisticated than liquidity traders which depends on the variance σ_u^2 and the readers' misjudgement of the payoff, δ^2.

3.2 An Economy with a Journalist

In this section, we introduce the journalist and let her decide on whether to report on the firm ($\mathcal{D}_R = 1$) or not ($\mathcal{D}_R = 0$). The reporting decision depends on two factors, the utility gain for her readers Δ_R and the stochastic opportunity cost c. Therefore, the journalist chooses to report on the firm if $\Delta_R > c$. Since the opportunity cost is privately observed by the journalist, the reporting decision is, ex ante, random and the firm manager can only compute a reporting probability:

$$\pi_R \equiv \mathbb{P}(\mathcal{D}_R = 1|\mathcal{I}_F) = \mathbb{P}(\Delta_R > c|\mathcal{I}_F). \tag{26}$$

To compute the reporting probability in closed-form, we use the expression for Δ_R derived in equation (16) and the fact that c is uniformly distributed between 0 and $\bar{c}$.

Lemma 2 (The journalist's reporting strategy) *For a given δ and β, the journalist reports with probability*

$$\pi_R(\delta,\beta) = \begin{cases} 0 & \text{if } \Delta_R < 0 \\ \frac{\Delta_R}{\bar{c}} & \text{if } \Delta_R \in [0,\bar{c}) \\ 1 & \text{if } \Delta_R \geq \bar{c} \end{cases} \tag{27}$$

where $\Delta_R = K_0\left(\delta^2 - \beta^2\right)$, $\delta = d - \mu_d$, and $\beta = (1-\alpha)b$.
Proof: *See Appendix A.1.3.*

Lemma 2 provides a closed-form solution for the journalist's ex ante reporting probability as a function of the firm's bias which is chosen at $t = 0$. If her readers are worse off from trading on her report ($\Delta_R < 0$), the journalist never reports ($\pi_R = 0$) even if the opportunity cost is low. At the other extreme, if the readers' benefit is greater than the largest opportunity cost $\bar{c}$ the journalist always reports ($\pi_R = 1$).

In the intermediate range, the journalist's reporting probability is proportional to the readers' utility gain Δ_R. We can see from the expression in Lemma 2 that two opposing forces affect Δ_R and therefore the reporting probability. On the one hand, readers benefit more from the journalist's report if the underlying payoff d is in the tails of its distribution, i.e. if δ^2 is large, because they would lose a lot from solely trading on the prior mean. On the other hand, readers are hurt by a large residual bias in the journalist's report because their inflated demand for the asset would be exploited by sophisticated traders. These two opposing forces imply that the journalist has an incentive to report two types of news. First, *extreme news* that move the readers' prior significantly and second, *reliable news* that are not extremely biased by the firm manager. Figure 3 plots π_R as a function of β and δ for a set of parameters.

Next, we move back to $t = 0$ and analyze the manager's bias choice. The manager chooses b, or equivalently $\beta = (1-\alpha)b$, to maximize the firm's expected stock price

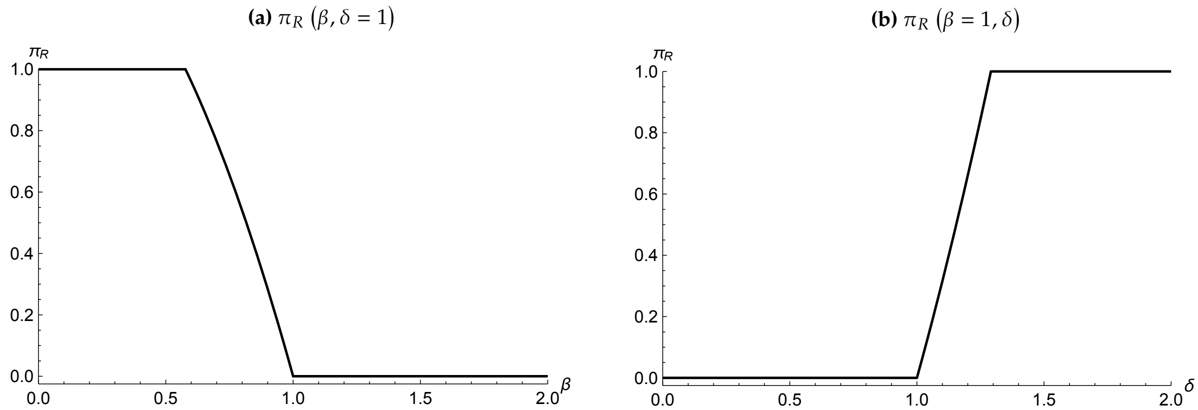

Figure 3: This figure plots the journalist's reporting probability as a function of β and δ. Parameters: $\overline{c} = 1$, $\chi = 1$, and $\kappa = \frac{1}{2}$.

conditional on the payoff d, or equivalently $\delta = d - \mu_d$. Therefore, we can use the expression for the equilibrium price in (10) and take an expectation over the journalist's reporting choice, i.e. the privately observed opportunity cost c, and the mean zero demand by liquidity traders. This leads to

$$\mathbb{E}[p|\mathcal{I}_F] = \mu_d + \frac{1}{1+\chi}\delta + \frac{\chi}{1+\chi}\pi_R(\delta,\beta)\left(\delta+\beta\right). \tag{28}$$

To compute the optimal degree of bias, we differentiate this expression with respect to β and note that the journalist's reporting probability is a negative function of β (see e.g. Panel (a) in Figure 3):

$$\frac{\partial\mathbb{E}[p|\mathcal{I}_F]}{\partial\beta} = \frac{\chi}{1+\chi}\left(\pi_R(\delta,\beta) + (\delta+\beta)\frac{\partial\pi_R(\delta,\beta)}{\partial\beta}\right). \tag{29}$$

This expression highlights the key trade-off the manager faces when he decides on the firm's degree of bias. On the one hand, a marginal increase in the bias has a positive impact on the expected stock price because it inflates the signal that the readers use in their trading decision. This positive impact is proportional to the reporting probability π_R because the readers are only affected by the residual bias if the journalist chooses to report. On the other hand, a marginal increase could also decrease the expected stock price because it reduces the reporting probability. The journalist anticipates a smaller increase in the readers' expected utility from reporting if the firm's degree of bias is larger. Given that we know from Lemma 2 that a decrease in Δ_R reduces the reporting probability, it follows that an increased β can decrease the expected stock price through this channel if $\delta + \beta > 0$.

It is also worth noting that the firm manager would always choose the highest permissible bias if the journalist's reporting probability was fixed at some positive value $\overline{\pi}_R$, such that $\frac{\partial \pi_R}{\partial \beta} = 0$. Hence, the journalist's threat *not* to report on the firm serves as an endogenous bias cost and incentivizes the manager to limit the degree of bias in equilibrium. For this reason we do not require an exogenous cost to achieve an interior equilibrium level of bias which distinguishes our setting from those in the existing information manipulation literature such as Goldman and Slezak (2006), Strobl (2013), Heinle and Verrecchia (2016), or Gao and Zhang (2018).

Assumption 3 (Cost parameters) *We impose the following two assumptions on the support of b and c:*

1. *The highest permissible level of bias is sufficiently low: $\overline{b} < \overline{b}_{max} = \frac{\mu_d}{3(1-\alpha)}$;*
2. *The highest opportunity cost for the journalist is sufficiently high: $\overline{c} > \overline{c}_{min} = K_0 \mu_d^2$.*

Before we solve for the manager's equilibrium bias, we impose two parameter restrictions on the support of the level of (residual) bias and that of the journalist's opportunity cost. First, we impose that the highest permissible bias cannot exceed an upper bound $\overline{\beta}_{max} = (1-\alpha)\overline{b}_{max}$. Second, we assume that the width of the distribution for the journalist's opportunity cost is sufficiently high, i.e. $\overline{c} > \overline{c}_{min}$.

Both assumptions are made to simplify the derivations of the manager's bias and the journalist's reporting decision but neither assumption is crucial for our main results. Specifically, the assumptions ensure that the journalist reporting decision is uncertain. We will come back to this point after the description of the equilibrium bias and reporting strategies.

