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JEL Classification: D62, D82, D84, G30

Keywords: Speculation, Manipulation, Superstar firms, Unicorns, Market efficiency, Stakeholders, High-skilled employees, Misallocation of resources, transparency

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How Financial Markets Create Superstars*

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November 25, 2022

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1 Introduction

A fundamental principle of financial economics is that firms' valuations are forward-looking and reflect their growth prospects. However, the high valuations of many firms precede the acquisition of capital and key stakeholders, such as talented employees, business partners, and investors, whose capital and expertise are instrumental to success. In such cases, high valuations not only reflect but can also lead to a higher likelihood of success by attracting stakeholders who rationally infer from the high stock prices that a firm's prospects are good. Tesla, labeled by Forbes a "$1 Trillion of Speculation" (Trainer, 2021), is a case in point. Three years after its IPO in 2010, Tesla was beset by production difficulties. Yet, with a stock price ten times its IPO level, the firm had become a magnet for investors and engineers, whose capital and expertise subsequently transformed it into a superstar.

It is hardly surprising that firms can benefit when high valuations attract employees, business partners, and investors (henceforth, "*stakeholders*"). It is also hardly surprising that these stakeholders consider a firm's stock price when offered equity or other contracts dependent on the firm's success (Subrahmanyam and Titman, 2001; Liang, Williams, and Xiao, 2021).[1] However, an open question is whether this feedback channel from prices to stakeholders' decisions can be abused when uninformed speculators — i.e., speculators without any private information about firm fundamentals — inflate the firm's valuation. In this paper, we show that such speculation can, indeed, be very profitable even when everyone is *rational* and anticipates such strategies. In particular, uninformed speculators profit from inflating prices, as that helps firms "fake it till they make it" by attracting capital, business, and employees that make the firms better. This comes at the expense of the truly good firms in the economy and leads to a misallocation of resources.

Silicon Valley offers numerous examples of high valuations helping firms fake it till they (sometimes) make it, despite concerns about inflated valuations.[2] Before its spectacular collapse, Theranos managed to attract over 800 highly skilled employees and raise capital in multiple investment rounds even after top scientists worldwide repeatedly voiced concerns about its technology. Similarly, WeWork's employees recount that high valuations encouraged them to believe that "it was going to be a rocket ship" despite widespread warnings in the popular media.[3] The same employees subsequently felt "shortchanged on salary" as the firm postponed its IPO and the value of their equity-based pay collapsed (Sharf and Jeans, 2020).

This phenomenon also manifests itself in public markets. For example, buoyed by a

[1] For further evidence that a firm's profitability and stock price is of first-order importance for prospective stakeholders, see Turban and Greening (1997), Bergman and Jenter (2007), and Agrawal and Matsa (2013).

[2] Gompers et al. (2020) report that over 90% of VCs consider most unicorns to be overvalued.

[3] See "WeWork is arguably the most overvalued company in the world," May 15, 2017, *Business Insider*.

steadily increasing stock price, Wirecard doubled its employee count between 2016 and 2019, secured a €150 million loan from Deutsche Bank, backed by its founder's equity in the firm, and raised €900 million in equity from SoftBank. Wirecard managed to pull this off, despite a series of contemporaneous articles in the *Financial Times* criticizing the firm's business model and exposing its fraudulent accounting practices.[4] A steady stock price increase also helped GameStop raise over a billion dollars of new equity in 2021 and poach top-level executives from Amazon and Chewy — including in the CEO and CFO positions — with generous equity packages.[5] And in its 2020 annual report, Nikola (another firm accused of faking success) explicitly discussed the importance of high stock prices to attract stakeholders.

Our result that inflating a firm's stock price can be profitable for uninformed speculators without any inventory in the firm's stock fills a gap in the literature that studies the real effects of financial markets. Notably, this literature has argued that inflating prices without positive information about firm fundamentals cannot be profitable when prices guide internally-funded investment decisions (Goldstein and Guembel, 2008). What explains the difference in predictions is that we incorporate the classical corporate finance problem that a firm must attract outside stakeholders (such as employees, business partners, and investors) to realize its growth prospect. As a result, the focus shifts from how stock prices help firms decide whether to pursue *internally-funded* investments to how stock prices affect the firm's ability to attract the *outside third parties* needed to realize these investments.

To formalize the main intuition behind our results, we develop a model in which the release of news about a firm triggers trading in its stock in financial markets. A market maker sets prices, anticipating that the order flows may come from noise traders or speculators. We use the term "speculators" to refer to strategic profit-motivated players whose entry is endogenous. Notably, these investors have a long-term focus and, thus, include not only hedge funds but also buy-and-hold investors. These speculators may or may not be able to infer the firm's true prospects from the released news, giving rise to either informed or uninformed strategic trading. The firm's prospects depend on whether it can attract crucial stakeholders who have outside opportunities. Being outsiders, these prospective stakeholders make rational inferences about the firm's prospects from its stock price.

Based on this setting, we show why and when uninformed speculators can profit from

[4] See "The House of Wirecard", April 27, 2015, *Financial Times*.

[5] According to GameStop's 2021 financial reports, its new CEO's and CFO's fixed pay was 85% lower than that of their predecessors, while bonus and equity pay had increased severalfold. Note that we do not refer to the short-run surge and crash in GameStop's stock price in January 2021 but to the subsequent long-lasting price increase. See " *GameStop's Earnings Don't Justify Its Price, But Investors Don't Care*," June 23, 2021, *Business Insider*.

inflating a firm's stock price by placing buy orders as if they had positive information about the firm's prospects. What is important is that stakeholders are rational and break even in expectation. Specifically, they require compensation for the probability of facing a firm with an inflated valuation. This means that firms with better prospects are pooled with firms with inflated stock prices whose prospects are not as good, implying that the former type of firms cross-subsidizes the latter type. Because of this cross-subsidization, firms with worse prospects can make a profit when inflated stock prices help them attract stakeholders at a low cost. As a result, an uninformed speculator can also make a profit from inflating stock prices, as she does not fully internalize the cost of inflating the price of the wrong firm. In short, inflating prices comes at the expense of firms with better prospects that end up cross-subsidizing those with worse prospects.

For an uninformed speculator to make a profit, she needs to trade over multiple periods. This is needed, as rational stakeholders will believe that high stock prices reflect positive information only if the firm's price is above the level consistent with the information of uninformed parties (such as themselves or uninformed speculators). Hence, uninformed speculators make trading losses when inflating prices to such levels, implying that they cannot profit from a single trading round. However, as long as trading takes place over multiple periods and prices initially adjust slowly, speculators can profit from executing their initial trades at low prices. That is, the speculator's profit is derived from her private information that she will continue inflating the firm's stock price, while the market maker is uncertain about whether the buy pressure will continue and positive feedback effects will kick in.

Our model generates clear predictions about which firms are likely to be the targets of uninformed speculators. For uninformed speculators to profit from inflating a firm's stock price, a necessary condition is that the firm offers stakeholders contracts linked to firm value, such as equity. Otherwise (with contracts that do not depend on firm success), there is no cross-subsidization across firms, leading uninformed speculators to internalize the cost of inflating the price of the wrong firm and making such speculation unprofitable. Thus, in line with the cited anecdotal evidence, potential targets of speculative trading will be firms that offer employees significant performance or equity-based pay or firms that seek equity financing to fund investments.[6] Since speculators target promising firms with uncertainty about their growth prospects, we further expect that the likely targets of speculators will be growth firms, newly-public firms, or firms in transition.

We also study the market conditions under which uninformed speculation can arise. For

[6] Though outside of our model, firms may offer such contracts for incentive reasons, to align risk preferences, or because collateral constraints or the risk and cash flow profile of their investment opportunities limit their ability to issue riskless debt.

uninformed speculators to profit when an inflated stock price triggers feedback effects, market conditions need to be "normal" (i.e., neither hot nor cold) as captured by the stakeholders' prior beliefs about the firm's prospects. Intuitively, uninformed speculators can profit from inflating the firm's stock price only if that facilitates sufficiently large cross-subsidization across firms. However, the scope for such cross-subsidization is limited if the stakeholders' prior beliefs are already very positive, such as in hot markets. Stakeholders' prior beliefs cannot be very negative either, as it is then very hard to inflate stock prices to a sufficiently high level to attract stakeholders. Similarly, "normal" can also refer to the stakeholders' outside options. If these options are very low, cross-subsidization has a minor impact on the firm's stock price, making it impossible for uninformed speculators to make a profit; and if the stakeholders' outside options are very high, the firm will not be able to attract stakeholders, especially when they anticipate that its stock price is artificially inflated.

Markets need to be "normal" also in terms of how costly or difficult it is to obtain information about a firm, as, for speculative trading to be profitable, prices need to be intermediately informative. Indeed, if prices are uninformative, speculation is unlikely to have real effects since prices will have little impact on the stakeholders' beliefs. On the other hand, speculators cannot make a profit if prices are very informative, as prices will react quickly to trading orders. Thus, intermediate costs of acquiring information will be the most conducive to speculation. An immediate implication is that the firm's choice of transparency can affect the likelihood that the firm becomes a target for speculative trading.

When firms manage to use high prices to build up their stakeholder base, reversals of (inflated) prices will only be partial. This is because, once triggered, positive feedback effects are hard to reverse, implying a persistent impact on a firm's prospects. This is easiest to see when we interpret stakeholders as capital providers: once a capital injection is sunk, it cannot be reclaimed. Price reversals (typically triggered by short-sellers) are difficult even if we interpret stakeholders as employees who can leave at any time. For example, this is the case if the value created by employees does not fully dissipate with their departure, and they have been promised a substantial bonus or equity pay that they would forgo by leaving. In such cases, if employees leave, the size of the pie might grow less than in the firm's best-case scenario. However, the pie is shared among fewer parties, mitigating the negative impact for the remaining equity holders. This makes short-selling less attractive.[7] The fact that reversing feedback effects is difficult, together with our insight that inflating prices is often

[7]There are other reasons why reversing positive feedback effects is hard. The positive externalities of being on a star team are likely to keep stakeholders, even if they observe less positive information. Leaving is also made difficult by contractual and non-compete agreements (Marx, Strumsky, and Flemming, 2009). Furthermore, employees are typically reluctant to leave after less than a year, as recruiters consider such short-tenured job-hopping a major red flag (Bullhorn, 2012; Fan and DeVaro, 2020).

the only type of uninformed speculation that can be profitable,[8] suggests that for uninformed speculators, profiting from inflating prices is easier than from undermining them.

Similar to uninformed speculators in secondary markets, uninformed investors in private (primary) markets also have the incentive to inflate a firm's valuation if that helps it attract key stakeholders. Specifically, we extend our model to consider the problem of an entrepreneur who raises capital from a venture capitalist before the firm goes public. Following arguments similar to those in the baseline model, we show that, in line with folk wisdom (Braithwaite, 2018; Owen, 2020; Taparia, 2020), the firm and the venture capitalist can profit from inflating the firm's valuation, as that helps it to "fake it till it makes it." Together with our baseline model, these results help explain why unicorns can be created in an apparent discrepancy with fundamentals in private markets (Gornall and Strebulaev, 2020) and why the "buzz" can persist and have a positive real effect on firm value in secondary markets.

Related Literature. Our paper relates primarily to the fast-growing literature studying feedback effects from secondary markets on firm value (Dow and Gorton, 1997; Bond, Edmans, and Goldstein, 2012; Goldstein, 2022). Building on Subrahmanyam and Titman (2001) and extensive work in strategic management (Fombrun and Shanley, 1990; Turban and Greening, 1997), we explore the feedback effect between a firm's stock price and its ability to attract key employees, business partners, and investors. Our main contribution is to show that this feedback effect can be triggered by uninformed speculation and to derive predictions about what type of firms and under what market conditions will be targeted.

Our result that uninformed speculators can profit from inflating stock prices is, perhaps, surprising, given that prior work has argued that such speculation cannot be profitable (Goldstein and Guembel, 2008; Edmans, Goldstein, and Jiang, 2015). The difference comes from the fact that in those papers, financial markets mislead *internally-funded* investment decisions, which always destroys shareholder value. As a result, even though trading on positive information is more profitable than trading on negative information (Edmans, Goldstein, and Jiang, 2015), uninformed speculators can profit only from short-selling (Goldstein and Guembel, 2008). By contrast, we show that uninformed speculative buying can be profitable, as high prices affect the decisions of *outside third parties*, such as investors or employees. Notably, the effect of prices on such third parties is also prominent in Goldstein, Ozdenoren, and Yuan's (2013) model of market frenzies, in which small traders with correlated information about firm fundamentals put more weight on such information in their trading since that affects the decisions of capital providers; however, there is no uninformed speculation in

[8] We show that if the firm cannot attract stakeholders without a positive feedback effect from stock prices, uninformed short-selling will have no real effect and will be unprofitable. By contrast, uninformed buying can be profitable.

their model. Our contribution is to show that inflated valuations help firms "fake it till they make it" at the expense of the good firms in the economy. Moreover, by showing that uninformed speculators can often profit only from inflating prices (and not from eroding prices) and providing clear predictions about the type of firms and the market conditions under which they are likely to be affected, we offer guidance for when regulators' primary concern should be the inefficiencies emerging from such speculation rather than from short-selling.[9]

Endogenizing feedback effects not only leads to additional predictions but also reverses some predictions based on exogenous feedback effects. In particular, we show that speculators with no pre-existing position in the firm can initiate profitable speculative trading. Thus, the scope for such trading is very large, as it is potentially open to anyone. By contrast, when feedback effects are exogenous, trading that inflates a firm's stock price is beneficial to speculators only if they already have a sufficiently large position in the firm (Khanna and Sonti, 2004), implying a limited scope for such speculation. More broadly, the feedback mechanism we describe contributes to work in which speculators pump up a firm's stock price (or engage in spoofing), hoping to sell at a higher price (Allen and Gorton, 1992; Chakraborty and Yilmaz, 2004; Skrzypacz and Williams, 2022). The main difference to such schemes is that speculative trading in our setting increases a targeted firm's fundamental value and may be driven by buy-and-hold investors.[10]

Our extension about private firms raising financing from a VC shares the premise of Khanna and Mathews (2016) that high valuations can help attract stakeholders to private firms by signaling good prospects. The main conceptual differences from Khanna and Mathews (2016) are that their model does not consider manipulation by uninformed investors; there is no misallocation of talent and resources; and "B" firms cannot be made into stars. By contrast, all of these aspects are central to our results that uninformed investors can profit from helping firms "fake it till they make it."

Our results that uninformed speculation is more likely to occur when firms' transparency is intermediate complements work on how transparency affects feedback effects of financial markets, which has focused mainly on how disclosure may crowd in or crowd out information production by traders (Gao and Liang, 2013; Goldstein and Yang, 2017, 2019). Though not

[9] Our result that reversing positive feedback effects is hard even when short-sellers have negative information *reinforces* the profitability of inflating prices. While we do not model how firms could respond when targeted by short-sellers, existing work suggests that endogenizing such responses will strengthen the asymmetry we predict. For example, large blockholders may trade against short-sellers (Khanna and Mathews, 2012), and managers may engage in stock repurchases (Campello, Matta, and Safi, 2020).

[10] Our focus on how stock prices can help attract talent differentiates our paper also from prior work that studies how feedback effects impact asset sales (Frenkel, 2020). Interestingly, Matta, Rocha, and Vaz (2020) show that speculators can benefit from shorting a firm's stock while buying its competitor's, and Ahnert, Machado, and Perreira (2022) argue that trading can affect the probability of receiving a government bailout.

our main focus, in our model, more transparency does not necessarily make prices more informative or increase firm value, as it can attract uninformed speculators. This insight adds to prior work showing that more transparency may undermine price efficiency and firm value (Banerjee, Davis, and Gondhi, 2018, 2022).[11]

2 Model

We consider a firm that tries to attract stakeholders to realize a growth opportunity. Stakeholders can be interpreted as high-quality employees or business partners, or, alternatively, as capital providers. The firm's stock is traded, and its price is set by a market maker depending on the trading orders. Prospective stakeholders infer the firm's prospects from its stock price, which guides their decision of whether to accept the contract offered by the firm. All players are risk neutral and maximize their profits, and there is no discounting. In what follows, we add more structure to this framework.

Timeline. There are four dates, $t \in \{0, 1, 2, 3\}$. At date $t = 0$, there is a penniless firm with an investment opportunity, the prospects of which depend on whether it can attract stakeholders and on the realization of a firm-specific shock $\omega \in \{G, B\}$. This shock is realized at the end of date $t = 0$, and it affects the investment opportunity's success probability.

There is a news release about the shock at date $t = 1$, which triggers trading at dates $t = 1$ and $t = 2$. There are two agents in the financial market: a trader ("she") and a market maker ("he"). The market maker does not have the specialized knowledge to interpret the news and infer ω. Furthermore, he cannot distinguish the type of trader he is facing. The ex ante probability of facing a noise trader who does not trade strategically is β. The probability of facing a strategic trader is $1-\beta$. Initially, we take β as given but later endogenize it (Section 3.3.3). It is common knowledge that the trader and her type are the same in both periods.