Proposition 2 (Equilibrium Bias and Reporting) *If $\overline{b}$ and $\overline{c}$ satisfy the conditions in Assumption 3, there exists a unique bias and reporting equilibrium in which:*

1. *The firm's equilibrium (residual) bias is given by:*

$$\beta^* = \begin{cases} \overline{\beta} & \text{if } \delta \in [3\overline{\beta}, \mu_d] \\ \frac{1}{3}\delta & \text{if } \delta \in [0, 3\overline{\beta}) \\ -\delta & \text{if } \delta \in [-\overline{\beta}, 0) \\ \overline{\beta} & \text{if } \delta \in [-\mu_d, -\overline{\beta}) \end{cases} \tag{30}$$

2. The journalist's equilibrium reporting probability is given by:

$$\pi_R^* = \begin{cases} \frac{K_0}{\bar{c}}(\delta^2 - \bar{\beta}^2) & \text{if } \delta \in [3\bar{\beta}, \mu_d] \\ \frac{8}{9}\frac{K_0}{\bar{c}}\delta^2 & \text{if } \delta \in [0, 3\bar{\beta}) \\ 0 & \text{if } \delta \in [-\bar{\beta}, 0) \\ \frac{K_0}{\bar{c}}(\delta^2 - \bar{\beta}^2) & \text{if } \delta \in [-\mu_d, -\bar{\beta}) \end{cases} \tag{31}$$

where $\bar{\beta} = (1-\alpha)\bar{b}$ *and* $K_0 = \frac{1+2\chi}{2\kappa(1+\chi)^2}$. *As before,* μ_d *denotes the mean payoff,* $\bar{c}$ *the highest opportunity cost for the journalist, and* $\bar{b}$ *the largest permissible bias.*
Proof: *See Appendix A.1.4*

Proposition 2 shows the firm's equilibrium bias and the journalist's equilibrium reporting probability. Starting with the former, we can see that the firm's choice of β depends on the realization of the fundamental d (or δ). In particular, there are four distinct intervals and three distinct outcomes for both equilibrium variables. First, if the payoff is in the far-left or the far-right tail of its distribution, the manager's bias is maximal and the journalist reports with a positive probability. Second, if the payoff is slightly below the unconditional mean, $\delta \in [-\bar{\beta}, 0)$, the manager is able to fully prevent the journalist from reporting such that $\pi_R^* = 0$. Third, for slightly above-average values of the payoff, $\delta \in [0, 3\bar{\beta})$, the manager's bias is smaller than before, and the journalist reports with a positive probability.[26]

It should be noted that the results are based on the assumption that the range of the journalist's opportunity cost is sufficiently wide, i.e. $\bar{c}$ is above a certain threshold. This assumption ensures that we always remain in the most relevant case that the journalist might not report on the firm and and π_R^* is strictly below 1.

Figure 4 evaluates the equilibrium bias and reporting probability for a set of parameters as a function of the firm's de-meaned payoff $\delta = d - \mu_d$. We can see that the journalist's reporting probability is highest in the tails of the distribution because readers benefit a lot from an informative report in this range. This motive allows the manager to set the level of bias to its maximum value $\bar{\beta}$. We can also see that this range is wider for below-average values of d, i.e. the firm manager has a higher incentive to bias bad news. In this case the manager is not concerned about the journalist's not reporting because the

[26]Note that the manager always chooses the smallest bias if he is indifferent between multiple values of b. This assumption could be relaxed if we introduce an explicit bias cost.

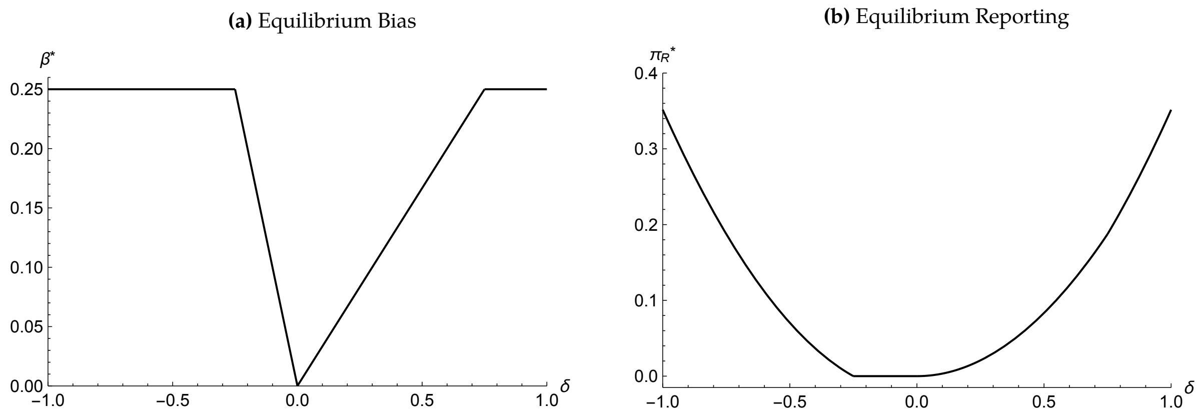

Figure 4: This figure plots the firm's equilibrium bias and the journalist's equilibrium reporting probability as a function of δ. Parameters: $\bar{c} = 2$, $\chi = 1$, $\mu_d = 1$, $\bar{c} = 2$, $\kappa = \frac{1}{2}$, and $\bar{\beta} = \frac{1}{4}$.

expected stock price would increase due to the readers' trading on the prior mean μ_d. In the intermediate range of the payoff, we get an asymmetric V-shaped pattern for β^* and an increasing L-shaped pattern for π_R^*. Thus, the manager is able to prevent reporting on slightly negative news by choosing a sufficiently high level of bias. For slightly positive news, both β^* and π_R^* increase in d. Without the assumption that $\bar{\beta} < \bar{\beta}_{max}$ in Assumption 3, the manager would be able to force the journalist's reporting probability to zero for all $\delta < 0$. Intuitively, the manager benefits from this outcome because he can hide below-average information from the readers who, in turn, push up the stock price by trading on the prior μ_d. At the same time, it is optimal for the journalist not to report because the readers would lose too much in expected trading profits to sophisticated traders who can exploit their overoptimistic demands for the asset.

Corollary 1 (Properties of Equilibrium Bias) *Suppose $\bar{b}$ and $\bar{c}$ satisfy the conditions in Assumption 3, then:*

1. *The firm chooses a higher level of bias (on average) in the presence of bad news:*

$$\mathbb{E}[\beta^*|\delta < 0] > \mathbb{E}[\beta^*|\delta > 0]. \quad (32)$$

2. *The unconditional level of bias is given by*

$$\mathbb{E}[\beta^*] = \frac{\bar{\beta}(\mu_d - \bar{\beta})}{\mu_d} > 0. \quad (33)$$

It is increasing in μ_d and $\bar{\beta}$.

Proof: *See Appendix A.1.5.*

Corollary 1 describes the properties of the firm's equilibrium bias in more detail. First, we show that, on average, the firm manager chooses a higher level of bias if the underlying news is below-average ($\delta < 0$). In our setting the manager has a higher incentive to bias negative news because he is less concerned with a reduced reporting probability in this case, i.e. the endogenous biasing cost is lower. However, if the underlying news is particularly positive, the firm manager wants to ensure that the journalist reports it with a high probability. The equilibrium bias is lower if $\delta > 0$. These findings are consistent with the empirical evidence in the prior literature that managers take actions to avoid (small) negative earnings surprises (see e.g., Burgstahler and Dichev, 1997; Degeorge et al., 1999; Huang et al., 2014). We show that biasing the disclosed information is an effective tool because it reduces media coverage and thus the attention of less-sophisticated traders.

Definition 4 (Media Tilt) *We define the (positive) tilt in the journalist's reporting probability* $\pi_R(\delta)$ *as:*

$$\tau(|\delta|) \equiv \pi_R(|\delta|) - \pi_R(-|\delta|). \tag{34}$$

Definition 4 introduces the concept of *tilt* in the journalist's reporting decision. Intuitively, $\tau(|\delta|)$ measures the difference in the reporting probability of good news and bad news for a fixed spread $|\delta|$ away from the mean μ_d.

We can now use the equilibrium values for π_R derived in Proposition 2 and derive the equilibrium tilt in the main model.

$$\tau(|\delta|) = \begin{cases} 0 & \text{if } |\delta| \in [3\overline{\beta}, \mu_d) \\ \frac{K_0}{\overline{c}}\left(\overline{\beta}^2 - \frac{1}{9}\delta^2\right) & \text{if } |\delta| \in [\overline{\beta}, 3\overline{\beta}) \\ \frac{8}{9}\frac{K_0}{\overline{c}}\delta^2 & \text{if } |\delta| \in [0, \overline{\beta}) \end{cases} \tag{35}$$

with $K_0 = \frac{1+2\chi}{2\kappa(1+\chi)^2}$ and $\overline{\beta} = (1-\alpha)\overline{b}$. The equilibrium tilt is thus (weakly) positive in the main model. We formalize this result, together with other properties of π_R, next.

Corollary 2 (Properties of Equilibrium Reporting) *Suppose* $\overline{b}$ *and* $\overline{c}$ *satisfy the conditions in Assumption 3, then:*

1. *The equilibrium media tilt is weakly positive,* $\tau(|\delta|) \geq 0$.

2. *The journalist is more likely to report (on average) in the presence of good news:*

$$\mathbb{E}[\pi_R^*|\delta > 0] > \mathbb{E}[\pi_R^*|\delta < 0]. \tag{36}$$

3. *The unconditional expected reporting probability is given by*

$$\mathbb{E}[\pi_R^*] = \frac{K_0}{3\overline{c}\mu_d}\left(\mu_d^3 - 3\mu_d\overline{\beta}^2 + 4\overline{\beta}^3\right). \tag{37}$$

It is increasing in μ_d and decreasing in κ, χ, $\overline{\beta}$, and $\overline{c}$.

Proof: *See Appendix A.1.6.*

Corollary 2 shows that the journalist is more likely to report on good news. Therefore, our model creates a form of positive *ex post* media bias. This result is consistent with the empirical evidence in Solomon (2012) that investor relations firms are able to attract more media coverage of its client's good news relative to bad news by "spinning the news." In our setting, the firm's spin is captured by the (positive) bias in its public signal. It should, however, be noted that this type of media bias is in the best interest of the readers because the journalist's reporting decision is made fully benevolently. The reason for this bias is the firm's increased incentive to bias negative news (Corollary 1). To protect her readers from a higher β^*, the journalist reduces her reporting probability and forces them to trade on their prior belief about the asset payoff.