The probability that a speculator can interpret the news as a signal s about the firm-specific shock ω depends on the firm's level of transparency α, which maps into the probability of informed trading. Specifically, with probability α, the speculator's knowledge about the firm is sufficient, and her signal perfectly reveals ω. With probability $1 - \alpha$, the speculator's signal is pure noise (i.e., $s = \varnothing$).[12] Intuitively, if the firm is more transparent, it

[11] More broadly, our result that uninformed trading affects the firm's fundamental value by attracting stakeholders adds to other mechanisms through which trading affects shareholder value, such as by affecting shareholders' incentives to intervene to discipline management (Maug, 1998), to vote (Levit, Malenko, and Maug, 2020), to exert pressure through the threat of exit (Edmans and Manso, 2011), and to use short-term debt (Voss, 2022).

[12] To give an example, suppose that there is news that the firm's CFO resigns. Noise traders and the market maker do not know how to interpret this news, but strategic traders, who closely follow the firm,

is easier for the speculator to infer useful information from the news (e.g., Fishman and Hagerty, 1989; Banerjee, Davis, and Gondhi, 2018). Note that unlike the bulk of the literature, our model does not need to assume that financial markets are better-informed than the firm's management about the firm's prospects; what matters for our mechanism is that financial markets are more informed than prospective stakeholders.[13]

At date $t = 3$, the firm offers a contract to prospective stakeholders who need to be compensated for forgoing $\overline{w}$. If we interpret stakeholders as employees or business partners, $\overline{w}$ can be interpreted as an outside option; and if we interpret stakeholders as capital providers, $\overline{w}$ can be interpreted as their investment amount. Prospective stakeholders observe the firm's stock price, form their beliefs about the expected compensation given the contract offered by the firm, and decide whether to accept it.

In Section 5, we extend this baseline model by introducing an additional period at which the firm raises start-up capital. We relegate the details of this extension to Section 5.

Projects and Contracting. If the firm attracts stakeholders, it has a probability λ_ω of becoming a "star" and generating $x > 0$. This probability is higher if the shock is good, i.e., $\lambda_G - \lambda_B =: \Delta\lambda > 0$. If the firm does not attract stakeholders, it generates low cash flow $y \geq 0$, where $x - y := \Delta y > 0$. It is common knowledge that the ex-ante probability that the shock is good ($\omega = G$) is q_0, and the probability that the shock is bad ($\omega = B$) is $1 - q_0$. We assume that the present value from attracting stakeholders is greater than stakeholders' outside option only if $\omega = G$, i.e.,

$$y + \lambda_B \Delta y < \overline{w} < y + \lambda_G \Delta y.$$

Contracting with prospective stakeholders involves offering a payment of R to stakeholders that the firm pays regardless of the cash flow realized at $t = 3$ and an additional payment ΔR that the firm pays on top of R in the high cash flow state. As is standard, we assume that all parties are protected by limited liability and that contracts are monotone, i.e., $0 \leq R \leq y$ and $0 \leq \Delta R \leq \Delta y$.[14] The latter monotonicity assumptions ensure that no party has incentives to sabotage the firm (Innes, 1990). Once the firm attracts stakeholders, its project is implemented, and all cash flows are realized. In Section 4, we extend this baseline model to consider stakeholders leaving the firm after they have joined.

might be able to infer the news's true information content.

[13]That is, the speculator's information can also be about firm fundamentals. Instead, in the literature in which outsiders are better informed than managers, the speculator's information is typically about generic aspects such as market demand, industry trends, or competition (see Bond et al., (2012) for an overview).

[14]We can further relax the assumptions that the firm is penniless and that the project's cash flows are binary. Ultimately, all that will matter for our analysis is that the firm offers state-contingent contracts.

Trading in the Financial Market. Following Glosten and Milgrom (1985), we assume that the market maker sets a bid and an ask price at which he is willing to sell or buy one unit of the stock.[15] The price is equal to the firm's expected value, conditional on the information revealed by the order flow, D_t. Price p_{D_1} at $t = 1$ is conditional on the order flow, D_1, at $t = 1$, and price $p_{D_1 D_2}$ at $t = 2$ is conditional on the order flows at $t = 1$ and $t = 2$. The market maker absorbs the trading flow out of his inventory.

We restrict attention to market orders of the form $D_t \in \{-1, 0, 1\}$, i.e., the trader can buy, (short) sell one unit, or do nothing. After observing signal s, the speculator submits an order $D_1 \in \{-1, 0, 1\}$ at date $t = 1$. The speculator's trading order $D_2 \in \{-1, 0, 1\}$ at $t = 2$ can be contingent not only on signal s but also on the trading strategy at date $t = 1$. We assume that noise traders are non-strategic and submit a trading order equal to -1, 0, or 1 with equal probability. Before trading starts at $t = 1$, the trader has neither long nor short positions in the firm.

Equilibrium Concept. The equilibrium concept is perfect Bayesian equilibrium, where the speculator submits her trading orders to maximize her expected final-period payoff

$$\max_{D_{1,2} \in \{-1,0,1\}} \left(y - R + \left(\lambda_B + q\left(s\right)\Delta\lambda\right)\left(\Delta y - \Delta R\right) - p_{D_1}\right) D_1 \\ + \left(y - R + \left(\lambda_B + q\left(s\right)\Delta\lambda\right)\left(\Delta y - \Delta R\right) - p_{D_1 D_2}\right) D_2$$

subject to: (i) her beliefs $q(s)$ at the time of contracting, where $q(B) = 0$, $q(\varnothing) = q_0$, and $q(G) = 1$; (ii) the market maker's price-setting rule p_{D_1} and $p_{D_1 D_2}$, which conditions on the order flow D_1 and D_2 and allows the market maker to break even in expectation; (iii) the prospective stakeholders' participation constraint

$$R + \left(\lambda_B + q_{D_1 D_2}\Delta\lambda\right)\Delta R \geq \overline{w}, \tag{1}$$

where, with some abuse of notation, $q_{D_1 D_2} := q(p_{D_1 D_2})$ denotes the stakeholders' posterior beliefs that the firm-specific shock is $\omega = G$. This short-hand notation makes it explicit that the beliefs depend on the prices, which depend on the order flow observed by the market maker in the financial market; (iv) all players use Bayes' rule to update their beliefs; and (v) all players are rational, and their beliefs about the other players' strategies are correct in equilibrium. We restrict attention to pure strategies (except for the noise trader). Figure 1 summarizes the model.

[15] In a previous working paper version, we show that our main findings also persist in a setting based on Kyle (1985), in which there are two traders — one noise trader and one speculator who is informed with probability α and uninformed with probability $(1 - a)$.

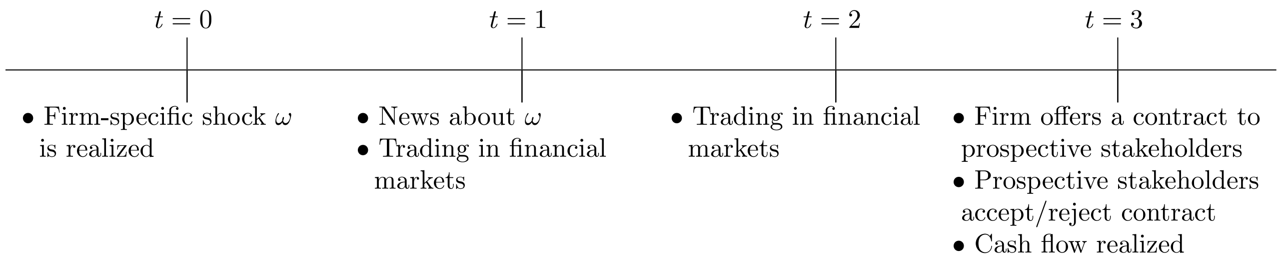

Figure 1: Timeline.

Alternative Interpretations. Our model applies to both non-financial stakeholders, such as employees or business partners, and financial stakeholders, such as capital providers. In particular, passive investors, such as institutional investors, endowments, banks, and family offices that invest in myriad firms are likely to pay attention to prices to inform their investment decisions.[16]

Furthermore, note that our insights are not restricted to a firm attracting new stakeholders. To the extent that speculators in financial markets may have information that insiders do not, an alternative interpretation of the model is that existing employees need to be incentivized to take an action that increases the firm's value but has a private cost $\overline{w}$ for the employees. Another interpretation is that stakeholders need to be persuaded not to leave for an outside option, paying $\overline{w}$.[17]

3 Why and When Inflating Prices is Profitable

We solve the model backwards by characterizing, first, the stakeholders' decision of whether or not to accept the contract offered by the firm at $t = 3$. Then, we analyze, the trading game at $t = 2$ and $t = 1$. Initially, we simplify the exposition by normalizing the firm's cash flows in the low-cash-flow state to zero, i.e., $y = 0$, as this allows us to abstract from issues related to contracting. Subsequently, we study the importance of contracts by allowing for $y > 0$ in Section 3.3.1.

The firm attracts the stakeholders at date $t = 3$ if their posterior beliefs indicate that the

[16] Another interpretation of stakeholders is as a target firm in an M&A transaction, where the target firm's owners require at least $\overline{w}$ to sell out. One caveat of this interpretation is that targets in M&A are likely to do their own due diligence, arguably making them similarly informed to the informed speculators in our model. Note that the same is likely to be true for investors, such as venture capitalists, with deep knowledge of the firm, who sometimes continue to provide capital to firms after they go public (Iliev and Lowry, 2020) but are unlikely to be swayed by uninformed speculators in the market.

[17] If a firm finds itself on a negative trajectory, however, it may suffer from negative contagion effects whereby stakeholders start leaving because others are leaving. Equity-based compensation makes firms especially susceptible to such contagion risks (Hoffmann and Vladimirov, 2022).

contract offered by the firm is at least as valuable as their opportunity cost $\overline{w}$. A necessary condition for such a contract to be feasible is that

$$(\lambda_B + q_{D_1 D_2} \Delta\lambda)\, x \geq \overline{w},$$

which is equivalent to

$$q_{D_1 D_2} \geq q^* := \frac{\overline{w} - \lambda_B x}{\Delta\lambda x}. \tag{2}$$

3.1 Benchmark: Trading When Stakeholders Do Not Learn From Prices

We start by exploring the benchmark case in which stakeholders do not use the information revealed in prices to update their beliefs about the firm. This could be rational if stakeholders also observe signal s. In this case, trading has no real feedback effects, and the profit opportunities for uninformed speculators are very limited. In fact, in our model, there are none.

An uninformed trader cannot make a profit because, when she buys, she buys at a higher price, and when she sells, she sells at a lower price than what she believes to be the firm's true value. These unfavorable price adjustments occur because the market maker accounts for the probability that the trades might be coming from an informed trader. Thus, buy orders lead to a price increase and sell orders to a price decrease. Intuitively, an uninformed trader cannot beat a market in which she is the worst-informed player.[18] Relegating all formal proofs to the Appendix, we can summarize this benchmark case as:

Lemma 1 *If stakeholders observe s and, thus, do not consider stock prices when deciding whether to accept the contract offered by the firm, the speculator does not trade if she is uninformed.*

3.2 How Uninformed Speculation Creates Stars

Our first main result is that uninformed speculation can be profitable if prospective stakeholders aid their decision of whether to accept the contract offered by the firm by learning from stock prices.

[18] An uninformed speculator could make a trading profit in a modification of our model with two traders — a noise trader and a speculator, similar to Kyle (1985). In this modification, if the noise trader buys in the first period (moving prices up), the uninformed speculator can make a trading profit from short selling in the second period, as she knows that there is no informed trader around. Such profit opportunities do not exist in our model, as all trades come from the same trader.

Proposition 1 *There are multiple pure-strategy equilibria in which an uninformed speculator ($s = \varnothing$) trades as a positively informed speculator ($s = G$), and the firm attracts stakeholders by offering a contract* $\Delta R = \frac{\overline{w}}{\lambda_B + q_{D_1 D_2}\Delta\lambda}$.

The uninformed speculator's profit is derived from the fact that she is better informed about the direction of her follow-up trades and how these trades are likely to affect stakeholders' beliefs and, as a result, the firm's fundamental value. In what follows, we make this intuition more precise by showing why the uninformed speculator's trading strategy can be profitable even though the market maker and prospective stakeholders are rational, anticipate the speculator's strategy, and break even in expectation.

Consider the following candidate equilibrium in which the uninformed speculator trades as if she has positive information about the firm: The speculator buys in both periods if her signal is good or uninformative, $s \in \{G, \varnothing\}$, and sells if the signal is bad. Hence, buy orders reveal positive information about the firm's prospects, whereas sell orders reveal negative information; the firm can attract stakeholders if their posterior beliefs about the compensation offered by the firm are higher than their outside option $\overline{w}$. The firm optimally sets the stakeholders' compensation such that they break even given their posterior beliefs — i.e., condition (1) holds with equality (for details, see Lemma C.2 in the Appendix). Note that if $y = 0$, the only feasible value for R is zero, and it holds that $\Delta R = \frac{\overline{w}}{\left(\lambda_B + q_{D_1 D_2}\Delta\lambda\right)}$.

Consider the pricing of the firm's equity. Since the market maker must account for the probability that the buy orders may also come from uninformed or noise traders, the price does not fully adjust to the firm's true value even after two buy orders ($D_1 = D_2 = 1$). Specifically, the price p_{11} at $t = 2$ after a buy order in each trading period and the price p_1 at $t = 1$ after a buy order in the first trading period, respectively, are

$$p_{11} = (\lambda_B + q_{11}\Delta\lambda)\left(x - \frac{\overline{w}}{\lambda_B + q_{11}\Delta\lambda}\right), \tag{3}$$

$$p_1 = \pi_{11} p_{11} + (1 - \pi_{11})(\lambda_B + q_0\Delta\lambda)\left(x - \frac{\overline{w}}{\lambda_B + q_0\Delta\lambda}\right)\mathbf{1}_{q_0 \geq q^*}, \tag{4}$$

where π_{11} is the (endogenous) probability that the market maker assigns to observing a buy order at $t = 2$ after observing a buy order at $t = 1$; $\mathbf{1}_{q_0 \geq q^*}$ is an indicator function taking the value of one if $q_0 \geq q^*$, in which case the firm attracts stakeholders at a compensation of $\frac{\overline{w}}{\lambda_B + q_0\Delta\lambda}$ instead of $\frac{\overline{w}}{\lambda_B + q_{11}\Delta\lambda}$.

Since it is a standard result that an informed trader can profit from her information advantage by trading with her information, we focus on the case in which the speculator is uninformed. The uninformed speculator's valuation of the firm if the stakeholders join at a compensation of $\frac{\overline{w}}{\lambda_B+q_{11}\Delta\lambda}$ is

$$(\lambda_B + q_0\Delta\lambda)\left(x - \frac{\overline{w}}{\lambda_B + q_{11}\Delta\lambda}\right). \tag{5}$$

Notably, the price p_{11} (given by (3)) at which the uninformed speculator buys at $t = 2$ is higher than her expectation about the value of the firm, given by (5), as $q_{11} > q_0$. Intuitively, the price cannot be lower, as it must reflect a higher probability that the state is good compared to uninformed players' prior beliefs, i.e., $q_{11} > q_0$. Thus, an uninformed speculator cannot make a profit in a one-period trading game.

However, the uninformed speculator can make a profit when trading takes place over multiple periods, as then she might be able to execute her initial trades at a lower price, because the price does not internalize fully that the firm will attract stakeholders at a lower cost. Specifically, if the price p_1 (given by (4)) at which she buys at $t = 1$ is lower than her valuation of the firm, the trading profit from the first trading period could more than offset the loss from the second.[19] Note that despite the second-period trading loss, there is no time-inconsistency in the uninformed speculator's trading strategy, as, without her second trade, the firm will not be able to attract stakeholders at a lower cost.

In a nutshell, uninformed speculation can be profitable because the speculator is better informed about how she intends to trade at $t = 2$. That is, the speculator's private information that she intends to continue inflating the price, which will allow the firm to attract stakeholders (at a lower cost), gives rise to an endogenous information rent even though the speculator has no private information about the firm-specific shock ω. The reason that the price p_1 at $t = 1$ may react only slowly, allowing the uninformed speculator to make a profit on her first-period trade, is that the market maker must take into account that the order flow could be coming from noise traders. This intuition also extends to alternative equilibria with uninformed trading, such as ones in which the speculator buys only in $t = 1$ and does not trade in $t = 2$ if $s \in \{G, \varnothing\}$. Such equilibria are even more profitable for an uninformed speculator, as then she does not incur trading losses from buying in the second period.[20]

Thus far, we have presented the case in which uninformed speculators find it profitable to inflate stock prices. It is conceivable that an uninformed speculator might also pursue the opposite strategy – mimicking the trading strategy of a negatively informed speculator, by, for example, short-selling in both periods. We discuss short-selling in detail in Section 4, but at this point it is worth noting that uninformed short-selling is never profitable if $q_0 < q^*$.

[19]For comparison, note that a positively informed speculator (observing $s = G$) makes a profit on both trades, as her valuation, $\lambda_G (x - w)$, is higher than both p_1 and p_{11}.

[20]In such equilibria, the lack of trading or short-selling that reverses the price increase in $t = 1$ implies that stakeholders' posterior beliefs about the firm continue improving in $t = 2$.

Then, the stakeholders' prior beliefs are not sufficiently positive, making it impossible for the firm to attract stakeholders without a positive feedback effect from the market. In this case, there is no equilibrium in which the uninformed speculator can profit from short-selling, as selling has no real feedback effects: with or without short-selling, the firm cannot attract stakeholders. Hence, an intuition similar to that of Lemma 1 applies again.[21]

Lemma 2 *If $q_0 < q^*$, there are equilibria in which an uninformed speculator makes a profit from trading as a positively informed speculator but no equilibria in which she makes a profit from trading as a negatively informed speculator by short-selling.*

3.3 When Does Uninformed Speculation Occur?

The fact that the speculator is better informed about her future trades is one of the main reasons that inflating the firm's stock price without positive information about the firm can be profitable. However, other factors matter too. In what follows, we discuss these factors in detail and develop more extensively the economic intuition.

3.3.1 The Importance of Contract Design

A fundamental insight from our paper is that an uninformed speculator can profit from inflating a firm's stock price only if the firm compensates stakeholders with state-contingent contracts. Explaining why this is the case requires investigating at whose expense the speculator makes a profit.

Stakeholders and the market maker in our model are rational and break even — thus, they do not lose out in expectation from the fact that speculators might be trading without any information. In particular, they anticipate that buy orders might be coming from an uninformed speculator and, as a result, the firm's stock price might be higher than warranted. Since stakeholders' posterior beliefs do not improve as much as they might in equilibria without uninformed speculation, firms with good prospects are forced to offer more favorable terms to attract stakeholders. Hence, truly good firms with stock prices below fundamental value end up cross-subsidizing worse firms that can pool with them because their stock prices are inflated by uninformed speculators. Therefore, the key implication is that the uninformed speculator's profits come at the expense of the truly good firms.[22] In particular, since cross-subsidization allows firms with worse projects to make a profit from attracting

[21] Note that there can be no equilibrium in which a negatively informed speculator also buys, as then, the trades will cease to have any information role.

[22] As is standard, noise traders also lose out.

stakeholders, it effectively protects uninformed speculators from internalizing the full cost of inflating the price of the wrong firm.

When contracts are more sensitive to the realized firm-specific shock ω (which occurs if the contract's variable component, i.e., ΔR, is larger, holding the stakeholders' participation constraint binding), the effect of cross-subsidization is stronger and the uninformed speculator's profits are higher. Without cross-subsidization, the uninformed speculator cannot make a profit from inflating the firm's stock price. To show these claims more formally, we consider (for this Section only) the case in which the firm generates a positive cash flow also in the low cash flow state, i.e., $y > 0$. To focus on the impact of contract design on the opportunities for uninformed speculation, we assume that the firm's owners have the same information as stakeholders.[23]

In this setting, Proposition 1 applies unchanged if the firm offers a contract $\{R, \Delta R\} = \left\{0, \frac{\overline{w}}{\lambda_B + q_{11}\Delta\lambda}\right\}$. However, Proposition 1 no longer applies if the firm offers a compensation contract $\{R, \Delta R\} = \{\overline{w}, 0\}$, which guarantees stakeholders a payment of $\overline{w}$, regardless of the firm's cash flow. That is, the stakeholders' compensation does not involve any cross-subsidization from G-firms to B-firms.[24] To see that an uninformed speculator cannot make a profit, recall that a necessary condition for such a profit in an equilibrium in which she trades as a positively informed trader is that her first-period trading profit is positive. However, this is never the case if $\{R, \Delta R\} = \{\overline{w}, 0\}$. In particular, it holds that

$$\begin{aligned} p_1 &= \pi_{11} p_{11} + (1 - \pi_{11}) \left(y + \left(-\overline{w} + (\lambda_B + q_0 \Delta\lambda)\, x \right) \mathbf{1}_{q_0 \geq q^*} \right) \\ &\geq \pi_{11} p_{11} + (1 - \pi_{11}) \left(y - \overline{w} + (\lambda_B + q_0 \Delta\lambda)\, x \right) \end{aligned}$$

since attracting stakeholders, given beliefs q_0, only increases firm value if $q_0 \geq q^*$. Hence, given that $p_{11} = y - \overline{w} + (\lambda_B + q_{11}\Delta\lambda)\, x$, the uninformed speculator's first-period trading profit is:

$$\begin{aligned} & y - \overline{w} + (\lambda_B + q_0 \Delta\lambda)\, \Delta y - p_1 \\ \leq\; & \pi_{11} (q_0 - q_{11})\, \Delta\lambda \Delta y < 0. \end{aligned}$$

Summing up, for $\{R, \Delta R\} = \{\overline{w}, 0\}$, the first-period trading profit and, as a result, the overall

[23] If the firm is better informed about its project than stakeholders are, the choice of $\{R, \Delta R\}$ will play a signaling role. As is standard, the unique contract surviving standard equilibrium refinements stipulates $R = \min\{\overline{w}, y\}$, as this minimizes the cross-subsidization of B-firms by G-firms (this analysis can be provided upon request).

[24] This case essentially corresponds to that analyzed in Goldstein and Guembel (2008) who consider a setting in which a manager learns from stock prices whether to undertake an investment using the firm's internal resources. Since in their setting, there is no external financing, there is no cross-subsidization.

profit from uninformed speculation is negative. Intuitively, without cross-subsidization, the uninformed speculator fully internalizes the cost that attracting stakeholders destroys value for equity holders if $\omega = B$, which, in turn, erodes the value of the uninformed speculator's long position.

Proposition 2 *For any given contract $\{R, \Delta R\}$ for which stakeholders' participation constraint binds, the uninformed speculator's profit increases in the variable component, ΔR, of stakeholders' compensation. There is no equilibrium with uninformed speculation if $\Delta R = 0$.*

Discussion: Uninformed Speculation and Welfare. Informed speculation in our model improves welfare by facilitating a better, value-creating match between stakeholders and firms. By contrast, uninformed speculation destroys value by worsening that match. Although firms with worse prospects but inflated prices generate value for equity holders by attracting stakeholders, the created value is, in expectation, less than stakeholders' outside options — a cost borne ex ante by the good firms. This resulting misallocation of talent and resources does not amount to welfare-neutral transfers across players, as it destroys welfare by worsening investment inefficiencies.

3.3.2 Speculation and Market Conditions

Another central insight from our model is that equilibria with uninformed speculation do not arise in hot or cold markets but, rather, when market conditions are "normal." In what follows, we define this notion of "normal" along several dimensions.

First, a necessary condition for equilibria with uninformed speculation to exist is that the stakeholders' opportunity cost, $\overline{w}$, is neither too high nor too low. On the one hand, if $\overline{w}$ is very high, the stakeholders' posterior beliefs need to improve significantly for the firm to be able to attract the stakeholders. However, this is unlikely if they expect that the stock price could have been driven by uninformed speculation. On the other hand, if $\overline{w}$ is very low, cross-subsidization in the stakeholders' compensation has little effect on the firm's value and, thus, its stock price, which makes it impossible for an uninformed speculator to make an overall trading profit.

It is worth noting that the condition on stakeholders' opportunity cost $\overline{w}$ for a given prior q_0 can alternatively be stated in terms of the stakeholders' prior beliefs q_0 for a given level of opportunity cost $\overline{w}$. Taking this interpretation, the stakeholders' priors also need to be "normal." On the one hand, if q_0 is very low, stakeholders' posterior beliefs about the firm cannot improve sufficiently to convince stakeholders to forgo their outside options. On the other hand, if q_0 is very high, there is little scope for further improvement in beliefs, implying

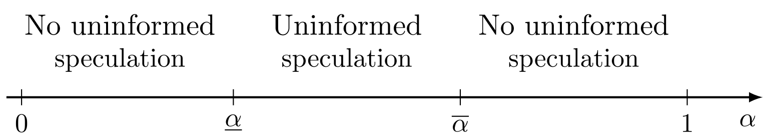

Figure 2: Transparency and uninformed speculation.

that cross-subsidization in stakeholders' compensation matters little for stock prices, again making it impossible for an uninformed speculator to make an overall trading profit.

Second, the probability of informed trading, captured by α, should be intermediate, as buy orders should have an intermediate impact on the market maker's posterior beliefs and the resulting prices (Figure 2). On the one hand, if the probability of informed trading is high, prices will increase steeply following buy orders. This will make it hard for the uninformed speculator to profit from buying, as she is, after all, unsure about the true nature of the firm-specific shock. On the other hand, if the probability of informed trading is very low, prices will have little impact on the stakeholders' beliefs. Hence, prices will not affect much the firm's ability to attract stakeholders or the contracts it needs to offer them, thus muting the feedback effects of financial markets. Moreover, if the probability of informed trading is low, it could also become optimal for a negatively informed speculator to buy in both periods. Such deviations would undermine the proposed uninformed speculation equilibrium.[25]

Proposition 3 *There are thresholds $\underline{\alpha}$ and $\overline{\alpha}$ such that an equilibrium in which an uninformed speculator ($s = \varnothing$) mimics the trading strategy of a positively informed speculator ($s = G$) exists if the probability that the speculator is informed is intermediate, $\alpha \in [\underline{\alpha}, \overline{\alpha}]$. Furthermore, a necessary condition for such equilibria to exist is that the outside option, $\overline{w}$, and prior beliefs, q_0, are intermediate (the threshold values for α, $\overline{w}$, and q_0 that define the respective intermediate ranges are defined in the Appendix).*

As a side note, it is worth briefly remarking that higher transparency may decrease price efficiency, defined by the difference between the firm's fundamental equity value and its stock market value.[26] To give a simple example, if transparency is very low, the compensation that the stakeholders require to join is very high. In the extreme, the firm uses all its cash flows to pay stakeholders, as $\Delta R = \frac{\overline{w}}{\lambda_B + q_{D_1 D_2}\Delta\lambda} = x$. Then, the pricing error is zero, as the firm's

[25] Interestingly, by introducing spoofing to the Glosten and Milgrom setting, Skrzypacz and Williams (2022) also show that manipulative trading (i.e., spoofing) is most likely when the probability of informed trading, α, is intermediate. The forces behind their result are different, as they are unrelated to feedback effects: for low α, prices move too little; and for high α, the market maker is likely to put a very high probability on spoofing — in either case, spoofing becomes less profitable.

[26] In our model, stock market capitalization is the same as the firm's market value as the firm has no debt. Note that we often use stock price and stock market value interchangeability.

fundamental value is zero regardless of whether the firm can attract stakeholders. The key observation now is that a higher level of transparency affects the firm's fundamental value, as stock price increases (associated with buy orders) have a bigger impact on stakeholders' posterior beliefs, allowing the firm to attract stakeholders at a lower cost. Since in this case, the price set by the market maker differs from the firm's fundamental value, the pricing error increases.

Corollary 1 *By affecting stakeholders' contracts and the firms' ability to attract stakeholders, higher transparency requirements can lead to a larger discrepancy between the firm's fundamental equity value and its stock market valuation.*

3.3.3 Endogenous Entry of Speculators

The speculator in our model can make positive trading profits regardless of whether or not she is informed, raising the question of whether this profit opportunity dissipates if we allow for the entry of speculators. We extend our model to study this question in Appendix B.1. In particular, we assume that identifying potential targets for speculation requires costly monitoring of the news and analyst reports and forecasts.[27] Once a speculator has identified such a target, her signal about it may or may not be informative, and our baseline model applies. In this setting, equilibria with uninformed speculation exist as long as entry costs (i.e., the cost of monitoring news) are intermediate (Proposition B.1). If they are too high, the equilibrium fraction of speculators and the probability of informed trading (captured by $(1-\beta)\,\alpha$) will be too low for prices to meaningfully affect prospective stakeholders' decisions. Instead, if entry costs are too low, more speculators will be attracted to enter, making prices very sensitive to new trades. Overall, this insight supports the general message that emerges from our paper: market conditions need to be normal (as opposed to extreme) for uninformed speculation to pay off.

3.3.4 Discussion: Other Equilibria

In addition to equilibria with uninformed speculation, there can also be equilibria without uninformed speculation (Proposition B.2 in Appendix B.2), which raises the question of which equilibrium will be more likely to emerge in financial markets. Addressing the important question of equilibrium selection is beyond the scope of our analysis. In practice, it is conceivable that equilibria with uninformed speculative trading could be triggered by news releases, possibly overhyped by (social) media.[28] Given our result that speculators do not

[27] Clearly, if acquiring information were costless, speculators would flood the market, as they could make a profit from trading on their information.

[28] Goldman, Martel, and Schneemeier (2021) recently analyzed the importance of media for stock prices.

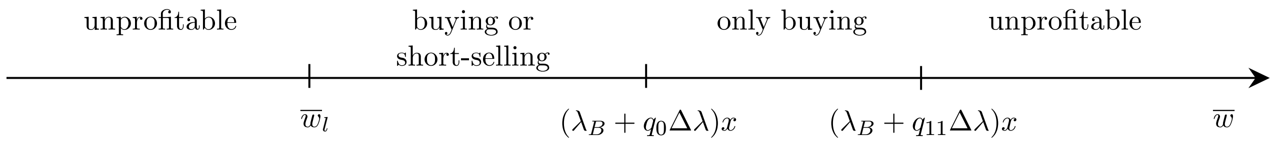

Figure 3: Profitability of uninformed speculation. The figure shows the regions in which uninformed speculation can be profitable, depending on stakeholders' opportunity cost $\overline{w}$. In this figure, $\overline{w}_l$ is the lowest threshold for $\overline{w}$ for which an equilibrium with uninformed speculation can be supported.

need to have prior inventory in the firm's stock, the implication is that there is wide scope for engaging in such speculation.

4 Speculative Short-Selling vs Speculative Buying

Lemma 2 shows that, for $q_0 < q^*$, uninformed speculators can benefit from inflating the firm's stock price but not from short-selling that erodes the firm's stock price. In this section, we consider the opportunities for short-selling when $q_0 \geq q^*$, so that the stakeholders' prior beliefs are sufficiently high that they would join the firm even without a positive feedback effect from the market.

4.1 Speculation Before the Firm Attracts Stakeholders

If $q_0 \geq q^*$, both uninformed buying and short-selling can have real effects. In particular, if an uninformed trader mimics a negatively informed speculator, short-selling will worsen the terms with which the firm can attract stakeholders. It could even make attracting stakeholders impossible if stakeholders' posterior beliefs dropped below q^*. In the presence of such real effects, uninformed short-selling can become profitable. Together with Proposition 1 and Lemma 2, it follows:

Corollary 2 *While only uninformed speculative buying can be profitable if $q_0 < q^*$ (equivalently, $\overline{w} > (\lambda_B + q_0\Delta\lambda)\, x$), both uninformed speculative buying and short-selling can be profitable if $q_0 \geq q^*$ (i.e., $\overline{w} \leq (\lambda_B + q_0\Delta\lambda)\, x$).*

Figure 3 summarizes the insights from Proposition 3 and Corollary 2 in terms of the stakeholders' opportunity costs $\overline{w}$. In the Appendix, we offer concrete parametric examples for the different types of equilibria that can be supported.[29]

[29] We do not discuss the details of equilibria with uninformed short-selling, as Goldstein and Guembel (2008) have analyzed the existence of such equilibria in detail.

4.2 Speculation After the Firm Attracts Stakeholders: Limits to Arbitrage

Next, we explore the question of when speculative trading can reverse stakeholders' decision to join the firm. Considering this question is important, as the stakeholders' prior beliefs could be the result of speculative trading preceding date $t = 0$. Moreover, the prospect of reversal affects the incentives to inflate prices in the first place. To address this question, we extend our analysis to consider the case in which the stakeholders' high prior beliefs, $q_0 \geq q^*$, allow the firm to attract stakeholders already at $t = 0$ by offering $\Delta R = \frac{\overline{w}}{\lambda_B + q_0 \Delta\lambda}$.

The limits to reversing positive feedback effects (and, thus, possibly arbitraging away inefficiencies) are immediate when we interpret stakeholders as capital providers. Then, reversals are not possible if the investment $\overline{w}$ is sunk. The new information effectively comes too late for capital providers, and all they can do is wait for their contractual payments in $t = 3$.

Next, we consider the alternative interpretation of stakeholders as employees and show that reversals are often unlikely in this context as well. The difference between the interpretation of stakeholders as employees and as investors is that the employees' opportunity cost $\overline{w}$ is not necessarily sunk. We consider the following scenario. If employees leave before $t = 3$: (i) they can still claim their outside option $\overline{w}$; (ii) they forgo their compensation; and (iii) the project yields a (liquidation) payoff of L.