Corollary 3 (Incremental Effect of the Media) *Suppose $\overline{b}$ and $\overline{c}$ satisfy the conditions in Assumption 3, then the introduction of a journalist leads to:*

1. *an increase in bias; an increase (a decrease) in the expected asset position of readers (sophisticated traders);*

2. *an increase in readers' welfare and a decrease in sophisticated traders' welfare;*

3. *an increase (a decrease) in the expected stock price conditional on $\delta > 0$ ($\delta < 0$) and unconditionally;*

4. *an increase (a decrease) in price drift if $\delta > 0$ ($\delta < 0$) and unconditionally; an increase in price quality (conditional on δ and unconditionally);*

relative to the benchmark economy without reporting.

Proof: *See Appendix A.1.7*

Corollary 3 compares the main model to the benchmark without reporting. We show that the introduction of a journalist leads to the following results. First, it increases the readers' expected utility. Even though the presence of a journalist encourages the firm to bias its public signal, readers are always better off in the presence of a journalist. This result is intuitive because the journalist's reporting policy makes sure that her report always (weakly) increases reader welfare, i.e. the journalist would never report if the readers' utility gain was negative. Furthermore, the presence of the journalist renders the readers *net buyers* of the asset. Without the journalist, they are equally likely to buy or sell the asset such that their expected position equals zero. With the journalist, their trades become more informed but also more exposed to the positive bias in the firm's signal. As a consequence readers become overly optimistic and end up buying the risky asset.

Second, sophisticated traders always suffer from the presence of the journalist. The fact that the journalist encourages the firm to bias does not affect these traders because they are perfectly aware of the bias and are able to control for it. Without reporting, sophisticated traders can exploit their informational advantage vis-a-vis the less sophisticated traders especially if d is far away from the mean. As shown above, reporting makes readers better informed on net and hence sophisticated traders benefit less from their more precise information. Given that readers become net buyers of the asset in the presence of the journalist, sophisticated traders naturally take the opposite side and become net-sellers. Note that this result complements the existing theoretical literature such as Gao and Liang (2013) or Han et al. (2016). In these papers, public signals also benefit uninformed traders at the expense of more sophisticated traders. However, in contrast to our model, the traders' beliefs only differ in terms of their precisions and not their levels. As a result, both types are equally likely to buy or sell the asset in these settings.

Third, the presence of a journalist leads to a positive bias in the expected stock price because, on average, the firm successfully inflates the readers' expectations through bias. Interestingly, this effect is concentrated in above-average payoff realizations. For below-average values, the presence of a journalist decreases the expected stock price because the journalist might reveal negative news that are too costly for the firm to bias. Since the positive effect dominates the negative effect, the unconditional incremental impact on price drift is positive, which is consistent with the empirical literature like Tetlock (2011).

Lastly, the presence of a journalist also renders the price more informative in our setting even though there are two opposing forces. On the one hand, the journalist encourages the firm to bias its signal more heavily which leads to a positive price drift and tends to decrease price quality. On the other hand, the journalist allows her readers to trade on an informative, albeit biased, signal which tends to increase price quality. Therefore it is not clear, ex ante, what the net effect is. However, it turns out that in our setting the second (positive) effect always dominates such that the presence of the journalist always improves price quality. The journalist's incremental impact on price quality and price drift is summarized in Figure 5.

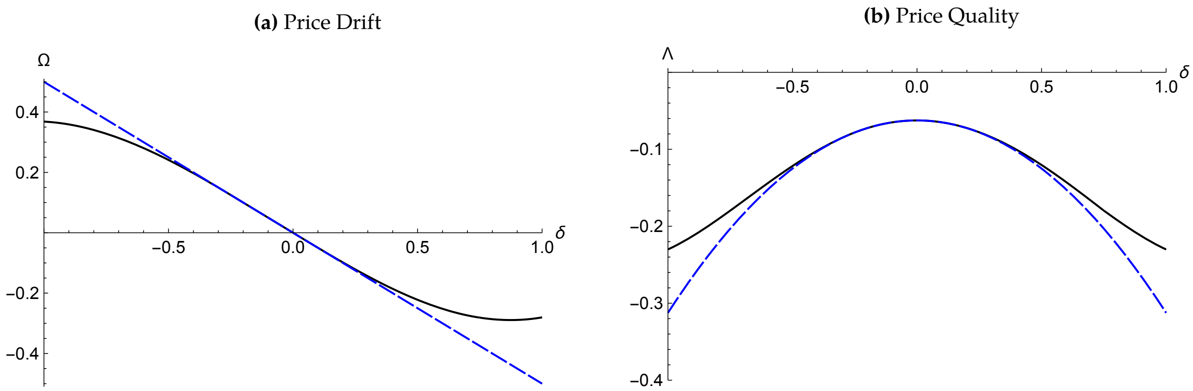

Figure 5: This figure plots the asset's equilibrium price drift and price quality as a function of δ. The solid black line corresponds to the model with a journalist and the dashed blue line to the model without a journalist. Parameters: $\overline{c} = 2$, $\chi = 1$, $\mu_d = 1$, $\overline{c} = 2$, $\kappa = \frac{1}{2}$, $\sigma_u = 1$, and $\overline{\beta} = \frac{1}{4}$.

4 Empirical Implications

Our model offers a rich set of empirical implications some of which relate to existing empirical findings and some which offer new untested predictions. In general we discuss three sets of implications: (i) those that relate to firm behavior; (ii) those that relate to journalist behavior; and (iii) those that relate to stock prices.

Our main predictions are summarized in Corollary 1 - 3 and are based on the joint equilibrium determination of media coverage and the firm's optimal choice of bias. Below we discuss the model implications in these three categories in detail and highlight how our results can be tested empirically.

4.1 Firm Bias

Our key result in Proposition 2 states that the extent of media coverage and firm bias arise as equilibrium choices. The first testable prediction in this category is that an *exogenous* increase in media coverage leads to more bias in the firm's public announcements.

Therefore, it would be interesting to identify a shock to media coverage and its causal impact on an empirical proxy for β, such as the *Readability Index* (Loughran and McDonald, 2014) or the *Fog Index* (Li, 2008) of a financial disclosure. One can test our model's implications either in the cross section of firms or over time. In both cases, it is necessary to first identify firms that are more likely to be covered by the media. For instance, our model predicts that firms with a greater variability of announcements are more attractive for journalists and should receive more coverage. Thus, one can test the hypothesis that firms with high-variable news bias announcements more than firms with low-variable news.

A second prediction of our model is that the level of bias in firm announcements should be higher when news is negative and lower when news is positive. This prediction is broadly consistent with Li (2008) who shows that annual reports for firms with lower earnings are more opaque. Furthermore, our model would suggest that this positive "tilt" should be stronger for the sub-sample of firms with higher media coverage.

4.2 Media Reporting

Our second set of predictions relate to the equilibrium choices of the media on what firm announcements they wish to cover. Testing these predictions would require creating a comprehensive data set of firm announcements and the extent of their media coverage. Our model provides several predictions for this relationship.

First, our model suggests that media coverage is higher for positive firm announcements, relative to negative announcements. This theoretical result is very robust and is due to the endogenous decision of the firm to bias negative news more heavily than positive news.[27]

Another testable implication of our model is the relation between the probability of media coverage and the obfuscation of the firm's announcement. We predict that an announcement with a higher *fog index* or a lower *readability index* will be less likely to be reported on. This result also depends on the "novelty" of the news as we also predict that more newsworthy announcements are more likely to get covered in the media.

Furthermore, our model sheds light on a potential selection effect with regards to the characteristics of the firms that are covered. In particular, we show that journalists are more likely to cover highly volatile firms (high σ_d) that are less likely to bias their announcements

[27]Note, however, that this prediction can be overturned whenever readers are sufficiently loss averse.

(low $\bar{b}$). It would be interesting to empirically investigate if media coverage changes in response to exogenous changes in one (or both) of these parameters.

Finally, one could also compare media coverage for *corporate* financial news, such as earnings announcements, to other financial news, such as unemployment statistics. Because earnings announcements can be more easily biased or obfuscated, our model predicts that their coverage should be (i) lower and (ii) more heavily tilted towards positive news.

4.3 Stock Prices

The third set of predictions relates to the relationship between media coverage and key properties of asset prices. This perhaps has been the main focus of previous empirical work on journalism in finance. A well-established finding in this literature is that media coverage oftentimes causes a temporary over-reaction in stock prices (see e.g., Vega, 2006; Tetlock, 2007; Ahern and Sosyura, 2014). Consistent with these findings, our model predicts that *unconditionally* the presence of a journalist, or an exogenous increase in media coverage, leads to an increase in price drift (see Corollary 3).

A second key result in the empirical literature is that media coverage of stale news also affects traders (see e.g., Huberman and Regev, 2001; Tetlock, 2007). These papers interpret their findings as indicative of an investor behavioral bias, such as limited attention. Our model suggests that the reporting of stale news is an *optimal* decision of a journalist. Hence, the journalist will report on news only if she believes that her readers would still benefit from this information. This implies, for example, that one could analyze whether during the reporting of the stale information, there were no other significant new announcements from other firms.

In addition to the above, our model also provides several more nuanced predictions. For instance, we find that for negative news, the price overreaction is *weaker* with media coverage relative to without. But for positive news, this pattern is reversed (see Figure 5, Panel (a)). Our model also offers testable predictions with regards to the informational content of prices or price quality. We find that the causal impact of media coverage on price quality is strictly positive and particularly strong for extreme news (see Figure 5, Panel (b)).