Assumption (ii) is arguably realistic in the context of employees paid with vesting equity and performance bonuses, which is the setting we are interested in (Proposition 2). Assumption (iii) applies to cases in which the value that employees have created at a firm does not fully dissipate with their departure. Arguably, most businesses geared toward producing physical or digital products fit this description. However, there are also other examples, such as when scientists and engineers generate patents for the firm. We assume that it is efficient for employees to leave and the project to be liquidated if $\omega = B$ but not if $\omega = G$:

$$\lambda_B \left(x - \frac{\overline{w}}{\lambda_B + q_0 \Delta\lambda} \right) \leq L \leq \lambda_G \left(x - \frac{\overline{w}}{\lambda_B + q_0 \Delta\lambda} \right).$$

The trade-off for speculators is now readily apparent. If the negative price pressure from short-selling causes stakeholders to leave, the firm is relieved from its obligation to pay them. Thus, even though the departure of stakeholders reduces the expected size of the "pie" if $\omega = G$, there is a countervailing effect for equity holders, as they are left with a larger share of the remaining pie, L. This countervailing effect dominates if the liquidation value L that becomes available through the employees' involvement is sufficiently high (i.e., L is larger than some lower bound $\underline{L}$) or if the firm has promised a large fraction of its cash flows to employees in order to ensure it can attract them to realize the risky project. In these cases, the speculators' profit from short-selling that scares stakeholders away and forces the firm to liquidate the risky project, is limited. In fact, short-selling may even end up *increasing* the firm's stock price, making short-selling unattractive regardless of the firm's information. Related, L cannot be too high either (i.e., it cannot be that the firm benefits too much when stakeholders leave). This is because a negatively informed speculator will then be able to make a profit from buying in the first period to benefit from the value increase when her subsequent trades drive stakeholders to leave.[30]

Lemma 3 *The opportunities for reversing positive feedback effects, possibly driven by inflated prior beliefs, are limited. There are thresholds $\underline{L}$ and $\overline{L}$, such that when the project's liquidation value is intermediate, $L \in [\underline{L}, \overline{L}]$, there is no equilibrium in which the negative information impounded into prices by short-sellers triggers stakeholders to abandon the firm before $t = 3$.*

Interestingly, though Edmans, Goldstein, and Jiang (2015) show that trading on negative information is less profitable than trading on positive information, which is related to Lemma 3, they also show that uninformed speculation inflating prices is not profitable. By contrast, the main insight from our analysis in Propositions 1–3 and Lemma 3 is that such speculation is not only profitable but also likely to persist, as positive feedback effects are hard to reverse.

4.3 Transparency and Speculation Opportunities

Firms often have wide latitude in how transparent they want to be about their business, raising the question of how the firm's choice of transparency affects the probability of uninformed speculation. While we do not mean to suggest that transparency decisions are based primarily on this calculation, we believe that considerations of how transparency will affect speculative trading in the firm's stock are economically significant enough to be contemplated when deciding on the firm's level of transparency. For example, one effect that a firm might consider is that, outside the intermediate region for L defined in Lemma 3, informed and possibly uninformed speculative short-selling can potentially reverse positive feedback effects. However, analogous to Proposition 3, there are no equilibria with speculative short-selling if transparency is sufficiently low or sufficiently high.

[30]Note that a key difference between our setting and laying off staff to improve operational efficiency is that employees leave voluntarily. In particular, although equity holders might be better off liquidating the project, this does not imply that attracting employees in the first place is suboptimal, as employees are instrumental both for running the project and for its positive liquidation value. Indeed, the firm generates zero if it does not attract stakeholders.

More precisely, consider an extension of our model in which the firm chooses its transparency level α at $t = 0$. A firm that wants to avoid becoming the target of speculative short-selling that scares off stakeholders can benefit from being either very transparent or very intransparent.[31] Specifically, if the transparency level α is very low, the probability of informed trading is low and, hence, prices have little impact on stakeholders' beliefs and decisions to leave the firm. This is trivial to see if $\alpha = 0$. Alternatively, firms can reduce the likelihood that stakeholders leave by increasing transparency. Higher transparency makes prices more sensitive to trades. As a result, the parameter range $L \in \left[\underline{L}, \overline{L}\right]$ for which speculators cannot benefit from trading on negative information increases ($\overline{L}$ increases). This strategy is not as effective as setting $\alpha = 0$, but is possibly more realistic for public firms, which typically must comply with minimum disclosure requirements.[32]

Proposition 4 *The firm can reduce the profitability of short-selling that triggers stakeholders to leave, by choosing the highest feasible transparency level α. Alternatively, the firm can prevent trading from having an impact on stakeholders' decision to leave by choosing a transparency level below a threshold $\underline{\alpha}''$ (defined in the Appendix).*

Taken together, our results suggest that opportunities for speculative trading will be endogenously asymmetric. First, speculation inflating stock prices is the only type of profitable speculation if speculators are uninformed and $q_0 < q^*$ (Corollary 2). Second, the firm has incentives and tools to avoid becoming the target of speculation that scares off stakeholders (Proposition 4). Thus, we predict that, when stock prices affect stakeholders' decisions, inflating prices is more profitable for uninformed speculators than undermining prices. This prediction is strengthened by the fact that, once positive feedback effects have been triggered, they are hard to reverse (Lemma 3). This asymmetry is noteworthy, as in models in which stock prices inform internally-funded investment decisions rather than the decisions of stakeholders, the asymmetry goes the other way (Goldstein and Guembel, 2008).

[31] The evidence supports our premise that a more detailed corporate disclosure policy has a key impact on the informativeness of stock prices (Healy, Hutton, and Palepu, 1999; Gelb and Zarowin, 2002). Examples of information that could help speculators infer ω include the firm's choice of quality of auditor, the number of items it reports in its financial reports, the accuracy of such reports, and the intensity of discussion of items such as R&D expenses, capital expenditures, product and segment data, and major business partners (Bushman, Piotroski, and Smith, 2004). Furthermore, in its regulatory filings, earnings calls, and news releases, a firm can choose how transparent it wants to be about its strategy; organizational structure; the identity of major shareholders; the background, share ownership, and affiliations of board members; as well as non-executive officers and employees.

[32] Moreover, lowering transparency might be hard for firms that had previously chosen high transparency (outside of our model) since, once information is released, it cannot be taken back.

Corollary 3 *When stock prices affect the decisions of stakeholders, opportunities for profiting from uninformed trading will be asymmetric, with uninformed speculators finding it easier to profit from inflating than deflating stock prices.*

5 Fake It Till You Make It in Private Markets

The insight that investors can benefit from an artificially inflated valuation if that helps the firm "fake it till it makes it" by attracting high-quality stakeholders extends beyond trading in secondary markets. This section shows that manipulation that exploits this feedback effect can start while the firm is still private and is raising growth financing. The cost of manipulation comes, once again, at the expense of outside third parties — the good firms that end up cross-subsidizing firms with worse prospects. Moreover, the only possible manipulation is one that presents the firm as better than it is.[33]

Extension: Raising Start-up Capital. Consider an extension of the baseline model with two additional dates, $t = -2$ and $t = -1$, at which the firm is started with outside capital. Specifically, at $t = -2$, a penniless entrepreneur seeks financing K from a venture capitalist (VC) to start the firm. Apart from this start-up capital, the firm also needs to attract stakeholders — i.e., employees or business partners with an outside option of $\overline{w}$; alternatively, the firm may need to raise follow-up financing $\overline{w}$ provided by uninformed investors. Before the financing contract with VCs is signed, the entrepreneur and the VC, but not the stakeholders, observe a signal $\widetilde{s} \in \{G, B, \varnothing\}$, which may reveal the firm-specific shock $\widetilde{\omega}$ that determines the firm's likelihood of generating high cash flows at $t = -1$. The firm-specific shock $\widetilde{\omega}$ and the cash flows at $t = -1$ may, but need not, be correlated with the firm-specific shock ω at $t = 0$ and the cash flows at $t = 3$. Similar to the baseline model, the signal $\widetilde{s}$ is fully informative with probability α and pure noise, i.e., $\widetilde{s} = \varnothing$, otherwise. The prior probability that the firm-specific shock is good is $\widetilde{q}$. If the firm-specific shock is good, the firm has a probability λ_G of generating high cash flows, x, at date $t = -1$ if it attracts stakeholders. If the shock is bad, this probability is λ_B. If the firm is unsuccessful, it generates zero.

To keep the analysis simple, we assume that the firm is liquidated if its cash flow at $t = -1$ is zero (i.e., if the firm is unsuccessful). If the firm is successful (i.e., generates x), it goes public, and the VC sells out.[34] The game continues then with the baseline model

[33] Note that the concept of short-selling has no analog in private markets.

[34] If the states in $t = -2$ and $t = 0$ are correlated, the venture capitalist's decision to stay invested could act as a signal about the firm's type. We do not pursue this extension, as it does not add qualitatively to our results. Venture capitalists, indeed, typically, exit their investments at the time of a firm's initial public

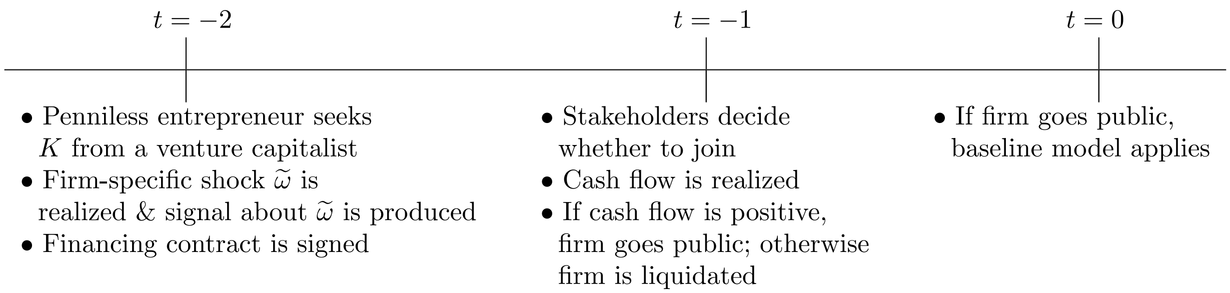

Figure 4: Timeline — Raising Start-Up Capital.

starting at date $t = 0$. Figure 4 summarizes the model's extension.

Contracting. Consider date $t = -2$ at which an entrepreneur seeks capital K to start the firm. We assume that investors compete on prices. As in the baseline model, since the firm generates zero in the low cash flow state, it can only offer a payment, denoted by ΔR_0, in the high-cash-flow state.

Consider the following candidate equilibrium. If the firm and the VC observe $\widetilde{s} = B$, the firm does not raise capital. If $\widetilde{s} = G$, the firm offers the VC an equity stake γ that satisfies her participation constraint

$$\lambda_G \left(\gamma \left(x - \Delta R_0\right) + \gamma p_0\right) = K. \tag{6}$$

In expression (6), $\lambda_G \left(x - \Delta R_0\right)$ is the firm's expected cash flow at $t = -1$ net of the compensation ΔR_0 promised to stakeholders; and p_0 is the price of equity if the firm goes public. If the firm and the VC are uninformed ($\widetilde{s} = \varnothing$), they agree on an additional payment, which increases the overall payment to the VC at $t = -1$ to $S \geq \gamma \left(x - \Delta R_0\right)$, where S is defined by the VC's participation constraint

$$\left(\lambda_B + \widetilde{q}\Delta\lambda\right)\left(S + \gamma p_0\right) = K, \tag{7}$$

with this contract converting to an equity stake γ (as defined by condition (6)) upon an initial public offering.[35] Only the equity stake γ is disclosed to outsiders. Such convertible contracts are common in venture capital financing (Hellmann, 2006; Gornall and Strebulaev,

offering (Gompers, 1996).

[35] We implicitly assume that stakeholders' contracts cannot condition on those offered to the venture capitalist. This assumption is realistic, and relaxing it is possible.

2020). Finally, the firm offers stakeholders:

$$\Delta R_0 = \frac{\overline{w}}{\left(\frac{\alpha\widetilde{q}}{\alpha\widetilde{q}+1-\alpha}\lambda_G + \frac{1-\alpha}{\alpha\widetilde{q}+1-\alpha}\left(\lambda_B + \widetilde{q}\Delta\lambda\right)\right)}. \tag{8}$$

Our equilibrium concept is again perfect Bayesian equilibrium. We refine out-of-equilibrium beliefs by assuming that stakeholders place probability one on $s = B$ if they observe an offer different from ΔR_0.

Also in this extension of our model, stakeholders are rational and demand to be compensated for the risk that they might be dealing with a firm about which investors are uninformed. In particular, expression (8) corresponds to the stakeholder's binding participation constraint, where $\frac{\alpha\widetilde{q}}{\alpha\widetilde{q}+1-\alpha}$ is the probability that stakeholders attribute to the VC being positively informed, and $\frac{1-\alpha}{\alpha\widetilde{q}+1-\alpha}$ is the probability that the VC is uninformed.

To show that the proposed equilibrium exists, it suffices to show that it is feasible to construct contracts that satisfy the participation constraints (6)–(8) and the incentive constraint guaranteeing that when the firm and the VC observe $s = B$, they do not pretend to be positively informed. That is, even if the firm offers the VC all cash flows in $t = -1$ (i.e., it offers the VC a payment $\widetilde{S} = x - \Delta R_0$ at $t = -1$) it will hold

$$\lambda_B\left(x - \Delta R_0 + \gamma p_0\right) \leq K. \tag{9}$$

Similar to Proposition 3, we obtain that inflating the firm's valuation is feasible and can help attract stakeholders as long as the stakeholders' outside option $\overline{w}$ is intermediate. If $\overline{w}$ is too high, then the stakeholders' posterior beliefs cannot improve sufficiently to convince them to accept the firm's contract offer, given that they anticipate that the firm's valuation might have been inflated. And if $\overline{w}$ is very low, mimicking becomes very attractive. That is, the VC and the firm are willing to pretend that the firm is good even if $\widetilde{s} = B$, undermining incentive compatibility (condition (9)).

Proposition 5 *If the entrepreneur and VC observe $\widetilde{s} = G$, the firm can raise equity financing by issuing $\gamma = \frac{K}{\lambda_G(x-\Delta R_0+p_0)}$. If the entrepreneur and the VC are uninformed about $\widetilde{\omega}$, i.e., $\widetilde{s} = \varnothing$, they agree on a financing contract paying the VC $S = \frac{K}{(\lambda_B+\widetilde{q}\Delta\lambda)} - \gamma p_0$ at $t = -1$ and converting to an equity stake γ upon an IPO. Only the equity stake, γ, is disclosed to outsiders. In either case, the firm attracts stakeholders by promising a compensation of $\Delta R_0 = \frac{\overline{w}}{\frac{\alpha\widetilde{q}}{\alpha\widetilde{q}+1-\alpha}\lambda_G+\frac{1-\alpha}{\alpha\widetilde{q}+1-\alpha}(\lambda_B+\widetilde{q}\Delta\lambda)}$. There are thresholds $\overline{w}_a$ and $\overline{w}_b$ such that this contract is feasible and arises in equilibrium if $\overline{w} \in [\overline{w}_a, \overline{w}_b]$.*

6 Empirical Implications

Our model's premise is that there is a feedback effect from stock prices on prospective stakeholders' decisions. Anecdotal evidence for this feedback channel abounds (see the Introduction). There is also extensive empirical evidence that a wide variety of stakeholders pay attention to prices and that elevated prices remain high long enough to allow firms to benefit from an improved image that can help them attract stakeholders. For example, it has been found that two of the most important factors for prospective employees before joining a firm are its profitability and stock market value (Dowling, 1986; Fombrun and Shanley, 1990; Turban and Greening, 1997; Bergman and Jenter, 2007). A firm's stock price also matters for business partners and suppliers, deciding whether to expand their relationship with a firm by making firm-specific investments (Liang, Williams, and Xiao, 2021). There is evidence that capital providers also pay attention to stock prices (Baker, Stein, and Wurgler, 2003; Derrien and Kecskes, 2013; Grullon, Michenaud, and Weston, 2015). Naturally, to affect stakeholders' decisions, high valuations and stock prices must remain elevated for some time. This is typically the case in private markets, where valuations are rarely updated more than once a year, when the firm raises a new funding round. Also in public markets, it is common that speculative trading keeps prices elevated over many months (Aggarwal and Wu, 2006). The same is sometimes true even when prices increase following news releases that do not contain fundamental information (Huberman and Regev, 2001; Cooper, Dimitrov, and Rau, 2001).

Based on this feedback channel, our central result is that uninformed speculators can profit from inflating firm valuations, even when everyone is rational and anticipates such speculation.

Implication 1 ***(Speculation targets)*** *Uninformed speculators target firms that:*
(i) are about to undertake significant investments that promise high growth potential but are hard to assess;
(ii) compensate employees and business partners with performance pay or equity-like instruments; or raise equity financing.

Firms likely to fit Implication 1 include human-capital-intensive growth firms, recently-listed firms, or firms undergoing a transition or restructuring. The anecdotal evidence (of Wirecard, GameStop, Tesla, Nikola, WeWork, Theranos, etc.) cited in the Introduction fits this description.

Clearly, not all firms can become a target of speculative trading. One important factor for uninformed speculation to be profitable is that market conditions are "normal." Specifically, stakeholders must believe that targeted firms have a sufficiently high potential that trumps stakeholders' concerns about inflated valuations. At the same time, prior beliefs cannot be too high either (as in hot markets), as then there is little scope for uninformed speculation to play a significant role in affecting stakeholders' decisions and cross-subsidization across firms (Proposition 3). Another factor for uninformed speculation to be profitable is that the probability of informed trading (or, respectively, the cost of acquiring information about targeted firms) is intermediate (Section 3.3.3). Over the counter (OTC) markets largely fit this description. Indeed, speculation inflating firms' stock prices over months has been particularly common in OTC markets. Furthermore, conditional on speculation taking place in such opaque markets, manipulation is more likely when such markets are less opaque (Aggarwal and Wu, 2006). This is consistent with our prediction that inflating stock prices is most lucrative when transparency and the probability of informed trading are intermediate.

Implication 2 ***(Speculation and market conditions)*** *Uninformed speculation is more likely in "normal" market conditions, i.e., when the market sentiment is neither too negative nor positive, and when employees' and investors' outside opportunities are neither too bad nor too good. Furthermore, the probability of informed trading, transparency, and the cost of acquiring information about the firm should be intermediate.*

Implication 2 differentiates our paper from irrational exuberance theories focusing on hot markets in which firms can free ride on positive market sentiment, helping them cheaply attract financial and possibly non-financial capital (Baker and Wurgler, 2002; Baker, Stein, and Wurgler, 2003). Another stark contrast to such theories is that stakeholders in our model anticipate that valuations may be inflated and do not lose on average from their dealings with the firm.

Our model further predicts that the price reversals following news (Barber and Odean, 2008) will be less-pronounced for firms, such as those from Implication 1, that can use the increase in their stock price to attract high-quality employees and business partners or raise capital. For example, while GameStop's share price partially reversed after its increase in March 2021, at the end of 2021, it had stabilized at more than eight times its 2020 levels. The fact that the reversal was partial possibly reflects the firm's success in attracting experienced high-level executives and raising the capital it needed for its transformation to an e-commerce business.[36]

Reversals of positive feedback effects are hard (and, thus, price reversals will be partial) even when there are traders with negative information about the firm. This is the case if

[36] Notably, this partial reversal is entirely rational and unrelated to other explanations of reversal patterns, attributed to overreaction and other behavioral biases (Jegadeesh and Titman, 2001; Daniel, Hirschleifer, Subrahmanyam, 1998).

investors have already sunk capital in the firm; or when the value created by employees is unlikely to dissipate after their departure (Lemma 3). Hence, the price inflation created by speculative buying can persist, making it even more profitable to pursue such speculation.[37]

Implication 3 ***(Speculation and price reversals)*** *Inflated prices will reverse less for firms that can benefit from building up their stakeholder base by attracting employees and raising capital. Furthermore, price reversals are less likely if: investors have sunk capital in the firm or employees must forgo part of their compensation when leaving the firm, and the value they have created does not fully dissipate with their departure.*

Overall, we expect that uninformed speculation opportunities will be endogenously asymmetric, as speculators will find it easier to make a profit from inflating than deflating prices (Corollaries 2 and 3). In particular, while firms will not try to preempt speculation inflating their stock price from which they can benefit, they can try to preempt speculative short-selling that harms them.[38] Furthermore, once the firm has become the target of speculative trading inflating its stock price, corrective trading by short-sellers reversing price increases is often unprofitable (Implication 3).[39] Short-selling constraints (such as the up-tick rule in the U.S.) make corrective trading even more difficult and exacerbate the resulting misallocation of talent and resources.

Uninformed speculation related to artificially inflating a firm's valuation is not restricted to secondary markets and can occur when a firm raises start-up capital. In this context, the feedback we describe might be even more pronounced and have a bigger impact, as valuations of private firms are updated much less frequently. Indeed, venture capitalists are often accused of promoting the well-known strategy of "fake it till you make it," which (as in our model) has the objective of attracting business and employees by portraying a firm in a better light than it actually merits (Braithwaite, 2018; Owen, 2020; Taparia, 2020). In line with such concerns, Gornall and Strebulaev (2020) show that close to half of unicorns would lose their unicorn status once properly pricing in all protections for VC investors stipulated in the actual contracts. Our model illustrates that firms for which building up their stakeholder

[37] Relatedly, Dow, Han, and Sangiorgi (2020) show that, once the firm's price has moved in one direction for non-fundamental reasons, it might stay there even after the shock is removed.

[38] For example, one lever with which firms can make uninformed speculation less profitable is the choice of high transparency. More disclosure and more transparency are often associated with better corporate governance. However, more transparency may backfire in some contexts by increasing agency costs emerging from too much monitoring (Hermalin and Weisbach, 2012) or premature abandonment of investments (Boot and Vladimirov, 2020).

[39] Moreover, since equity holders can benefit from inflated valuations, they are likely to trade against short-sellers seeking to correct the stock price. For example (outside of our model), large blockholders may purchase more shares (Khanna and Mathews, 2012) or the firm's management may engage in stock repurchases (Campello, Matta, and Saffi, 2021).

base is particularly important and that compensate stakeholders with performance- or equity-based pay are more likely to fall in this category of unicorns, whose investors effectively help them "fake it till they make it."

Implication 4 *(**Inflated unicorns**) Venture capitalists are more likely to agree to inflated valuations that can attract stakeholders and help firms "fake it till they make it" when firms pay stakeholders with performance or equity-based pay. Convertible financing contracts that offer VCs downside protection not clearly communicated to outsiders, facilitate this strategy.*

7 Conclusion

In this paper, we argue that speculators with no fundamental information about a firm can profit from inflating its stock price and help it "fake it till it makes it" even though everyone is rational and anticipates such strategies. The underlying mechanism is that high prices attract stakeholders, such as key employees, business partners, or investors, who rationally infer that there is a chance that the high prices reflect stellar prospects. Since stakeholders are rational and anticipate that prices might also be inflated, they do not lose out, on average. Instead, the speculators' profits come at the expense of the good firms in the economy, which end up cross-subsidizing worse ones with inflated prices or end up losing access to talent and funding altogether.

Uninformed speculators can make a profit when inflating the prices of firms that raise equity (or, more generally, finance themselves with information-sensitive securities) or compensate stakeholders with performance or equity-based pay. In the presence of such instruments, the inflated stock prices effectively facilitate cross-subsidization from good to bad firms. This cross-subsidization protects uninformed speculators against the risk of inflating the price of the wrong firm and is the reason that uninformed speculation can be profitable. Thus, speculators are likely to target cash-constrained or human-capital-intensive firms with high potential but uncertain growth prospects that resort to equity financing or paying employees with equity. Newly-listed firms or firms in transition that have high growth potential but highly uncertain prospects are also likely targets.

Uninformed speculation is most likely to occur in "normal," as opposed to hot, markets. In particular, uninformed speculation inflating prices is most profitable when stakeholders' outside options and the cost of acquiring information about targeted firms are neither too low nor too high. Furthermore, stakeholders' prior beliefs about the firm cannot be too positive (as in hot markets) or too negative (as in cold markets), as in these cases, uninformed speculation has too little impact to pay off. It is also notable that once speculation triggers positive feedback effects, such effects are hard to reverse, even when there are informed traders with negative information about a firm. That is, price reversals following such speculation are likely to be partial, especially when firms use the elevated stock price to build up their stakeholder base.

Investors can profit from inflating valuations that help firms fake it till they make it, not only in public, but also in private, markets. Again, the investor's profit comes from the fact that attracting high-quality stakeholders through inflated valuations creates firm value at the expense of the good firms in the economy. Overall, our model rationalizes why venture capitalists and entrepreneurs might knowingly agree on unrealistically high valuations that elevate firms to unicorn status and why such an inflated image can persist in secondary markets and subsequently become a reality.

References

[1] Aggarwal, Rajush, and Guojun Wu, 2006, Stock market manipulations, *Journal of Business*, 79(4), 1915–1953.

[2] Agrawal, Ashwini K., and David A. Matsa, 2013, Labor unemployment risk and corporate financing decisions. *Journal of Financial Economics*, 108(2), 449–470.

[3] Ahnert, Toni, Caio Machado, and Anna Pereira, 2022, Trading for bailouts, Working Paper.

[4] Allen, Franklin, and Garry Gorton, 1992, Stock price manipulation, market microstructure and asymmetric information, *European Economic Review* 36(2–3), 624–630.

[5] Baker, Malcolm, and Jeffrey Wurgler, 2002, Market timing and capital structure, *Journal of finance* 57(1), 1–32.

[6] Baker, Malcolm, Jeremy Stein, and Jeffrey Wurgler, 2003, When does the market matter? Stock prices and the investment of equity-dependent firms, *Quarterly Journal of Economics* 118(3), 969– 1006.

[7] Banerjee, Snehal, Jesse Davis, and Naveen Gondhi, 2018, When transparency improves, must prices reflect fundamentals better?, *Review of Financial Studies* 3(6), 2377–2414.

[8] Banerjee, Snehal, Jesse Davis, and Naveen Gondhi, 2022, Incentivizing effort and informing investment: the dual role of stock prices, Working Paper.

[9] Barber, Brad M., and Terrance Odean, 2008, All that glitters: the effect of attention and news on the buying behavior of individual and institutional investors, *Review of Financial Studies* 21(2), 785–818.

[10] Bergman, Nittai K., and Dirk Jenter, 2007, Employee sentiment and stock option compensation, *Journal of Financial Economics* 84(3), 667–712.

[11] Bond, Philip, Alex Edmans, and Itay Goldstein, 2012, The real effects of financial markets, *Annual Review of Financial Economics* 4, 39–60.

[12] Boot, Arnoud, and Vladimir Vladimirov, 2020, Co-opetition and disruption with public ownership, Working Paper.

[13] Braithwaite, Tom, 2018, "Fake it till you make it" – but know when to stop, Retrieved from https://www.ft.com/content/d7a06eb6-d18b-11e5-92a1-c5e23ef99c77.

[14] Bushman, Robert M., Joseph D. Piotroski, and Abbie J. Smith, 2004, What determines corporate transparency?, *Journal of Accounting Research* 42(2), 207–252.

[15] Campello, Murillo, Rafael Matta, and Pedro A. C. Saffi, Does stock manipulation distort corporate investment? The role of short selling costs and share repurchases, 2020, Working Paper.

[16] Chakraborty, Archishman, and Bilge Yilmaz, 2004, Informed manipulation, *Journal of Economic theory* 114(1), 132–152.

[17] Cooper, Michael J., Orlin Dimitrov, and P. Raghavendra Rau, 2001, A rose. com by any other name, *Journal of Finance* 56(6), 2371–2388.

[18] Daniel, Kent, David Hirshleifer, and Avanidhar Subrahmanyam, 1998, Investor psychology and security market under-and overreactions, *Journal of Finance* 53(6), 1839–1885.

[19] Derrien, Francois, and Ambrus Kecskes, 2013, The real effects of financial shocks: evidence from exogenous changes in analyst coverage, *Journal of Finance* 68(4), 1407–1440.

[20] Dow, James, and Gary Gorton, 1997, Stock market efficiency and economic efficiency: is there a connection?, *Journal of Finance* 52(3), 1087–1129.

[21] Dow, James, Jungsuk Han, and Francesco Sangiorgi, 2020, Hysteresis in price efficiency and the economics of slow-moving capital, *Review of Financial Studies* forthcoming.

[22] Dowling, Grahame R., 1986, Managing your corporate images, *Industrial Marketing Management* 15(2), 109–115.

[23] Edmans, Alex, and Gustavo Manso, 2011, Governance through trading and intervention: a theory of multiple blockholders, *Review of Financial Studies* 24(7), 2395–2428.

[24] Edmans, Alex, Itay Goldstein, and Wei Jiang, 2015, Feedback effects, asymmetric trading, and the limits to arbitrage, *American Economic Review* 105(12), 3766–3799.

[25] Fan, Xiaodong, and Jed DeVaro, 2020, Job hopping and adverse selection in the labor market, *Journal of Law, Economics, and Organization* 36(1), 84–138.

[26] Fishman, Michael J., and Kathleen M. Hagerty, 1989, Disclosure decisions by firms and the competition for price efficiency, *Journal of Finance* 44(3), 633–646.

[27] Fombrun, Charles, and Mark Shanley, 1990, What's in a name? Reputation building and corporate strategy, *Academy of Management Journal* 33(2), 233–258.

[28] Frenkel, Sivan, 2020, Dynamic asset sales with a feedback effect, *Review of Financial Studies* 33(2), 829–865.

[29] Gao, Pingyang, and Pierre Jinghong Liang, 2013, Informational feedback, adverse selection, and optimal disclosure policy, *Journal of Accounting Research* 51(5), 1133–1158.

[30] Gelb, David S., and Paul Zarowin, 2002, Corporate disclosure policy and the informativeness of stock prices, *Review of Accounting Studies* 7(1), 33–52.

[31] Goldman, Eitan, and Günter Strobl, 2013, Large shareholder trading and the complexity of corporate investments, *Journal of Financial Intermediation* 22 (1), 106–122.

[32] Goldman, Eitan, Jordan Martel, and Jan Schneemeier, 2021, A theory of financial media, *Journal of Financial Economics*, forthcoming.

[33] Goldstein, Itay, 2022, Information in financial markets and its real effects, *Review of Finance*, forthcoming.

[34] Goldstein, Itay, and Alexander Guembel, 2008, Manipulation and the allocational role of prices, *Review of Economic Studies* 75(1), 133–164.

[35] Goldstein, Itay, and Liyan Yang, 2017, Information disclosure in financial markets, *Annual Review of Financial Economics* 9, 101–125.

[36] Goldstein, Itay, and Liyan Yang, 2019, Good disclosure, bad disclosure, *Journal of Financial Economics* 131(1), 118–138.

[37] Goldstein, Itay, Emre Ozdenoren, and Kathy Yuan, 2013, Trading frenzies and their impact on real investment, *Journal of Financial Economics* 109(2), 566–582.

[38] Gompers, Paul A., 1996, Grandstanding in the venture capital industry, *Journal of Financial Economics* 42(1), 133–156.

[39] Gompers, Paul A., Will Gornall, Steven Kaplan, and Ilya A. Strebulaev, 2020, How do venture capitalists make decisions?, *Journal of Financial Economics* 135(1), 169–190.

[40] Glosten, Lawrence R., and Paul R. Milgrom, 1985, Bid, ask and transaction prices in a specialist market with heterogeneously informed traders, *Journal of Financial Economics* 14(1), 71–100.

[41] Gornall, Will, and Ilya Strebulaev, 2020, Squaring venture capital valuations with reality, *Journal of Financial Economics* 135(1), 120–143.

[42] Grullon, Gustavo, Sebastien Michenaud, and James P. Weston, 2015, The real effects of short-selling constraints, *Review of Financial Studies* 28(6), 1737–1767.

[43] Healy, Paul M., Amy P. Hutton, and Krishna G. Palepu, 1999, Stock performance and intermediation changes surrounding sustained increases in disclosure, *Contemporary Accounting Research* 16(3), 85–520.

[44] Hellmann, Thomas, 2006, IPOs, acquisitions, and the use of convertible securities in venture capital, *Journal of Financial Economics* 81(3), 649–679.

[45] Hermalin, Benjamin E., and Michael S. Weisbach, 2012, Information disclosure and corporate governance, *Journal of Finance* 67(1), 195-233.

[46] Hoffmann, Florian, and Vladimir Vladimirov, 2022, Worker runs, Working Paper.

[47] Huberman, Gur, and Tomer Regev, 2001, Contagious speculation and a cure for cancer: a nonevent that made stock prices soar, Journal of Finance 56(1), 387–396.

[48] Iliev, Peter, and Michelle Lowry, 2020, Venturing beyond the IPO: financing of newly public firms by venture capitalists, *Journal of Finance* 75(3), 1527-1577.

[49] Inderst, Roman, and Vladimir Vladimirov, 2019, Growth firms and relationship finance: a capital structure perspective, *Management Science* 65(11), 5411–5426.

[50] Innes, Robert D., 1990, Limited liability and incentive contracting with ex-ante action choices, *Journal of Economic Theory* 52(1), 45–67.

[51] Jegadeesh, Narasimhan, and Sheridan Titman, 2001, Profitability of momentum strategies: an evaluation of alternative explanations, *Journal of Finance* 56(2), 699–720.

[52] Khanna, Naveen, and Ramana Sonti, 2004, Value creating stock manipulation: feedback effect of stock prices on firm value, *Journal of Financial Markets* 7(3), 237–270.

[53] Khanna, Naveen, and Richmond D. Mathews, 2012, Doing battle with short-sellers: the conflicted role of blockholders in bear raids, *Journal of Financial Economics* 106(2), 229-246.