Finally, we show in Corollary 3 that the media has a causal impact on the trading behavior of its readers. More specifically, media coverage renders less sophisticated traders *net buyers* and more sophisticated traders *net sellers*, which is broadly consistent with the findings in the existing literature. For instance, Barber and Odean (2008) show that individual investors are net buyers of stocks that are covered in the news. Our model provides a micro-foundation for this result and further predicts that it should be particularly strong if (i) the reported news is extreme and (ii) the reported news is positive and thus more heavily-biased.

5 Extensions

In this section, we explore several model extensions to assess the robustness of our main model and to provide further insights. Detailed derivations and proofs for this section can be found in Appendix A.2.

5.1 Alternative Media Objective

In the baseline model, we assumed that the journalist acts benevolently and chooses $\mathcal{D}_R$ to maximize the readers' long-term utility. To gauge the robustness of this assumption, we will analyze two alternative objective functions for the journalist next.

Relevance vs. Accuracy

Consider a general utility function from reporting for the journalist of the form

$$U_J(\mathcal{D}_R = 1) = \phi_1(d - \mu_d)^2 - \phi_2(s_J - d)^2 = \phi_1\delta^2 - \phi_2\beta^2 \tag{38}$$

with $\phi_1, \phi_2 > 0$. We normalize the journalist's utility from not reporting to zero, $U_J(\mathcal{D}_R = 0) = 0$.

The journalist's objective contains two terms. The first term captures her desire to report news that is *relevant*, i.e. different from the market-wide prior expectation μ_d. At the same time, the journalist dislikes reporting heavily-biased or *inaccurate* news. This second component is measured by the residual bias $s_J - d = \beta$. The coefficient ϕ_2 could also be interpreted as an indicator of quid-pro-quo incentives such that a decrease in ϕ_2 indicates a greater willingness to report heavily-biased news, which of course benefits the firm. In general, the two coefficients ϕ_1 and ϕ_2 determine the relative strength of these two effects and, without loss of generality, we set $\phi_2 = 1$ and we restrict ϕ_1 to lie in the set $[0, \overline{\phi}_1]$.

Except for the different objective function, we keep all of the assumptions from the main model. It is also important to note that this extension collapses to the main model, in terms of the equilibrium β and π_R, if the journalist assigns equal weights to the two components δ^2 and β^2, i.e. if $\phi_1 = \phi_2$.

Assumption 1a (Journalist's Objective) *The journalist's reporting decision is made to maximize U_J in Equation (38) net of a private reporting cost $c \sim U[0, \overline{c}]$ with $\overline{c} \in (0, \infty)$.*

The journalist reports the announcement ($\mathcal{D}_R = 1$) if and only if $U_J > c$ such that $\pi_R = \frac{U_J}{\overline{c}}$ if $U_J \in [0, \overline{c}]$ and $\pi_R = 0$ or $\pi_R = 1$ otherwise. As in the main model, we assume that $\overline{c}$ is sufficiently large such that $\pi_R \in [0, 1)$. The firm chooses $\beta \in [0, \overline{\beta}]$ to maximize $\mathbb{E}[p|\delta]$, anticipating the journalist's reporting probability.

We formally prove in Appendix A.2 that the firm's optimal bias is given by

$$\beta^* = \begin{cases} \frac{1}{3}\delta\left(\sqrt{1+3\phi_1} - 1\right) & \text{if } \delta > 0 \\ -\frac{1}{3}\delta\left(\sqrt{1+3\phi_1} + 1\right) & \text{if } \delta \leq 0 \text{ and } \phi \geq 1 \\ -\sqrt{\phi_1}\delta & \text{if } \delta \leq 0 \text{ and } \phi < 1. \end{cases} \tag{39}$$

Thus, as before, we find that the firm biases negative news more than positive news. Moreover, the equilibrium reporting probability is given by $\pi_R = \frac{1}{\overline{c}}\left(\phi_1\delta^2 - \beta^2\right)$, such that there is again a positive tilt in the journalist's reporting behavior and good news is more likely to be reported than bad news. This finding appears to be a quite general implication of the strategic interaction between the firm and the journalist, rather then a result of the specific objective function in the main model.

Quite interestingly, we can use this extension to analyze the equilibrium ramifications of a change in the journalist's incentives, i.e. ϕ_1. More specifically, an increase in ϕ_1 increases the journalist's willingness to report for a given δ and β, which leads to an increase in π_R. Of course, the firm reacts to this change and increases its equilibrium bias β^*. It follows, that an increase in ϕ_1 increases the journalist's reporting probability more for good news such that the equilibrium tilt $\tau(|\delta|)$ increases in ϕ_1.

Perhaps surprisingly, we show in Appendix A.2 that price quality Λ is hump-shaped in ϕ_1 for positive news ($\delta > 0$) and weakly decreasing in ϕ_1 for negative news $\delta < 0$. These effects are again driven by the positive impact of ϕ_1 on the firm's bias and the journalist's reporting probability. While an increase in bias decreases price quality, the increase in the reporting probability increases it. For negative news, the first effect dominates such that the total effect is negative. For good news, there exists an intermediate value of ϕ_1 that balances this trade-off and maximizes price quality.

It is also interesting to note that in this extension, the introduction of a journalist is not necessarily to the readers' benefit. More specifically, readers could be better off without a journalist even though they are required to trade on their prior. We show in Appendix A.2 that readers are always better off *without* a journalist for bad news. For good news, they are better off without a journalist if ϕ_1 is sufficiently large. In both cases, the fact that the introduction of the journalist encourages the firm to bias their signal outweighs the positive effect of reporting.

Loss Aversion Incentives

In this version of the model, we endow the journalist with an additional (exogenous) incentive to report negative, i.e. below-average, news. This incentive could capture the journalist's desire to cater to her readers' loss aversion.[28] Hence *not reporting* on bad news carries a large reputational cost for the journalist. More generally, this reduced-form specification is consistent with the anecdotal concept of "if it bleeds it leads," which insinuates an inherent negative bias in media coverage.

In the context of this extension, we introduce a new parameter $\phi_0 \geq 0$ and adjust the journalist's utility from reporting to:

$$U_J(\mathcal{D}_R = 1) = \Delta_R + \phi_0 \delta^2 \mathbf{1}_{\delta<0} \tag{40}$$

and normalize the utility from not reporting to zero, as before.

Assumption 1b (Journalist's objective) *The journalist's reporting decision is made to maximize U_J in Equation (40) net of a private reporting cost $c \sim U[0, \bar{c}]$ with $\bar{c} \in (0, \infty)$.*

If $\phi_0 > 0$ and if $\delta < 0$ ("bad news"), then the journalist realizes an additional reporting benefit that is proportional to the relevance of the news. Consequently, she is ex ante more likely to report "bad news" than "good news." We formally show in the Appendix that the

[28]See e.g., Barberis and Huang (2001) or Easley and Yang (2015) for theoretical asset pricing frameworks with loss-averse agents.

equilibrium bias and reporting probability is given by:

$$\beta^* = \begin{cases} \frac{1}{3}\delta & \text{if } \delta > 0 \\ -\frac{1}{3}\left(\sqrt{4 + 3\frac{\phi_0}{K_0}} + 1\right)\delta & \text{if } \delta < 0 \end{cases} \tag{41}$$

and

$$\pi_R^* = \begin{cases} \frac{8}{9} \times \frac{K_0}{\bar{c}}\delta^2 & \text{if } \delta > 0 \\ \frac{2}{9} \times \frac{\left(2K_0 + 3\phi_0 - \sqrt{K_0\left(4K_0 + 3\phi_0\right)}\right)}{\bar{c}}\delta^2 & \text{if } \delta < 0. \end{cases} \tag{42}$$

It follows from these expressions that the firm biases negative news more strongly, as in the main model. Moreover, an increase in the journalist's incentive to report bad news, increases the firm's equilibrium bias: $\frac{\partial \beta^*}{\partial \phi_0} > 0$ if $\delta < 0$.

Most interestingly, we can show that the journalist is more likely to report negative news if and only if $\phi_0 > \overline{\phi}_0$ where $\overline{\phi}_0$ is a positive constant defined in Appendix A.2. This result is very intuitive. If the journalist's additional benefit from reporting bad news is sufficiently large, she is more likely to report on δ_2 than on δ_1 with $\delta_2 = -\delta_1 \in (-\mu_d, 0)$.

Furthermore, $\overline{\phi}_0$ is decreasing in χ and κ. It follows that a reduction in the journalist's readership or the transaction cost reduces the cutoff $\overline{\phi}_0$ and renders it more likely that the journalist tilts coverage towards negative news.

5.2 Informed Readers

In this section, we relax another key assumption of the main model. More specifically, we now assume that readers might be able to observe the firm's signal directly but are unable to remove any bias from it. If readers observe the firm's announcement without an associated media report, they trade on the biased signal $s_F = d + b$. In this version of the model, the journalist's main role is thus to de-bias or clarify public announcements.

Assumption 2a (Readers' observed signals) *An individual reader observe the firm's signal directly with probability* $\theta \in [0, 1]$. *If a reader observes* s_F *and* s_J, *he relies on* s_J.

We keep all of the remaining assumptions from the main model. In particular, we still assume that the journalist maximizes reader welfare subject to the private reporting cost c. To simplify the exposition, we assume that the random variable governing the readers' observed signals is perfectly correlated among readers.

If the journalist reports s_J, the readers' expected utility is equal to $\frac{\kappa\sigma_u^2}{2(1+\chi)^2} - K_0(1-\alpha)^2 b^2$ as shown in Lemma 1. Similarly, if the journalist does not report and the readers do not observe s_F directly, it is given by $\frac{\kappa\sigma_u^2}{2(1+\chi)^2} - K_0(1-\alpha)^2\delta^2$. If, however, the readers observe s_F directly and there is no report, their expected utility is equal to $\frac{\kappa\sigma_u^2}{2(1+\chi)^2} - K_0 b^2$.

It follows that the journalist chooses $\mathcal{D}_R \in \{0,1\}$ to maximize the readers' expected utility gain:

$$\tilde{\Delta}_R = K_0\left[(1-\theta)\delta^2 - \left((1-\alpha)^2 - \theta\right) b^2\right] \tag{43}$$

with $K_0 = \frac{1+2\chi}{2\kappa(1+\chi)^2}$.

In this alternative setting, the impact of an increase in the firm's bias on the reader's utility gain from reporting is given by:

$$\frac{\partial\tilde{\Delta}_R}{\partial b} = -2K_0\left[(1-\alpha)^2 - \theta\right] b. \tag{44}$$

Hence, the impact of b on $\tilde{\Delta}_R$ is more subtle in this extension and, perhaps surprisingly, not always negative. In particular, an increase in b makes it *more* profitable for the journalist to report if and only if $\theta > (1-\alpha)^2$. Thus, if traders are sufficiently likely to observe the firm's signal directly, a more heavily-biased signal increases the utility gain from reporting and leads to an increase in the reporting probability. Quite interestingly, the endogeneity of the journalist's reporting decision could still pose an implicit bias cost due to the following trade-off. On the one hand, an increase in b increases the firm's stock price, especially if many traders directly observe the firm's signal. On the other hand, an increase in b also encourages the journalist to report, which reduces the impact of the bias on the price if the journalist is skilled ($\alpha > 0$).

5.3 Endogenous Media Skill

A potential concern with our baseline model is that the journalist's ability to de-bias the firm's announcement was taken as exogenous. We now show that our results are robust to endogenous skill acquisition by the journalist. Specifically, we allow the journalist to choose the degree with which the firm's signal is de-biased at a constant cost $c_\alpha > 0$. We denote the journalist's decision to pay this cost by $\mathcal{D}_\alpha \in \{0,1\}$ such that her skill is given by:

$$\alpha = \begin{cases} \alpha_0 & \text{if } \mathcal{D}_\alpha = 0 \\ 1 & \text{if } \mathcal{D}_\alpha = 1, \end{cases} \tag{45}$$

where $\alpha_0 \in [0, 1)$ denotes the journalist's baseline skill. Therefore, the journalist can de-bias the firm's signal perfectly after paying c_α.

The journalist's problem is thus given by:

$$\max_{\{\mathcal{D}_R, \mathcal{D}_\alpha\}} \mathbb{E}\left[U_R | \mathcal{I}_J\right] - \mathcal{D}_R c - \mathcal{D}_\alpha c_\alpha. \tag{46}$$

We show formally in Appendix A.2 that the journalist is willing to pay c_α if the news is sufficiently interesting relative to her reporting cost c and if the firm's bias is sufficiently high relative to the de-biasing cost c_α. Under these two conditions the journalist de-biases s_F perfectly and reports $s_J = d$ to her readers. If the firm's bias is smaller than this cutoff, the journalist might still report the announcement but she is not willing to pay c_α. Moreover, if both b and $|\delta|$ are small relative to the corresponding cost, the journalist will neither report nor de-bias.

At $t = 0$, when the firm manager chooses the bias in s_F, he takes the journalist's optimal response at $t = 1$ into account. In particular, he understands that the journalist is willing to perfectly de-bias s_F if it is too heavily biased. In this case, the expected stock price would not be affected by b such that it is strictly preferable for the firm to reduce the bias. In equilibrium, the firm never sets the bias to a value that would trigger the journalist to pay c_α. Hence, all of our main results still apply, with the only difference that $\overline{b}$, the exogenous limit on the bias, is replaced by the cutoff that renders the journalist indifferent between paying c_α or not. Hence, the journalist's ability to de-bias the firm's signal perfectly creates an endogenous upper limit on the firm's equilibrium bias.

6 Conclusion

Financial journalists are part of the ecosystem of agents who take the vast amount of publicly available financial information and process this information to their readers. We consider a model in which the role of the financial journalist is to both identify to her readers the most important financial information, as well as clarify the content of the information put out by the firm. The resulting equilibrium demonstrates the type of news that a strategic journalist will choose to report as well as how her presence affects her readers' ability to trade, the incentive of firms to bias their announcements, and equilibrium stock prices.

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A Appendix

A.1 Proofs

A.1.1 Proof of Lemma 1

1. First consider an arbitrary sophisticated trader with optimal demand $x_S = \frac{1}{\kappa}(d-p)$. Plugging this demand into the expression for the trader's utility in equation (5) yields:
$$U_S = \frac{1}{\kappa}(d-p)^2 - \frac{1}{2\kappa}(d-p)^2 = \frac{1}{2\kappa}(d-p)^2. \tag{A.1}$$
Plugging in the equilibrium stock price derived in equation (10) and utilizing $\mathbb{E}[u] = 0$, $\text{Var}(u) = \sigma_u^2$, and $\mathcal{D}_R \sim Be(\pi_R)$ leads to the expression derived in the Lemma.

2. Consider an arbitrary reader with optimal demand $x_R = \frac{1}{\kappa}(\mathcal{D}_R s_J + (1-\mathcal{D}_R)\mu_d - p)$. Plugging this demand into the expression for the trader's utility in equation (10) yields:
$$U_R = \frac{1}{\kappa}(\mathcal{D}_R s_J + (1-\mathcal{D}_R)\mu_d - p)(d-p) - \frac{1}{2\kappa}(d-p)^2. \tag{A.2}$$
Plugging in the equilibrium stock price derived in equation (10) and utilizing $\mathbb{E}[u] = 0$, $\text{Var}(u) = \sigma_u^2$, and $\mathcal{D}_R \sim Be(\pi_R)$ leads to the expression derived in the Lemma.

A.1.2 Proof of Proposition 1

As stated in the text, the equilibrium stock price is given by $p = \mu_d + \frac{\delta + \kappa u}{1+\chi}$, which leads to:
$$\mathbb{E}[p|\delta] = \mu_d + \frac{\delta}{1+\chi}. \tag{A.3}$$

Thus the firm's objective does not depend on b, such that $b^{no-J} = 0$. The expressions for $\mathbb{E}\left[U_R^{no-J}\right]$ and $\mathbb{E}\left[U_S^{no-J}\right]$ are obtained by evaluating (A.2) and (A.1) at $\mathcal{D}_R = 0$ and $b = 0$. The unconditional expectation of the stock price is equal to μ_d because $\mathbb{E}[\delta] = 0$.

Finally, to obtain the expressions for price drift and price quality, we evaluate Ω and Λ in equation (17) and (18) at $\mathcal{D}_R = 0$.

A.1.3 Proof of Lemma 2

The journalist reports if and only if her utility from reporting exceeds her utility from non-reporting, i.e. $\mathcal{D}_R = 1 \Leftrightarrow \Delta_R > c$ with $\Delta_R = K_0\left(\delta^2 - \beta^2\right)$, as shown in equation (16) in the text. Since c is uniformly distributed between 0 and $\overline{c}$, it follows that:

1. The journalist never reports if $\Delta_R < 0$: $\mathbb{P}(\Delta_R > c) = 0$;
2. The journalist always reports if $\Delta_R > \overline{c}$: $\mathbb{P}(\Delta_R > c) = 1$;
3. The journalist reports with probability π_R if $\Delta_R \in [0, \overline{c}]$: $\mathbb{P}(\Delta_R > c) = \frac{\Delta_R}{\overline{c}}$.

A.1.4 Proof of Proposition 2

As a first step, we use the expression for $E[p|\mathcal{I}_F]$, derived in equation (28), to re-write the firm's maximization problem as:

$$\max_{\beta \in \mathcal{B}} \widetilde{p}_0(\delta, \beta) = \pi_R \times (\delta + \beta) \tag{A.4}$$

with $\pi_R = \frac{K_0}{\overline{c}}(\delta^2 - \beta^2)$. Note that Assumption 3 ensures that $\pi_R \leq 1$. Moreover we get $\pi_R = 0$, if $\beta \geq |\delta|$. It immediately follows that we can restrict the support for β to $\mathcal{B} \equiv \left[0, \min\left(\overline{\beta}, |\delta|\right)\right]$ because all $\beta > |\delta|$ lead to the same value for the firm's objective.

It follows that the first and second derivative for the firm's objective are given by:

$$\frac{\partial \widetilde{p}_0}{\partial \beta} = \frac{K_0}{\overline{c}} (\delta - 3\beta)(\delta + \beta) \tag{A.5}$$

and

$$\frac{\partial^2 \widetilde{p}_0}{\partial \beta^2} = -2\frac{K_0}{\overline{c}} (\delta + 3\beta), \tag{A.6}$$

respectively.