[54] Khanna, Naveen, and Richmond D. Mathews, 2016, Posturing and holdup in innovation, *Review of Financial Studies* 29(9), 2419–2454.

[55] Kyle, Albert S, 1985, Continuous auctions and insider trading, *Econometrica* 53(6), 1315–1335.

[56] Levit, Doron, Nadya Malenko, and Ernst Maug, 2020, Trading and shareholder democracy, Working Paper.

[57] Liang, Lantian, Ryan Williams, and Steven Chong Xiao, 2021, Stock market information and innovative investment in the supply chain, *Review of Corporate Finance Studies* 10(4), 856–894.

[58] Marx, Matt, Deborah Strumsky, and Lee Fleming, 2009, Mobility, skills, and the Michigan non-compete experiment, *Management Science* 55(6), 875–879.

[59] Matta, Rafael, Sergio Rocha, and Paulo Vaz, 2020, Product market competition and predatory stock price manipulation, Working Paper.

[60] Maug, Ernst, 1998, Large shareholders as monitors: Is there a trade-off between liquidity and control?, *Journal of Finance* 53(1), 65–98.

[61] Nachman, David C., and Thomas H. Noe, 1994, Optimal design of securities under asymmetric information, *Review of Financial Studies* 7(1), 1–44.

[62] Owen, Thomas, 2020, Fake it until you make it: a Silicon Valley strategy that seems unstoppable, Retrieved from https://www.sfchronicle.com/business/article/Fake-it-until-you-make-it-a-Silicon-Valley-15012062.php.

[63] Sharf, Samantha, and David Jeans, 2020 WeWork employees feel abandoned and angry as SoftBank ditches its $3 billion buyout offer, retrieved from https://www.forbes.com/sites/samanthasharf/2020/04/13/wework-employees-feel-abandoned-and-angry-as-softbank-ditches-its-3-billion-buyout-offer/.

[64] Skrzypacz, Andrzej, and Basil Williams, 2022, Spoofing in equilibrium, Working paper.

[65] Subrahmanyam, Avanidhar, and Sheridan Titman, 2001, Feedback from stock prices to cash flows, *Journal of Finance* 56(6), 2389-2413.

[66] Taparia, Neal, 2020, 5 reasons why founders fake it till they make it, Retrieved from https://www.forbes.com/sites/nealtaparia/2020/06/17/5-compelling-reasons-to-fake-it-till-you-make/?sh=7b4f703d526

[67] Trainer, David, 2021, Tesla: $1 trillion of speculation, Retrieved from https://www.forbes.com/sites/greatspeculations/2021/11/09/tesla-1-trillion-of-speculation/?sh=3184dec477eb

[68] Turban, Daniel B., and Daniel W. Greening, 1997, Corporate social performance and organizational attractiveness to prospective employees, *Academy of Management Journal* 40(3), 658–672.

[69] Voss, Paul, 2022, Short-term debt and corporate governance, Working Paper.

Appendix A Proofs

Proof of Lemma 1. We proceed backwards. Suppose that prospective stakeholders observe the firm-specific shock. At $t = 3$, the firm can attract stakeholders if and only if the firm-specific shock is G. It is optimal for the firm to offer a compensation of $\Delta R = \frac{\overline{w}}{\lambda_G}$ for which the stakeholders' participation constraint binds. The argument is standard and, thus, relegated to Lemma C.2. Hence, the firm's expected payoff if the firm-specific shock is G is $\lambda_G x - \overline{w}$. By contrast, if the firm-specific shock is B, the firm cannot attract stakeholders (as $\lambda_B x < \overline{w}$), and the firm's value is zero. In what follows, we show a speculators traders with her information in both periods, and that an uninformed speculator does not trade.

The speculator's expected trading profit is

$$(\lambda_G (x - \Delta R) - p_{D_1}) D_1 + (\lambda_G (x - \Delta R) - p_{D_1 D_2}) D_2.$$

Clearly, the positively informed speculator (i.e., a speculator observing $s = G$) cannot make a strictly positive profit from not trading. She also cannot profit from selling in both periods or selling in one period and not trading in another, as the price set by the market maker will be at most $\lambda_G (x - \Delta R)$, resulting in an expected trading loss. By contrast, if the positively informed speculator deviates to buying in both periods, the price set by the market maker is at most $q_0 \lambda_G (x - \Delta R)$, resulting in a trading profit of at least

$$\begin{aligned} &2 (\lambda_G (x - \Delta R) - q_0 \lambda_G (x - \Delta R)) \\ &= 2 (1 - q_0) (\lambda_G x - \overline{w}) > 0. \end{aligned}$$

Similarly, it also cannot be that the positively informed trader buys in the first period but does not trade or sells in the second period, as then her expected profit from the second trade is either zero or negative, while by deviating to buying she can make a trading profit in that period of $(1 - q_0) (\lambda_G x - \overline{w})$. Finally, it remains to argue that the positively informed trader will deviate from equilibrium candidates in which she does not trade or sells in the first period and buys in the second. Suppose to a contradiction that such equilibria existed and that the speculator deviates to buying in the first period. Since in equilibrium, this trade does not come from a positively informed trader, the prices set by the market maker following buy orders in the first and second period are lower than after the equilibrium trades of a positively informed trader on the equilibrium path. Hence, by deviating, the positively informed speculator makes a strictly higher trading profit in both periods, completing the contradiction argument. Hence, the positively informed speculator buys in both periods. By symmetric arguments, we can show that a negatively informed speculator will sell in both periods.

It is now straightforward to show that the uninformed speculator will not trade. Her expected profit when she follows the same trading strategy as when she observes $s = G$ is

$$(q_0 (\lambda_G x - \overline{w}) - p_{D_1}) + (q_0 (\lambda_G x - \overline{w}) - p_{D_1 D_2}) < 0,$$

which is less than her expected payoff (of zero) when she abstains from trading in both periods. Furthermore, the uninformed trader cannot strictly benefit from trading as a positively informed trader in $t = 1$ and as a noise trader in $t = 2$, as she will make then trading loss on her first trade and no profit on her second trade. The argument that an uninformed speculator will not follow the trading strategy of a negatively informed speculator is symmetric. **Q.E.D.**

Proof of Proposition 1. In what follows, we show the existence of an equilibrium in which the speculator buys in both periods if $s \in \{G, \varnothing\}$ and sells in both periods if $s = B$. We discuss the existence of other equilibria at the end of the proof. To show existence, we, first, derive the posterior beliefs and the prices in both trading dates $t = 1$ and $t = 2$ (Step 1). In Step 2, we derive the speculator' expected trading profit and derive the necessary and sufficient conditions for this profit to be positive. Subsequently, we verify that the trading strategies at $t = 1$ and $t = 2$ are optimal in that there are no profitable deviations from these strategies (Steps 3 and 4).

Step 1: Posterior beliefs, prices, and equilibrium payoffs. The market maker's posterior belief that the firm-specific shock is $\omega = G$ is

$$q_{11} = \frac{\left((1-\beta) + \beta\frac{1}{9}\right) q_0}{(1-\beta)\,\alpha q_0 + (1-\beta)(1-\alpha) + \beta\frac{1}{9}} \quad \text{if } D_1 = D_2 = 1$$

$$q_{-1-1} = \frac{\beta\frac{1}{9}q_0}{(1-\beta)\,\alpha(1-q_0) + \beta\frac{1}{9}} \quad \text{if } D_1 = D_2 = -1$$

and $q_{D_1 D_2} = q_0$ for all other orders D_1 an D_2.[40] Since the firm can attract stakeholders only if $q_{11} \geq q^*$, there is a threshold

$$\alpha_{11}^* := \max\left\{0, \frac{\left(1 - \frac{8}{9}\beta\right)\left(1 - \frac{q_0}{q^*}\right)}{(1-\beta)(1-q_0)}\right\},$$

[40] These posteriors are formed using Bayes rule – see Lemma C.1 for details.

such that the firm can attract stakeholders after $D_1 = D_2 = 1$ only if $\alpha \geq \alpha_{11}^*$. Note that $\alpha_{11}^* = 0$ for the case when $q_0 > q^*$.

Furthermore, the market maker's beliefs that the trader chooses $D_2 = 1$ after she has chosen $D_1 = 1$ and, respectively, that she chooses $D_2 = -1$ after she has chosen $D_1 = -1$ are

$$\begin{aligned}
\pi_{11} &= \frac{(1-\beta)\,\alpha q_0 + (1-\beta)\,(1-\alpha) + \beta\frac{1}{9}}{(1-\beta)\,\alpha q_0 + (1-\beta)\,(1-\alpha) + \beta\frac{1}{3}} \\
\pi_{-1-1} &= \frac{(1-\beta)\,\alpha\,(1-q_0) + \beta\frac{1}{9}}{(1-\beta)\,\alpha\,(1-q_0) + \beta\frac{1}{3}}.
\end{aligned}$$

The prices at $t = 2$ and $t = 1$ are (see for details expressions (C.3) and (C.4) in Lemma C.1)

$$\begin{array}{ll}
p_{11} = (\lambda_B + q_{11}\Delta\lambda)\left(x - \frac{\overline{w}}{\lambda_B + q_{11}\Delta\lambda}\right) & \text{if } D_1 = D_2 = 1 \\
p_1 = \pi_{11}p_{11} + (1-\pi_{11})\,(\lambda_B + q_0\Delta\lambda)\left(x - \frac{\overline{w}}{\lambda_B + q_0\Delta\lambda}\right)\mathbf{1}_{q_0 \geq q^*} & \text{if } D_1 = 1 \\
p_{-1-1} = (\lambda_B + q_{-1-1}\Delta\lambda)\left(x - \frac{\overline{w}}{\lambda_B + q_{-1-1}\Delta\lambda}\right)\mathbf{1}_{q_{-1-1} \geq q^*} & \text{if } D_1 = D_2 = -1 \\
p_{-1} = \pi_{-1-1}p_{-1-1} + (1-\pi_{-1-1})\,(\lambda_B + q_0\Delta\lambda)\left(x - \frac{\overline{w}}{\lambda_B + q_0\Delta\lambda}\right)\mathbf{1}_{q_0 \geq q^*} & \text{if } D_1 = -1 \\
p_{D_1D_2} = p_0 := (\lambda_B + q_0\Delta\lambda)\left(x - \frac{\overline{w}}{\lambda_B + q_0\Delta\lambda}\right)\mathbf{1}_{q_0 \geq q^*} & \text{otherwise}
\end{array}$$

where $\mathbf{1}_{q_0 \geq q^*}$ and $\mathbf{1}_{q_{-1-1} \geq q^*}$ are indicator functions equal to one if $q_0 \geq q^*$ and $q_{-1-1} \geq q^*$, respectively, and zero otherwise. The speculator's expected payoff from buying in both trading periods is

$$\Pi_{11}(s) = 2\,(\lambda_B + q\,(s)\,\Delta\lambda)\left(x - \frac{\overline{w}}{\lambda_B + q_{11}\Delta\lambda}\right) - p_{D_1} - p_{D_1D_2}$$

which, after plugging in for p_{D_1} and $p_{D_1D_2}$, can be stated as

$$\Pi_{11}(s) = \begin{cases}
\begin{array}{l} 2q\,(s)\,\Delta\lambda\left(x - \frac{\overline{w}}{\lambda_B + q_{11}\Delta\lambda}\right) \\ + \left((1-\pi_{11})\,\lambda_B - (1+\pi_{11})\,q_{11}\Delta\lambda\right)\left(x - \frac{\overline{w}}{\lambda_B + q_{11}\Delta\lambda}\right) \end{array} & \text{if } q_0 < q^* \\
\begin{array}{l} 2q\,(s)\,\Delta\lambda\left(x - \frac{\overline{w}}{\lambda_B + \Delta\lambda q_{11}}\right) \\ + \Delta\lambda\left((1-\pi_{11})\,(q_{11} - q_0)\,x - 2q_{11}\left(x - \frac{(\overline{w} - R)}{\lambda_B + \Delta\lambda q_{11}}\right)\right) \end{array} & \text{if } q_0 \geq q^*.
\end{cases} \tag{A.1}$$

Furthermore, we obtain that the speculator's expected payoff from selling in both trading periods is

$$\Pi_{-1-1}(s) = \begin{cases} 0 & \text{if } q_0 < q^* \\ (1-\pi_{-1-1})(\lambda_B + q_0\Delta\lambda)\left(x - \frac{\overline{w}}{\lambda_B + q_0\Delta\lambda}\right) & \text{if } q_0 \geq q^* > q_{-1-1} \\ (1-\pi_{-1-1})(q_0 - q_{-1-1})\Delta\lambda x & \\ -2(q(s) - q_{-1-1})\Delta\lambda\left(x - \frac{\overline{w}}{\lambda_B + q_{-1-1}\Delta\lambda}\right) & \text{if } q_{-1-1} \geq q^*. \end{cases} \tag{A.2}$$

Step 2. Necessary and sufficient conditions for $\Pi_{11}(\varnothing) > 0$. First, consider the case in which $q_0 < q^*$ (i.e., $\overline{w} > (\lambda_B + q_0\Delta\lambda)x$). In this case, $\mathbf{1}_{q_0 \geq q^*} = 0$, and a sufficient condition that the uninformed speculator's profit is positive, i.e., $\Pi_{11}(\varnothing) > 0$, is that $\alpha \leq \frac{1-\frac{2}{3}\beta-\sqrt{\left(1-\frac{2}{3}\beta\right)^2-\frac{4}{9}\beta\left(1-\frac{8}{9}\beta\right)}}{2(1-\beta)(1-q_0)}$. In this case, the sum of all terms multiplied by $\Delta\lambda$ in the first clause of (A.1) is positive. Next, we derive necessary and sufficient conditions for $\Pi_{11}(\varnothing) > 0$ for the case in which $\alpha > \frac{1-\frac{2}{3}\beta-\sqrt{\left(1-\frac{2}{3}\beta\right)^2-\frac{4}{9}\beta\left(1-\frac{8}{9}\beta\right)}}{2(1-\beta)(1-q_0)} > 0$. In Lemma C.3 in Appendix C, we show that if $\Pi_{11}(\varnothing)$ crosses zero for $\alpha \leq 1$, then it does so from above. Hence, there is a cutoff value $\overline{\alpha}_{11}$ at which $\Pi_{11}(\varnothing) = 0$, and it holds that $\Pi_{11}(\varnothing) > 0$ for $\alpha \leq \overline{\alpha}_{11}$.

It remains to show that the condition that $\alpha \leq \overline{\alpha}_{11}$ does not contradict the requirement that $\alpha \geq \alpha^*_{11}$. Clearly, this is never the case if $\overline{w} \to (\lambda_B + q_0\Delta\lambda)x$, as then $\alpha^*_{11} \to 0$. More generally, there is an upper threshold for $\overline{w}$ such that $\Pi_{11}(\varnothing) > 0$ if $\overline{w}$ is between $(\lambda_B + q_0\Delta\lambda)x$ and this upper threshold. To find this threshold, observe that α^*_{11} is increasing in $\overline{w}$ (as q^* is increasing in $\overline{w}$). By contrast, $\overline{\alpha}_{11}$ does not depend on $\overline{w}$. Hence, there is a unique cutoff for $\overline{w}$, implicitly defined by the value of $\overline{w}$ for which $\alpha^*_{11} = \min\{\overline{\alpha}_{11}, 1\}$, such that $\alpha^*_{11} < \overline{\alpha}_{11}$ if $\overline{w}$ is below this cutoff.

Second, consider the case in which $q_0 \geq q^*$ (i.e., $\overline{w} \leq (\lambda_B + q_0\Delta\lambda)x$). Since, in this case, $\alpha^*_{11} = 0$, the condition that $\alpha \geq \alpha^*_{11}$ is never binding. In Lemma C.3, we show that also for this case, if $\Pi_{11}(\varnothing) = 0$, then this is for at most one value $\overline{\alpha}_{11} \in [0,1]$. A necessary and sufficient condition for $\overline{\alpha}_{11} > 0$ is that $\overline{w} > \frac{1+\pi_{11}}{2}(\lambda_B + q_{11}\Delta\lambda)x$.

Note that in both cases (i.e., both when $q_0 < q^*$ and $q_0 \geq q^*$), the thresholds we have derived for $\overline{w}$ imply that $\overline{w}$ must be intermediate. Furthermore, these conditions on $\overline{w}$ can alternatively be stated as conditions on q_0.

Step 3: Ruling Out Deviations at $t = 2$**.** Denote

$$v(s, q_{D_1D_2}) = (\lambda_B + q(s)\Delta\lambda)\left(x - \frac{\overline{w}}{\lambda_B + q_{D_1D_2}\Delta\lambda}\right)\mathbf{1}_{q_0 \geq q^*}$$

and observe that if the market maker observes trading orders that are inconsistent with the equilibrium strategies associated with $s = G$ (i.e., $D_1 = D_2 = 1$) or $s = B$ (i.e., $D_1 = D_2 = -1$), he will set the price equal to p_0, and the firm will be able to attract stakeholders only if $q_0 \geq q^*$.