1. If $\delta \leq 0$, we have to differentiate the following two cases:
   (a) $|\delta| \leq \overline{\beta}$: in this case, $\widetilde{p}_0 \leq 0$ because $\pi_R \in [0, 1]$. As a result, it is maximized at $\beta^* = -\delta$.
   (b) $|\delta| > \overline{\beta}$: in this case, $\frac{\partial \widetilde{p}_0}{\partial \beta} > 0$ such that $\beta^* = \overline{\beta}$.
2. If $\delta > 0$, we can find β^* from the first-order condition $\frac{\partial \widetilde{p}_0}{\partial \beta} = 0$, which implies $\beta^* = \frac{1}{3}\delta$. If $\frac{1}{3}\delta > \overline{\beta}$, $\frac{\partial \widetilde{p}_0}{\partial \beta} > 0$ such that $\beta^* = \overline{\beta}$.

The expressions for π_R^* follow directly from evaluating the reporting probability at β^*.

A.1.5 Proof of Corollary 1

We can use the expression for β^* as a function of δ from Proposition 2 together with the fact that $\delta \sim U[-\mu_d, \mu_d]$ to get:

$$\mathbb{E}\left[\beta^*|\delta < 0\right] = \frac{\overline{\beta}}{\mu_d} \times \frac{\overline{\beta}}{2} + \frac{\mu_d - \overline{\beta}}{\mu_d} \times \overline{\beta} = \frac{\overline{\beta}}{\mu_d}\left(\mu_d - \frac{1}{2}\overline{\beta}\right) \tag{A.7}$$

and

$$\mathbb{E}\left[\beta^*|\delta > 0\right] = \frac{3\overline{\beta}}{\mu_d} \times \frac{\overline{\beta}}{2} + \frac{\mu_d - 3\overline{\beta}}{\mu_d} \times \overline{\beta} = \frac{\overline{\beta}}{\mu_d}\left(\mu_d - \frac{3}{2}\overline{\beta}\right), \tag{A.8}$$

which directly implies that $\mathbb{E}\left[\beta^*|\delta < 0\right] > \mathbb{E}\left[\beta^*|\delta > 0\right]$.

The unconditional expectation of β^* is given by:

$$\mathbb{E}[\beta^*] = \frac{1}{2}\left(\mathbb{E}\left[\beta^*|\delta < 0\right] + \mathbb{E}\left[\beta^*|\delta > 0\right]\right) = \frac{\overline{\beta}}{\mu_d}\left(\mu_d - \overline{\beta}\right). \tag{A.9}$$

The comparative statics are given by $\frac{\partial \mathbb{E}[\beta^*]}{\partial \mu_d} = \frac{\overline{\beta}^2}{\mu_d^2} > 0$ and $\frac{\partial \mathbb{E}[\beta^*]}{\partial \overline{\beta}} = 1 - 2\frac{\overline{\beta}}{\mu_d} > 0$ because $\overline{\beta} < \frac{1}{3}\mu_d$ by Assumption 3.

A.1.6 Proof of Corollary 2

The result for the equilibrium media tilt follows directly from the expression given in the text. Furthermore, we can compute the conditional expectations as:

$$\mathbb{E}\left[\pi_R^*|\delta < 0\right] = \frac{\mu_d - \overline{\beta}}{\mu_d} \times \frac{K_0}{\overline{c}}\left(\frac{1}{3}\left(\overline{\beta}^2 + \mu_d\overline{\beta} + \mu_d^2\right) - \overline{\beta}^2\right) \tag{A.10}$$

and

$$\mathbb{E}\left[\pi_R^*|\delta > 0\right] = \frac{3\overline{\beta}}{\mu_d} \times \frac{8K_0}{3\overline{c}} \times \overline{\beta}^2 + \frac{\mu_d - 3\overline{\beta}}{\mu_d} \times \frac{K_0}{\overline{c}}\left(2\overline{\beta}^2 + \overline{\beta}\mu_d + \frac{\mu_d^2}{3}\right). \tag{A.11}$$

Simple algebra confirms that $\mathbb{E}\left[\pi_R^*|\delta > 0\right] > \mathbb{E}\left[\pi_R^*|\delta < 0\right]$.

The unconditional expectation of π_R^* is then equal to $\frac{1}{2}\left(\mathbb{E}\left[\pi_R^*|\delta > 0\right] + \mathbb{E}\left[\pi_R^*|\delta < 0\right]\right)$, which yields:

$$\mathbb{E}[\pi_R^*] = \frac{K_0}{3\mu_d\overline{c}}\left(4\overline{\beta}^3 - 3\overline{\beta}^2\mu_d + \mu_d^3\right). \tag{A.12}$$

Hence, $\mathbb{E}[\pi_R^*]$ is increasing in K_0 and decreasing in $\overline{c}$. Moreover, Assumption 3 implies that $\frac{\partial \mathbb{E}[\pi_R^*]}{\partial \overline{\beta}} = \frac{2K_0\overline{\beta}}{\mu_d \overline{c}} \left(2\overline{\beta} - \mu_d\right) < 0$ and $\frac{\partial \mathbb{E}[\pi_R^*]}{\partial \mu_d} = \frac{2K_0}{3\mu_d^2 \overline{c}} \left(\mu_d^3 - 2\overline{\beta}^3\right) > 0$.

A.1.7 Proof of Corollary 3

1. Bias. This result follows trivially from the fact that $b^{no-J} = 0$, while β^* (or equivalently b^*) is weakly positive.

2. Asset positions.

   (a) Readers. Without a journalist, the average asset position is equal to $\mathbb{E}[x_R^{no-J}] = \mathbb{E}\left[\frac{-\delta}{\kappa(\chi+1)}\right] = 0$. With a journalist, the average asset position is equal to $\mathbb{E}[x_R] = \mathbb{E}\left[\frac{\pi_R(\beta+\delta)-\delta}{\kappa(\chi+1)}\right] = \mathbb{E}\left[\frac{\pi_R(\beta+\delta)}{\kappa(\chi+1)}\right]$. Hence, the incremental impact of the journalist is given by:

   $$\mathbb{E}\left[x_R - x_R^{no-J}\right] = \frac{K_0}{\kappa(\chi+1)\overline{c}}\mathbb{E}\left[(\delta^2 - \beta^2)(\delta + \beta)\right] > 0 \qquad \text{(A.13)}$$

   where we used that $\delta^2 \geq \beta^2$ and the distribution of β (as a function of δ) derived in Proposition 2.

   (b) Sophisticated traders. Without a journalist, the average asset position is equal to $\mathbb{E}[x_S^{no-J}] = \mathbb{E}\left[\frac{\delta\chi}{\kappa\chi+\kappa}\right] = 0$. With a journalist, the average asset position is equal to $\mathbb{E}[x_S] = \mathbb{E}\left[\frac{\chi\left(\delta-\pi_R(\beta+\delta)\right)}{\kappa(\chi+1)}\right] = \mathbb{E}\left[\frac{-\chi\pi_R(\delta+\beta)}{\kappa(\chi+1)}\right]$. Hence, the incremental impact of the journalist is given by:

   $$\mathbb{E}\left[x_S - x_S^{no-J}\right] = \frac{-\chi K_0}{\kappa(1+\chi)\overline{c}}\mathbb{E}\left[(\delta^2 - \beta^2)(\delta + \beta)\right] < 0 \qquad \text{(A.14)}$$

   where we again used that $\delta^2 \geq \beta^2$ and the distribution of β (as a function of δ) derived in Proposition 2.

3. Welfare.

   (a) Reader welfare. We start with the $t = 1$ expected utility from Lemma 1. Then, we take an expectation over the journalist's reporting cost c, which yields $\mathbb{E}[U_R|\delta,\beta] = \frac{\kappa\sigma_u^2}{2(1+\chi)^2} - K_0\left(\pi_R\beta^2 + (1-\pi_R)\delta^2\right)$. As a next step, we plug in

$\pi_R = \frac{K_0}{\overline{c}} \left(\delta^2 - \beta^2\right)$, which leads to:

$$\mathbb{E}[U_R|\delta, \beta] = \frac{\kappa\sigma_u^2}{2(1+\chi)^2} - K_0 \left(\delta^2 - \frac{K_0}{\overline{c}} \left(\delta^2 - \beta^2\right)^2\right). \tag{A.15}$$

Next, we can use $\mathbb{E}[\delta^2] = \frac{1}{3}\mu_d^2$ and the expression for β^* in Proposition 2 to solve for $\mathbb{E}\left[U_R\right]$ in closed-form.

Moreover, we can compute the incremental impact of the journalist on reader welfare as:

$$\mathbb{E}\left[U_R - U_R^{no-J}\right] = \frac{K_0^2}{\overline{c}} \mathbb{E}\left[\left(\delta^2 - \beta^2\right)^2\right] > 0. \tag{A.16}$$

(b) Sophisticated trader welfare. We again start with the expression in Lemma 1 and take expectations over c to obtain $\mathbb{E}[U_R|\delta, \beta] = \frac{\kappa\sigma_u^2}{2(1+\chi)^2} + K_0 \left(\pi_R \beta^2 + (1-\pi_R)\delta^2\right)$, which can be re-written as:

$$\mathbb{E}[U_S|\delta, \beta] = \frac{\kappa\sigma_u^2}{2(1+\chi)^2} + K_0 \left(\delta^2 - \frac{K_0}{\overline{c}} \left(\delta^2 - \beta^2\right)^2\right). \tag{A.17}$$

The incremental effect of the journalist on sophisticated traders is thus given by:

$$\mathbb{E}\left[U_S - U_S^{no-J}\right] = -\frac{K_0^2}{\overline{c}} \mathbb{E}\left[\left(\delta^2 - \beta^2\right)^2\right] < 0. \tag{A.18}$$

4. Expected stock price. Again, we first compute the expected stock price conditional on (δ, β) by integrating over the journalist's reporting cost:

$$\mathbb{E}[p|\delta, \beta] = \mu_d + \frac{1}{1+\chi}\delta + \frac{\chi K_0}{(1+\chi)\overline{c}} \left(\delta^2 - \beta^2\right)\left(\delta + \beta\right) \tag{A.19}$$

It follows that the incremental effect of the journalist on $\mathbb{E}[p]$ is given by:

$$\mathbb{E}\left[p - p^{no-J}\right] = \frac{\chi K_0}{(1+\chi)\overline{c}} \mathbb{E}\left[\left(\delta^2 - \beta^2\right)\left(\delta + \beta\right)\right] > 0, \tag{A.20}$$

where we used that $\delta^2 \geq \beta^2$ and the distribution of β (as a function of δ) derived in Proposition 2.

The difference in the expected price conditional on $\delta > 0$ or $\delta < 0$ is given by:

$$\begin{aligned}
\mathbb{E}\left[p - p^{no-J}|\delta > 0\right] &= \frac{\chi K_0}{(1+\chi)\overline{c}}\mathbb{E}\left[\left(\delta^2 - \beta^2\right)\left(\delta + \beta\right)|\delta > 0\right] = \\
&= \frac{\chi K_0}{12(1+\chi)\overline{c}}\left(\frac{27\overline{\beta}^4}{\mu_d} - 6\overline{\beta}^2\mu_d - 12\overline{\beta}^3 + 4\overline{\beta}\mu_d^2 + 3\mu_d^3\right) > 0
\end{aligned} \tag{A.21}$$

because $\mu_d > 3\overline{\beta}$.

$$\begin{aligned}
\mathbb{E}\left[p - p^{no-J}|\delta < 0\right] &= \frac{\chi K_0}{(1+\chi)\overline{c}}\mathbb{E}\left[\left(\delta^2 - \beta^2\right)\left(\delta + \beta\right)|\delta < 0\right] = \\
&= \frac{\chi K_0}{(1+\chi)\overline{c}}\frac{(\overline{\beta} - \mu_d)^3(5\overline{\beta} + 3\mu_d)}{12\mu_d} < 0
\end{aligned} \tag{A.22}$$

because $\mu_d > 3\overline{\beta}$.

5. Price Drift and Quality.

   (a) Price Drift. Conditional on δ (or d), we can express price drift as:

$$\Omega(\delta) = \frac{\chi}{1+\chi}\left[\pi_R(\beta + \delta) - \delta\right] = \frac{\chi}{1+\chi}\left[\frac{K_0}{\overline{c}}\left(\delta^2 - \beta^2\right)(\delta + \beta) - \delta\right]. \tag{A.23}$$

   Thus the incremental effect of the journalist on price drift is given by:

$$\Omega(\delta) - \Omega^{no-J} = \frac{\chi}{1+\chi}\frac{K_0}{\overline{c}}\left(\delta^2 - \beta^2\right)(\delta + \beta) \tag{A.24}$$

   which is positive (negative) if $\delta > 0$ ($\delta < 0$) given that $\delta^2 \geq \beta^2$. Plugging in β and integrating over $\delta \sim U\left(-\mu_d, \mu_d\right)$ leads to the unconditional impact:

$$\mathbb{E}\left[\Omega(\delta) - \Omega^{no-J}\right] = \frac{K_0\chi\bar{\beta}\left(4\bar{\beta}^3 - 3\bar{\beta}^2\mu_d + \mu_d^3\right)}{3(\chi+1)\bar{c}\mu_d} > 0. \tag{A.25}$$

(b) Price Quality. Conditional on δ (or d), we can express price quality as:

$$\begin{aligned}\Lambda(\delta) &= -\frac{1}{(1+\chi)^2}\mathbb{E}\left[\pi_R\left(\kappa u+\chi\beta\right)^2+(1-\pi_R)\left(\kappa u-\chi\delta\right)^2|\delta\right]\\ &= -\frac{1}{(1+\chi)^2}\left(\kappa^2\sigma_u^2+\chi^2\right)\delta^2+\pi_R(\beta^2-\delta^2))\Big)\\ &= -\frac{1}{(1+\chi)^2}\left(\kappa^2\sigma_u^2+\frac{\chi^2\mu_d^2}{3}-\frac{K_0\chi^2}{\overline{c}}\left(\delta^2-\beta^2\right)^2\right). \end{aligned} \tag{A.26}$$

Thus the incremental effect of the journalist on price quality is given by:

$$\Lambda(\delta)-\Lambda^{no-J}=\frac{\chi^2}{(1+\chi)^2}\times\frac{K_0}{\overline{c}}\left(\delta^2-\beta^2\right)^2\geq 0. \tag{A.27}$$

Therefore, the introduction of the journalist increases price quality for a given δ and, as a result, unconditionally: $\mathbb{E}\left[\Lambda(\delta)-\Lambda^{no-J}\right]>0$.

A.2 Derivations for Extensions

A.2.1 Alternative Media Objective: Relevance vs. Accuracy

As in the main model, we can express the firm's objective function equivalently as $\tilde{p}_0=\pi_R(\delta+\beta)$ with $\pi_R=\mathbb{P}\left(\phi_1\delta^2-\beta^2>c\right)$. To ensure that $\pi_R\in[0,1)$, we assume that $\overline{c}>\phi_1\mu_d^2$. Furthermore, note that $\pi_R=0$ if $\beta\geq\sqrt{\phi_1}|\delta|$. As before, we can restrict the support for β to $\left[0,\min\left(\overline{\beta},\sqrt{\phi_1}|\delta|\right)\right]$ because all $\beta>\sqrt{\phi_1}|\delta|$ lead to the same value for the firm's objective. The simplify the exposition, we assume $\overline{\beta}>\sqrt{\phi_1}\mu_d$ in this extension.

The first and second derivative for the firm's objective are given by:

$$\frac{\partial\tilde{p}_0}{\partial\beta}=\frac{1}{\overline{c}}\left(\phi_1\delta^2-2\beta\delta-3\beta^2\right) \tag{A.28}$$

and

$$\frac{\partial^2\tilde{p}_0}{\partial\beta^2}=-\frac{2}{\overline{c}}\left(\delta+3\beta\right), \tag{A.29}$$

respectively.

1. If $\delta>0$, there is a unique interior optimum with $\beta^*=\frac{1}{3}\delta\left(\sqrt{3\phi_1+1}-1\right)$.

2. If $\delta\leq 0$, the optimal β depends on ϕ.

(a) If $\phi_1 < 1$, $\beta^* = \sqrt{\phi_1}|\delta|$.

(b) If $\phi_1 \geq 1$, $\beta^* = -\frac{1}{3}\delta\left(\sqrt{3\phi_1+1}+1\right)$.

The equilibrium reporting probability follows directly from $\pi_R^* = \frac{1}{c}\left(\phi_1\delta^2 - (\beta^*)^2\right)$:

$$\pi_R^* = \begin{cases} \frac{2\delta^2\left(3\phi_1+\sqrt{3\phi_1+1}-1\right)}{9\overline{c}} & \text{if } \delta > 0 \\ \frac{2\delta^2\left(3\phi_1-\sqrt{3\phi_1+1}-1\right)}{9\overline{c}} & \text{if } \delta \leq 0 \text{ if } \phi_1 \geq 1 \\ 0 & \text{if } \delta \leq 0 \text{ if } \phi_1 < 1. \end{cases} \tag{A.30}$$

It immediately follows that $\frac{\partial \pi_R^*}{\partial \phi_1} \geq 0$ and $\frac{\partial b^*}{\partial \phi_1} \geq 0$.

Price quality is given by:

$$\Lambda(\delta) = \begin{cases} \frac{-\chi^2}{(1+\chi)^2}\left(\kappa^2\sigma_u^2 + \delta^2 - \frac{(\beta^2-\delta^2)(\beta^2-\delta^2\phi_1)}{\overline{c}}\right) & \text{if } \delta > 0 \\ \frac{-\chi^2}{(1+\chi)^2}\left(\kappa^2\sigma_u^2 + \delta^2 - \frac{(\beta^2-\delta^2)(\beta^2-\delta^2\phi_1)}{\overline{c}}\right) & \text{if } \delta \leq 0 \text{ and } \phi_1 \geq 1 \\ \frac{-\chi^2}{(1+\chi)^2}\left(\kappa^2\sigma_u^2 + \delta^2\right) & \text{if } \delta > 0 \text{ and } \phi_1 < 1. \end{cases} \tag{A.31}$$

Plugging in the optimal β, we can show that:

$$\frac{\partial \Lambda}{\partial \phi_1} \begin{cases} \geq 0 & \text{if } \delta > 0 \text{ and } \phi_1 \leq \overline{\phi} \text{ and } \frac{\partial \Lambda}{\partial \phi_1} < 0 \text{ otherwise} \\ \leq 0 & \text{if } \delta \leq 0 \text{ and } \phi_1 \geq 1 \\ = 0 & \text{if } \delta \leq 0 \text{ and } \phi_1 < 1 \end{cases} \tag{A.32}$$

Note that $\overline{\phi}$ solves $-12\overline{\phi} + \frac{9\overline{\phi}+7}{\sqrt{3\overline{\phi}+1}} + 20 = 0$.