We start by verifying that after the speculator who has observed $s \in \{G, \varnothing\}$ has played $D_1 = 1$ at $t = 1$, she will not deviate to choosing $D_2 \in \{-1, 0\}$, which is only consistent with the trading strategy of a noise trader on the equilibrium path. The speculator's expected payoff is then

$$(v(s, q_{D_1 D_2}) - p_1) + (v(s, q_{D_1 D_2}) - p_{1D_2}) D_2. \tag{A.3}$$

If $D_2 = -1$ and $s \in \{G, \varnothing\}$, the deviation payoff in (A.3) is $-p_1 + p_0 < 0$. Hence, such a deviation is not profitable. If $D_2 = 0$ and $s = \varnothing$, the deviation payoff is again weakly negative if $s = \varnothing$. Specifically, that payoff boils down to $-q_{11}\Delta\lambda x < 0$ if $q_0 < q^*$ and $-(q_{11} - q_0)\Delta\lambda x < 0$ if $q_0 \geq q^*$. Finally, if $D_2 = 0$ and $s = G$, the deviation payoff is again less than the speculator's equilibrium payoff, as the firm needs to pay stakeholders more (so the first-period trading profit is lower — it is $-p_1$ if $q_0 < q^*$ and $-p_1 + \lambda_G \left(x - \frac{\overline{w}}{\lambda_B + q_0 \Delta\lambda}\right)$ if $q_0 \geq q^*$— while the second-period trading profit is zero (while it is positive on the equilibrium path).

Similarly, a negatively informed speculator ($s = B$) will also not deviate after playing $D_1 = -1$ at $t = 1$. If she buys, i.e., $D_2 = 1$, then the price in the second trading period will be p_0, resulting in a weakly negative profit of $p_{-1} - p_0$ (strictly negative if $q_0 > q^*$ and zero otherwise). If the speculator does not trade, $D_2 = 0$, the deviation payoff is also weakly less than the speculator's equilibrium payoff. In particular, if $q_0 < q^*$, the deviation profit is zero, which is the same as on the equilibrium path. And if $q_0 \geq q^*$, the firm needs to pay stakeholders less, leading to a lower first period period trading profit of $p_{-1} - \lambda_B \left(x - \frac{\overline{w}}{\lambda_B + q_0 \Delta\lambda}\right)$ instead of $p_{-1} - \lambda_B \left(x - \frac{\overline{w}}{\lambda_B + q_{-1-1} \Delta\lambda}\right) \mathbf{1}_{q_{-1-1} \geq q^*}$, while the second-period trading profit is zero (while, on the equilibrium path, it is strictly positive).

Step 4: Ruling Out Deviations at $t = 1$. We continue by verifying that the speculator will not deviate at $t = 1$. In what follows, we present the proof for the case in which $q_0 < q^*$, which is sufficient to show the existence we claim in Proposition 1. For completeness, we also analyze the case in which $q_0 \geq q^*$ in Appendix C, which follows the same steps but is algebraically more tedious (see Lemma C.4).

Suppose that the speculator has observed $s \in \{G, \varnothing\}$. Regardless of how the speculator trades at $t = 2$, deviating to $D_1 \in \{-1, 0\}$ and, thus, trading as a negatively informed or noise trader at $t = 1$, results in the firm not being able to attract stakeholders, in which case its value is equal to the price set by the market maker at both trading dates: $p_{D_1} = p_{D_1 D_2} = p_0 = 0$. The speculator's expected payoff is then $(p_0 - p_{D_1}) D_1 + (p_0 - p_{D_1 D_2}) D_2 = 0$, which is less than what she obtains on the equilibrium path. The same argument applies if $s = B$, but the speculator deviates to $D_1 = 0$ or $D_1 = 1$ followed by $D_2 \in \{-1, 0\}$. Then, the speculator's deviation profit would be zero if $D_1 = 0$, $D_2 \in \{-1, 0\}$ and negative if $D_1 = 1$, $D_2 \in \{-1, 0\}$.

It remains to consider the case in which the speculator observes $s = B$ but mimics the strategy of a positively informed speculator and buys in both periods, i.e., $D_1 = D_2 = 1$. If the speculator's expected payoff, given by expression (A.1), is positive for some α, then it always crosses zero in $\alpha \in [0, 1]$ for a unique cutoff, which we denote with α_{11}^B. Note that since $\Pi_{11}(s)$ is increasing in $q(s)$ and $q(G) = 1 \geq q_0 \geq q(B) = 0$, it always holds that $\alpha_{11}^B < \overline{\alpha}_{11}$.

Defining $\underline{\alpha}_{11} := \max\left\{\alpha_{11}^B, \alpha_{11}^*\right\}$, we can summarize all conditions on α from Steps 2 - 4 as: there are thresholds $\underline{\alpha}_{11}$ and $\overline{\alpha}_{11}$, with $\underline{\alpha}_{11} < \overline{\alpha}_{11}$, such that an equilibrium (as stipulated at the beginning of the proof) exists if $\alpha \in [\underline{\alpha}_{11}, \overline{\alpha}_{11}]$.[41] This step concludes our existence proof.

It is straightforward to modify the above proof to show that there are equilibria in which the speculator buys in both periods if $s \in \{G, \varnothing\}$ and does not trade if $s = B$ or sells only in one of these periods. The only difference is the posterior belief that the speculator has observed a bad signal. However, since the price set by the market maker for any posterior belief $q_{D_1 D_2} \leq q_0$ is the same as above (i.e., zero), all arguments apply without any further changes. In Lemma C.5, we show that there are equilibria with uninformed speculation in which the speculator buys in $t = 1$ and does not trade in $t = 2$ if $s \in \{G, \varnothing\}$. Note that the expected payoff for an uninformed speculator in such equilibria is higher than when she buys in both periods since the price at which she buys in the first period is the same, but she does not incur a loss from trading at $t = 2$. **Q.E.D.**

Proof of Lemma 2. Building on the proof of Proposition 1, observe that if $q_0 < q^*$, in any equilibrium in which the uninformed speculator short-sells in either one or both trading periods, her equilibrium expected payoff will be zero in analogy to (A.2). Thus, there is no equilibrium in which the uninformed speculator makes a positive profit from short-selling. **Q.E.D.**

Proof of Proposition 2. We show the proof only for the class of equilibria in which the speculator buys the firm's stock in both trading dates if $s \in \{G, \varnothing\}$. The prices at $t = 1$

[41] The subscript 11 in $\underline{\alpha}_{11}$ and $\overline{\alpha}_{11}$ refers to the speculator's trading strategy if $s \in \{G, \varnothing\}$. We use $[\underline{\alpha}, \overline{\alpha}]$ in the statement of the Proposition, as for other speculation equilibria, such as those discussed below, the thresholds might be different.

and $t = 2$ are then

$$p_{11} = y - R + (\lambda_B + q_{11}\Delta\lambda)\left(\Delta y - \frac{\overline{w} - R}{(\lambda_B + q_{11}\Delta\lambda)}\right), \tag{A.4}$$

$$p_1 = \pi_{11}p_{11} + (1 - \pi_{11})\left(y + \mathbf{1}_{q_0 \geq q^*}\left(-R + (\lambda_B + q_0\Delta\lambda)\left(\Delta y - \frac{\overline{w} - R}{(\lambda_B + q_0\Delta\lambda)}\right)\right)\right), \tag{A.5}$$

where we use that, for any given R, ΔR is pinned down by the stakeholders' participation constraint as $\Delta R = \frac{\overline{w} - R}{\lambda_B + q_{D_1 D_2}\Delta\lambda}$; note that it is never optimal to offer $R > \overline{w}$, implying that $\Delta R \geq 0$ is satisfied. The speculator's valuation of the firm if the firm can attract stakeholders after the speculator buys in both periods is

$$y - R + (\lambda_B + q(s)\Delta\lambda)\left(\Delta y - \frac{\overline{w} - R}{\lambda_B + q_{11}\Delta\lambda}\right). \tag{A.6}$$

First, we show that, holding the stakeholders' expected compensation equal to $\overline{w}$, the uninformed speculator's expected payoff is decreasing in R. Plugging in for p_{11} and p_1 from the expressions from (A.4) and (A.5), the speculator's expected payoff becomes

$$\begin{aligned}
\Pi_{11}(s) \quad = \quad & (2(\lambda_B + q(s)\Delta\lambda) - (1 + \pi_{11})(\lambda_B + q_{11}\Delta\lambda))\left(\Delta y - \frac{\overline{w} - R}{\lambda_B + q_{11}\Delta\lambda}\right) \qquad \text{(A.7)} \\
& - (1 - \pi_{11})\left(R + \mathbf{1}_{q_0 \geq q^*}\left(-R + (\lambda_B + q_0\Delta\lambda)\left(\Delta y - \frac{\overline{w} - R}{(\lambda_B + q_0\Delta\lambda)}\right)\right)\right).
\end{aligned}$$

Taking the derivative with respect to R and simplifying, we obtain that:

$$\frac{\partial}{\partial R}\Pi_{11}(s) = 2\frac{q_0 - q_{11}}{\lambda_B + q_{11}\Delta\lambda}\Delta\lambda < 0.$$

Next, we show that the uninformed speculator's trading profit payoff is negative if $R = \overline{w}$ and $\Delta R = 0$. To see this, observe that the uninformed speculator's trading profit becomes then

$$\begin{aligned}
\Pi_{11}(\varnothing) \quad &= \quad (2(\lambda_B + q_0\Delta\lambda) - (1 + \pi_{11})(\lambda_B + q_{11}\Delta\lambda))\Delta y \\
& \qquad - (1 - \pi_{11})(\overline{w} + \mathbf{1}_{q_0 \geq q^*}(-\overline{w} + (\lambda_B + q_0\Delta\lambda)\Delta y)) \\
&< \quad (2(\lambda_B + q(s)\Delta\lambda) - (1 + \pi_{11})(\lambda_B + q_{11}\Delta\lambda) - (1 - \pi_{11})(\lambda_B + q_0\Delta\lambda))\Delta y \\
&= \quad (1 + \pi_{11})(q_0 - q_{11})\Delta\lambda\Delta y < 0.
\end{aligned}$$

Finally, observe that if $R = 0$, expression (A.7) is the same as (A.1) with the only difference that we need to replace x by Δy. Thus, Proposition 1 applies nearly unchanged. **Q.E.D.**

Proof of Proposition 3. All results are derived as part of the proof of Proposition 1. **Q.E.D.**

Proof of Corollary 1. We measure price efficiency by the (expected) squared error between the value of the firm and the price at which its equity is traded

$$\mathrm{E}\left[\left(v\left(s, q_{D_1 D_2}\right) - p_{D_1}\right)^2 + \left(v\left(s, q_{D_1 D_2}\right) - p_{D_1 D_2}\right)^2\right],$$

where the expectation is over s. It is sufficient to show that the pricing error increases in the transparency parameter α for at least one equilibrium.

Consider the case in which $\alpha = \underline{\alpha}_{11}$, and consider the equilibrium from Proposition 1. If λ_B is sufficiently low, we have that $\Pi_{11}(B) < 0$ for all α. Hence the lower bound for α in Proposition 3 is given by $\underline{\alpha}_{11} = \alpha_{11}^*$ and at this bound, it holds that $x - \frac{\overline{w}}{\lambda_B + q_{11}\Delta\lambda} = 0$. At this degenerate equilibrium, the firm's fundamental value is zero regardless of whether the firm can attract stakeholders, as even if the firm attracts stakeholders, all cash flows are paid out as compensation. Hence, the firm's price and the pricing errors are also zero regardless of how the speculator trades. As α increases, both $v\left(s, q_{D_1 D_2}\right)$ and the firm's stock prices increase away from zero (see the proof of Proposition 1). **Q.E.D.**

Proof of Corollary 2. We present parametric examples showing existence of equilibria with uninformed speculation for $q_0 < q^*$ and $q_0 \geq q^*$ in Lemma C.4 in Appendix C. **Q.E.D.**

Proof of Lemma 3. We argue to a contradiction. Suppose that there is an equilibrium in which the stakeholders leave the firm at $t = 2$ when they observe stock prices consistent with the equilibrium trading strategy of a negatively but not a positively informed speculator. We proceed in two steps. In Step 1, we define the equilibrium prices and expected payoffs. In Step 2, we argue to a contradiction by showing that the speculator cannot make a profit when her trading leads stakeholders to leave, provided that $L \in \left[\underline{L}, \overline{L}\right]$ (which we define below).

Step 1: Payoffs and prices. The speculator's expected payoff from when her trading leads stakeholders to leave is

$$\left(L - p_{D_1}\right) D_1 + \left(L - p_{D_1 D_2}\right) D_2. \tag{A.8}$$

Instead, the speculator's expected payoff when stakeholders do not leave the firm is

$$((\lambda_G + q(s)\Delta\lambda)(x - \Delta R) - p_{D_1}) D_1 + ((\lambda_G + q(s)\Delta\lambda)(x - \Delta R) - p_{D_1 D_2}) D_2. \quad (A.9)$$

Note that in this section, ΔR is set before the trading game starts and is not affected by it.

Let $\pi_{D_1 D_s}$ denote the probability that the market maker assigns that the trade in the second period comes from a speculator with signal s, after observing her order flow, D_1, in the first period. Analogously, let $p_{D_1 D_s}$ be the price that would result in period two if the market maker observes trading consistent with the equilibrium strategy of a speculator with signal s. The price at $t = 1$ can be stated as

$$p_{D_1} = \pi_{D_1 D_B} p_{D_1 D_B} + \pi_{D_1 D_G} p_{D_1 D_G} + (1 - \pi_{D_1 D_B} - \pi_{D_1 D_G})(\lambda_B + q_0 \Delta\lambda)(x - \Delta R). \quad (A.10)$$

If the market maker observes an order flow at $t = 1$ that is consistent with the strategy of a negatively but not a positively informed speculator, we have that $p_{D_1 D_B} = L$ and $\pi_{D_1 D_G} = 0$. If D_1 is the same for $s = B$ and $s = G$, but D_2 differs depending on the signal, we have that

$$p_{D_1 D_G} = (\lambda_B + q_{D_1 D_G} \Delta\lambda)(x - \Delta R).$$

Step 2. Trading strategies and deviations. Observe that there is no equilibrium in which the speculator does not buy in both periods if $s = G$. To see this, suppose to a contradiction that the speculator either does not trade or sells at $t = 1$ if $s = G$. By deviating and buying in both periods, the speculator will have to pay p_1 and p_{11} where both are weakly smaller than $(\lambda_B + q_0 \Delta\lambda)(x - \Delta R)$ since the market maker associates this strategy with a noise trader or potentially even with a negatively informed trader (at least at $t = 1$). Hence, the speculator's deviation trading profit is at least $2(\lambda_G - (\lambda_B + q_0 \Delta\lambda))(x - \Delta R)$, which is higher than her equilibrium profit of (A.9). The latter is true because the speculator makes a loss from short-selling, no profit from not trading, and a smaller profit from buying, since she buys at a price higher than $(\lambda_B + q_0 \Delta\lambda)(x - \Delta R)$. Using similar, arguments, it is easy to see that there is no equilibrium in which a positively informed speculator buys in the first but not the second period. In particular, deviating to buying in both periods makes then the speculator strictly better off, as the price in the first period is the same, while that in the second period is lower than the firm's fundamental value. Hence, the positively informed speculator's trading strategy is $\{D_1, D_2\} = \{1, 1\}$, and in any equilibrium in which stakeholders leave, the negatively informed strategy must differ from $\{D_1, D_2\} = \{1, 1\}$.