Finally, we can compute the utility gain for readers. We have shown in Appendix A.1.7 that the incremental effect of the journalist on reader utility is given by $\Delta U_R \equiv \mathbb{E}[U_R - U_R^{no-J}|\delta, \beta] = K_0\pi_R\left(\delta^2 - \beta^2\right)$. We can plug in the equilibrium bias and reporting probability to get:

$$\Delta U_R = \begin{cases} \frac{2K_0}{81\overline{c}}\delta^4\left(\sqrt{3\phi_1+1}+3\phi_1-1\right)\left(2\sqrt{3\phi_1+1}-3\phi_1+7\right) & \text{if } \delta > 0 \\ \frac{2K_0}{81\overline{c}}\delta^4\left(\sqrt{3\phi_1+1}-3\phi_1+1\right)\left(2\sqrt{3\phi_1+1}+3\phi_1-7\right) & \text{if } \delta \leq 0 \text{ and } \phi_1 \geq 1 \\ 0 & \text{if } \delta \leq 0 \text{ and } \phi_1 < 1 \end{cases} \tag{A.33}$$

It follows that $\Delta U_R \leq 0$ if $\delta \leq 0$. If $\delta > 0$, ΔU_R is positive if $\phi_1 < 5$ and (weakly) negative otherwise.

A.2.2 Alternative Media Objective: Loss Aversion

As before, we can write the firm's objective function as $\tilde{p}_0 = \pi_R \left(\delta + \beta\right)$ with

$$\pi_R = \begin{cases} \mathbb{P}\left(\Delta_R > c\right) & \text{if } \delta > 0 \\ \mathbb{P}\left(\Delta_R + \phi_0 \delta^2 > c\right) & \text{if } \delta < 0 \end{cases} \tag{A.34}$$

with $\Delta_R = K_0 \left(\delta^2 - \beta^2\right)$. To ensure that $\pi_R \in [0, 1)$, we assume that $\overline{c} > \left(K_0 + \phi_0\right) \mu_d^2$. Furthermore, we know that $\pi_R = 0$ for all $\beta \geq \sqrt{1 + \frac{\phi_0 \mathbf{1}_{\delta<0}}{K_0}}|\delta|$. Thus, we can restrict the support for β to $\left[0, \min\left(\overline{\beta}, \sqrt{1 + \frac{\phi_0 \mathbf{1}_{\delta<0}}{K_0}}|\delta|\right)\right]$. To simplify the exposition, we assume $\overline{\beta} > \sqrt{1 + \frac{\phi_0}{K_0}}\mu_d$ in this extension.

The first and second derivative for the firm's objective are given by:

$$\frac{\partial \tilde{p}_0}{\partial \beta} = \begin{cases} \frac{K_0}{\overline{c}} \left(\delta^2 - 2\beta\delta - 3\beta^2\right) & \text{if } \delta > 0 \\ \frac{K_0}{\overline{c}} \left(\left(1 + \frac{\phi_0}{K_0}\right) \delta^2 - 2\beta\delta - 3\beta^2\right) & \text{if } \delta < 0 \end{cases} \tag{A.35}$$

and

$$\frac{\partial^2 \tilde{p}_0}{\partial \beta^2} = -\frac{2K_0}{\overline{c}} \left(\delta + 3\beta\right), \tag{A.36}$$

respectively.

1. If $\delta \geq 0$, there is a unique interior optimum at $\beta^* = \frac{1}{3}\delta$.

2. If $\delta < 0$, there is a unique interior optimum at $\beta^* = -\frac{1}{3}\delta \left(\sqrt{4 + 3\frac{\phi_0}{K_0}} + 1\right)$.

The equilibrium reporting probability follows directly from $\pi_R^* = \frac{1}{\overline{c}} \left(\Delta_R + \phi_0 \delta^2 \mathbf{1}_{\delta<0}\right)$:

$$\pi_R^* = \begin{cases} \frac{8}{9}\frac{K_0}{\overline{c}}\delta^2 & \text{if } \delta > 0 \\ \frac{2}{9}\frac{\left(2K_0 + 3\phi_0 - \sqrt{K_0\left(4K_0 + 3\phi_0\right)}\right)}{\overline{c}}\delta^2 & \text{if } \delta < 0. \end{cases} \tag{A.37}$$

It follows that the reporting probability for a fixed spread $\delta_1 > 0$ and $\delta_2 = -\delta_1$ satisfies:

$$\pi_R(\delta = \delta_1) < \pi_R(\delta = \delta_2) \Leftrightarrow \phi_0 > \frac{5}{3}K_0 \equiv \overline{\phi}_0, \tag{A.38}$$

where $K_0 = \frac{1+2\chi}{2\kappa(1+\chi)^2}$.

A.2.3 Endogenous Media Skill

We first solve for the equilibrium $\mathcal{D}_R$ and $\mathcal{D}_\alpha$. Then, we solve for the equilibrium bias at $t = 0$. The journalist's problem is given by:

$$\max_{\{\mathcal{D}_R, \mathcal{D}_\alpha\}} \mathbb{E}[U_R|\mathcal{I}_J] - \mathcal{D}_R c - \mathcal{D}_\alpha c_\alpha. \tag{A.39}$$

The expected reader utility follows directly from the derivations in the main model and is equal to:

$$\mathbb{E}[U_R|\mathcal{I}_J] = \begin{cases} \frac{\kappa\sigma_u^2}{2(\chi+1)^2} & \text{if } \mathcal{D}_R = 1, \mathcal{D}_\alpha = 1 \\ \frac{\kappa^2\sigma_u^2-(1-\alpha_0)^2b^2(2\chi+1)}{2\kappa(\chi+1)^2} & \text{if } \mathcal{D}_R = 1, \mathcal{D}_\alpha = 0 \\ \frac{\kappa^2\sigma_u^2-(2\chi+1)\delta^2}{2\kappa(\chi+1)^2} & \text{if } \mathcal{D}_R = 0, \mathcal{D}_\alpha = 1 \\ \frac{\kappa^2\sigma_u^2-(2\chi+1)\delta^2}{2\kappa(\chi+1)^2} & \text{if } \mathcal{D}_R = 0, \mathcal{D}_\alpha = 0. \end{cases} \tag{A.40}$$

It follows directly that $\mathcal{D}_R = 0, \mathcal{D}_\alpha = 1$ is strictly dominated by $\mathcal{D}_R = 0, \mathcal{D}_\alpha = 0$, i.e. the journalist never wants to de-bias perfectly if she does not report.

For a given b and δ, the journalist's optimal choices are given by:

$$\{\mathcal{D}_R^*, \mathcal{D}_\alpha^*\} = \begin{cases} \{1,1\} & \text{if } K_0\delta^2 > c + c_\alpha \text{ and } (1-\alpha_0)^2b^2K_0 > c_\alpha \\ \{1,0\} & \text{if } K_0\delta^2 > c + (1-\alpha_0)^2b^2K_0 \text{ and } (1-\alpha_0)^2b^2K_0 \leq c_\alpha \\ \{0,0\} & \text{otherwise.} \end{cases} \tag{A.41}$$

where $K_0 = \frac{1+2\chi}{2\kappa(1+\chi)^2}$.

As in the main model, the firm maximizes the expected stock price by choosing $b \in [0, \overline{b}]$. As a first step, we will rule out some values for b. In particular, we define $\hat{b} \equiv \sqrt{\frac{c_\alpha}{K_0(1-\alpha_0)^2}}$ and assume that $\overline{b} > \hat{b}$. Note that for any $b > \hat{b}$, the journalist either reports and de-biases perfectly or does not report. In either case, the firm's objective is independent of b and can be written as:

$$p(\delta, \tilde{b}) = \mu_d + \frac{1}{1+\chi}\delta + \frac{\chi}{(1+\chi)\overline{c}}\left(K_0\delta^2 - c_\alpha\right)\delta \tag{A.42}$$

for any $\tilde{b} \in \left(\hat{b}, \overline{b}\right]$. Next, we evaluate the firm's objective at $b = \hat{b}$ for $|\delta| \leq \hat{b}$:

$$\begin{aligned} p(\delta, \hat{b}) &= \mu_d + \frac{1}{1+\chi}\delta + \frac{\chi}{(1+\chi)\overline{c}}K_0\left(\delta^2 - (1-\alpha_0)^2\hat{b}^2\right)(\delta + (1-\alpha_0)\hat{b}) \\ &= \mu_d + \frac{1}{1+\chi}\delta + \frac{\chi}{(1+\chi)\overline{c}}\left(K_0\delta^2 - c_\alpha\right)\left(\delta + \sqrt{\frac{c_\alpha}{K_0}}\right) > p(\delta, \tilde{b}). \end{aligned} \tag{A.43}$$

If $|\delta| > \hat{b}$, $\pi_R = 0$ and $p(\delta, \hat{b}) = p(\delta, \tilde{b})$.

We can thus see that the firm is always better off avoiding values of b in the interval $\left(\hat{b}, \overline{b}\right]$ such that the firm's objective can be written as $\max_{b\in[0,\hat{b}]} \mathbb{E}[p|d]$. Hence, we can derive the equilibrium values for b and π_R as in the main model, with $\hat{b}$ replacing $\overline{b}$.

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