Next, we consider the speculator's strategies when she is negatively informed ($s = B$)

or uninformed ($s = \varnothing$). First, we argue to a contradiction that there is no equilibrium in which a negatively informed speculator makes a profit from selling or not trading in period one, $D_1 \in \{0, -1\}$ if $L > \underline{L} := (\lambda_B + q_0 \Delta\lambda)(x - \Delta R)$. Recall that the speculator buys in the first period ($D_1 = 1$) if $s = G$. Hence, if the speculator plays, instead, $D_1 \in \{0, -1\}$, it becomes known that she has not observed $s = G$. Hence, it holds that $\pi_{D_1 D_G} = 0$. Since by contradiction assumption, stakeholders leave after the second period if $s = B$, we also have $p_{D_1 D_B} = L$. Plugging into expressions (A.8) and (A.10), we obtain that the speculator obtains a negative expected payoff from her first-period trade $D_1 \in \{0, -1\}$ if $L > (\lambda_B + q_0 \Delta\lambda)(x - \Delta R)$. Since $p_{D_1 D_B} = L$, we further have that the speculator's second-period trading profit is zero. Hence, the speculator's overall equilibrium expected trading profit is negative. This gives a contradiction since her expected payoff from deviating to not trading in both periods is zero.[42]

It remains to show that there is also no equilibrium in which a negatively informed speculator buys in period one, i.e., $D_1 = 1$ if $L < \overline{L} := \left(\lambda_B + \frac{(1-\beta)\alpha + \frac{2}{9}\beta}{(1-\beta)\alpha q_0 + \frac{2}{9}\beta} q_0 \Delta\lambda\right)(x - \Delta R)$. Suppose to a contradiction that such an equilibrium existed. In any equilibrium in which a negatively informed speculator makes a profit from trading, a speculator observing $s = \varnothing$ will play the same strategy, as the expected payoff from doing so is independent of the signal s (see expression (A.6)), while the profit from not trading is zero. Combined with the fact that the second-period trading profit is zero if the stakeholders leave, we can restrict attention to the case in which the speculator does not trade in the second period, i.e., $\{D_1, D_2\} = \{1, 0\}$, if $s = \{B, \varnothing\}$ since the case with $\{D_1, D_2\} = \{1, -1\}$ if $s = \{B, \varnothing\}$ is payoff-equivalent. It holds that:

$$\pi_{10} = \frac{(1-\beta)(\alpha(1-q_0) + (1-\alpha)) + \frac{1}{9}\beta}{1 - \frac{2}{3}\beta}$$

$$\pi_{11} = \frac{(1-\beta)\alpha q_0 + \frac{1}{9}\beta}{1 - \frac{2}{3}\beta}$$

$$p_{11} = \left(\lambda_B + \frac{\left((1-\beta)\alpha + \frac{1}{9}\beta\right) q_0}{(1-\beta)\alpha q_0 + \frac{1}{9}\beta}\Delta\lambda\right)(x - \Delta R)$$

Plugging π_{10}, π_{11}, p_{11} and p_1 into (A.10), we derive that a negatively informed speculator's expected profit from buying at $t = 1$, which is equal to $L - p_1$, is negative as long as $L < \left(\lambda_B + \frac{(1-\beta)\alpha + \frac{2}{9}\beta}{(1-\beta)\alpha q_0 + \frac{2}{9}\beta} q_0 \Delta\lambda\right)(x - \Delta R)$. **Q.E.D.**

Proof of Proposition 4. First, we argue that the firm can prevent the existence of equilibria in which changes in the firm's stock price cause stakeholders to leave by choosing α

[42] Recall that we assume that if the speculator's expected trading profit is zero, she does not trade.

sufficiently low. To see this, observe that stakeholders leave the firm if and only if their expected compensation at the firm is lower than their outside option $\overline{w}$. Hence, there is a threshold $\widehat{q}:=\frac{\overline{w}-\lambda_B\Delta R}{\Delta\lambda\Delta R}$, such that stakeholders leave if and only if their posterior beliefs are lower than $\widehat{q}$. Consider, now, any candidate equilibrium in which the speculator plays strategy $\{\widehat{D}_1, \widehat{D}_2\}$ when observing $s = B$. For any such strategy, it holds that the stakeholders' posterior beliefs following price movements, consistent with $\{\widehat{D}_1, \widehat{D}_2\}$, decrease in α, i.e., $\partial q_{\widehat{D}_1\widehat{D}_2}/\partial\alpha < 0$. Hence, there is a unique threshold $\underline{\alpha}''$, defined by the value of α for which $q_{\widehat{D}_1\widehat{D}_2} = \widehat{q}$, such that there is no equilibrium in which the stakeholders leave the firm if the firm chooses a transparency level $\alpha < \underline{\alpha}''$. Trivially, if $\alpha = 0$, the probability of informed trading is zero, trades do not affect prices, and stakeholders' decision to stay is never affected.

Next, we show that the firm can reduce the parameter range for which there are equilibria in which stock price changes lead stakeholders to leave the firm by choosing a transparency level as high as feasible. This follows from the fact that such equilibria do not exist if $L \in \left[\underline{L}, \overline{L}\right]$ (Lemma 3) and the fact that $\underline{L}$ does not depend on α, while $\overline{L}$ increases in α. **Q.E.D.**

Proof of Proposition 5. From the break even condition (6) of a venture capitalist who has observed $\widetilde{s} = G$, we obtain

$$\gamma = \frac{K}{\lambda_G \left(x - \Delta R_0 + p_0\right)}. \tag{A.11}$$

If the venture capitalist has observed $\widetilde{s} = \varnothing$, from the break even condition (7), we can derive

$$S = \frac{K}{(\lambda_B + \widetilde{q}\Delta\lambda)} - \gamma p_0. \tag{A.12}$$

The latter expression is strictly positive since $\lambda_G > (\lambda_B + \widetilde{q}\Delta\lambda)$ (see expressions (6) and (7)).

We, now, check when these contracts satisfy the feasibility restrictions $\gamma \in [0, 1]$ and $0 \leq S + \gamma p_0 + \Delta R_0 \leq x + p_0$. The last inequality requires that the sum of payment promised to the financier and the stakeholders cannot exceed the firm's cash flow and the price that the firm can obtain from selling its equity stake at $t = -1$ when the firm goes public. It holds

$$\begin{aligned} S + \gamma p_0 + \Delta R &\leq x + p_0 \\ \Longleftrightarrow \Delta R_0 &\leq x + p_0 - \frac{K}{(\lambda_B + \widetilde{q}\Delta\lambda)}. \end{aligned} \tag{A.13}$$

To show that $\gamma \in [0,1]$, we need to show that

$$\gamma = \frac{K}{\lambda_G \left(x - \Delta R_0 + p_0\right)} \leq 1,$$

which can be restated as

$$\Delta R_0 \leq x + p_0 - \frac{K}{\lambda_G}. \tag{A.14}$$

Observe that condition (A.14) is satisfied if condition (A.13) is satisfied.

Finally, we need to verify that the incentive constraint (9) is satisfied:

$$\lambda_B \left(x - \Delta R_0 + \frac{K}{\lambda_G \left(x - \Delta R_0 + p_0\right)} p_0 \right) \leq K.$$

Solving for the bounds of ΔR_0 for the latter condition is satisfied and considering condition (A.13) and the worker's break even condition (8), we can state all conditions on ΔR_0 as

$$x + \frac{1}{2}p_0 - \frac{K}{2\lambda_B} - \frac{\sqrt{\lambda_G^2 \left(K + \lambda_B p_0\right)^2 - 4K\lambda_B^2 \lambda_G p_0}}{2\lambda_B \lambda_G} \tag{A.15}$$

$$\leq \quad \Delta R_0 = \frac{\overline{w}}{\left(\frac{\alpha \widetilde{q} \lambda_G + (1-\alpha)(\lambda_B + \widetilde{q} \Delta\lambda)}{\alpha \widetilde{q} + (1-\alpha)}\right)}$$

$$\leq \quad \min \left\{ x + \frac{1}{2}p_0 - \frac{K}{2\lambda_B} + \frac{\sqrt{\lambda_G^2 \left(K + \lambda_B p_0\right)^2 - 4K\lambda_B^2 \lambda_G p_0}}{2\lambda_B \lambda_G} ; x + p_0 - \frac{K}{(\lambda_B + \widetilde{q}\Delta\lambda)} \right\} \tag{A.16}$$

Hence, we obtain that there are thresholds $\overline{w}_a$ and $\overline{w}_b$, defined by the (unique) values of $\overline{w}$ for which (A.15) and (A.16) are binding, such that all conditions (6)–(8) are satisfied if $\overline{w} \in [\overline{w}_a, \overline{w}_b]$. Note that since ΔR_0 is monotonically decreasing in α, the condition can also be expressed in terms of thresholds for α. **Q.E.D.**

Appendix B For Online Publication

B.1 Endogenous Entry of Speculators

To model the possibility of entry by speculators, we modify the baseline model (for this discussion only) such that there is a pool of traders, the size and the composition of which are endogenously determined. While the number of noise traders in that pool is fixed, the number of speculators is endogenous. The trader that the market maker faces in periods one and two is a random draw from that pool. That is, β is the endogenous probability that the market maker faces a noise trader. A new entry by speculators leads to a decrease in β. We denote by κ the speculator's cost of entry, which we interpret as the cost of monitoring the news and identifying which firm can become the target of speculative trading. This decision takes place after the firm chooses its transparency level (captured by α) but before trading starts. We continue to assume that the news observed by such speculators is informative about the state ω with probability α.

Let Π^{inf} and Π^{uninf} denote the speculator's profits conditional on becoming informed or remaining uninformed after observing a signal about ω. In any equilibrium with endogenous entry, all positive profit opportunities will be exhausted. That is, it must hold that

$$\mathrm{E}\Pi\left(\beta\right) := \alpha\Pi^{inf}\left(\beta\right) + \left(1-\alpha\right)\Pi^{uninf}\left(\beta\right) = \kappa. \tag{B.1}$$

The intuition is straightforward. If the expected profits from entry were positive, it would attract more entry. If they were negative, speculators would not enter. Thus, for any given level of transparency α and entry cost κ, condition (B.1) defines the equilibrium shares of noise traders, β, and speculators, $1-\beta$.

There is a wide parameter range for κ for which the speculation equilibria described in Proposition 1 arise in a setting with endogenous entry. The notable feature of this range is that entry costs must be intermediate. If they are too high, the equilibrium fraction of speculators and the probability of informed trading (captured by $\left(1-\beta\right)\alpha$) will be too low for prices to meaningfully affect prospective stakeholders' decisions. Instead, if entry costs are very low, speculators will be attracted to enter, making prices very sensitive to new trades. This would make it impossible for uninformed traders to profit from inflating prices. Hence, the case with endogenous entry adds to the general insight from our paper that speculation equilibria affecting prospective stakeholders' decisions arise when market conditions are "normal" as opposed to extreme.

Proposition B.1 *There are thresholds $\underline{\kappa}$ and $\overline{\kappa}$ such that for $\kappa \in [\underline{\kappa}, \overline{\kappa}]$, there are equilibria with uninformed speculation, where the equilibrium shares of speculators and noise traders are determined by condition (B.1).*

Proof of Proposition B.1. We only show the argument for the case in which $q_0 < q^*$ and the equilibrium with uninformed speculation in which the uninformed speculator buys in both periods. Similar intuition applies to all other equilibria with speculation. In what follows, we take the firm's choice of transparency α as given. Following the same steps as in that proof of Proposition 1, we can express the existence condition in terms of $\beta \in [\underline{\beta}_{11}, \overline{\beta}_{11}]$. The lower bound $\underline{\beta}_{11}$ is implicitly defined by $\Pi(\varnothing) = 0$. For the upper bound, it holds that

$\overline{\beta}_{11} = \min\{\beta_{11}, \beta_{11}^*\}$, where β_{11} is implicitly defined by $\Pi(B) = 0$ and β_{11}^* by condition (2).

Observe, now, that for any $\beta \in [\underline{\beta}_{11}, \overline{\beta}_{11}]$, we can define $\kappa^*(\beta)$ as the value of κ for which condition (B.1) holds. That is, $\kappa^*(\beta)$ is the level of monitoring cost for which the speculator's expected payoff from monitoring the news, given a fraction β of noise traders in the market, is zero. To find the domain of κ that supports equilibria with uninformed speculation and endogenous entry, we, therefore, need to find $\kappa^*(\beta)$ for all $\beta \in [\underline{\beta}_{11}, \overline{\beta}_{11}]$. Let $\underline{\kappa} = \min_{\beta \in [\underline{\beta}_{11}, \overline{\beta}_{11}]} \mathrm{E}\Pi(\beta)$ and $\overline{\kappa} = \max_{\beta \in [\underline{\beta}_{11}, \overline{\beta}_{11}]} \mathrm{E}\Pi(\beta)$. Using that $\mathrm{E}\Pi(\beta)$ and, thus, $\kappa^*(\beta)$ are continuous in β, we obtain that equilibria with uninformed speculation and endogenous entry exist if $\kappa \in [\underline{\kappa}, \overline{\kappa}]$. **Q.E.D.**

B.2 Other Equilibria

Proposition B.2 *If $\alpha \in [\underline{\alpha}, \overline{\alpha}]$, equilibria with and without uninformed speculative buying can coexist. There is a threshold $\underline{\alpha}' < \underline{\alpha}$, such that if $\alpha \in [\underline{\alpha}', \underline{\alpha}]$ or $\alpha > \overline{\alpha}$, there are only equilibria without uninformed speculative buying.*

Proof of Proposition B.2. From Proposition 3, equilibria with uninformed speculative buying exist if $\alpha \in [\underline{\alpha}, \overline{\alpha}]$. Thus, it suffices to show that there is an equilibrium without uninformed speculative buying (Step 1) that can be supported for $\alpha \geq \underline{\alpha}'$, where $\underline{\alpha}' < \underline{\alpha}$ (Step 2).

Step 1. Consider an equilibrium in which the speculator does not trade at $t = 1$ and buys at $t = 2$ if $s = G$, does not trade in either period if $s = \varnothing$, and sells in both periods if $s = B$. In the proposed equilibrium, the stakeholders' and the market maker's posterior belief that the firm-specific shock is $\omega = G$ is

$$q_{01} = \frac{\left((1-\beta)\,\alpha + \beta\frac{1}{9}\right) q_0}{(1-\beta)\,\alpha q_0 + \beta\frac{1}{9}}.$$

The stakeholders join the firm if and only if $q_{01} > q^*$. Clearly, if $q_0 \geq q^*$, this condition is always satisfied. For $q_0 < q^*$, there is a threshold $\underline{\alpha}' := \frac{\frac{1}{9}\beta\left(\frac{q^*}{q_0}-1\right)}{(1-\beta)(1-q^*)}$, corresponding to the value of α for which $q_0 = q^*$, such that the stakeholders join if $\alpha > \underline{\alpha}'$. The prices set by the market maker are as follows:

$$\begin{array}{ll} p_{01}=(\lambda_B+q_{01}\Delta\lambda)\left(x-\frac{\overline{w}}{\lambda_B+q_{01}\Delta\lambda}\right) & \text{if } D_1=0 \text{ and } D_2=1 \\ p_{-1-1}=\mathbf{1}_{q_{-1-1}\geq q^*}(\lambda_B+q_{-1-1}\Delta\lambda)\left(x-\frac{\overline{w}}{\lambda_B+q_{-1-1}\Delta\lambda}\right) & \text{if } D_1=-1 \text{ and } D_2=-1 \\ p_{-1}=\pi_{-1-1}p_{-1-1}+(1-\pi_{-1-1})\,p_0 & \text{if } D_1=-1 \\ p_{D_1}=p_{D_1D_2}=p_0=\mathbf{1}_{q_0\geq q^*}(\lambda_B+q_0\Delta\lambda)\left(x-\frac{\overline{w}}{\lambda_B+q_0\Delta\lambda}\right) & \text{otherwise} \end{array}$$

where $\pi_{-1-1}=\frac{(1-\beta)\alpha(1-q_0)+\beta\frac{1}{9}}{(1-\beta)\alpha(1-q_0)+\beta\frac{1}{3}}$. The speculator's expected payoff from $D_1=0$ and $D_2=1$ is

$$\begin{aligned} \Pi_{01}(s) &= (\lambda_B+q(s)\Delta\lambda)\left(x-\frac{\overline{w}}{\lambda_B+q_{01}\Delta\lambda}\right)-p_{D_1D_2} \\ &= (q(s)-q_{01})\,\Delta\lambda\left(x-\frac{\overline{w}}{\lambda_B+q_{01}\Delta\lambda}\right). \end{aligned}$$

Note that this expected payoff is positive if $s=G$ but is negative if $s\in\{B,\varnothing\}$. Thus, the speculator has no incentive to mimic $s=G$ if she observes $s\in\{B,\varnothing\}$.

The speculator's expected payoff from selling twice is

$$\begin{aligned} \Pi_{-1-1}(s) &= p_{-1-1}+p_{-1}-\mathbf{1}_{q_{-1-1}\geq q^*}2(\lambda_B+q(s)\Delta\lambda)\left(x-\frac{\overline{w}}{\lambda_B+q_{-1-1}\Delta\lambda}\right) \\ &= ((1+\pi_{-1-1})(\lambda_B+q_{-1-1}\Delta\lambda)-2(\lambda_B+q(s)\Delta\lambda))\,\mathbf{1}_{q_{-1-1}\geq q^*}\left(x-\frac{\overline{w}}{\lambda_B+q_{-1-1}\Delta\lambda}\right) \\ &\quad +(1-\pi_{-1-1})\,\mathbf{1}_{q_0\geq q^*}(\lambda_B+q_0\Delta\lambda)\left(x-\frac{\overline{w}}{\lambda_B+q_0\Delta\lambda}\right). \end{aligned}$$

For the existence claim in the proposition, it is sufficient to consider the case where $q_0<q^*$. In this case, the firm's fundamental value is commonly known and equal to the price set by the market maker of $p_0=0$. Hence, if $q_0<q^*$, the speculator observing $s=G$ also does not deviate to short-selling or trading as a noise trader. Similarly, the speculator does have an incentive to trade as a noise trader if $s\in\{B,\varnothing\}$ as her payoff is then the same as on the equilibrium path.

Step 2. Finally, we show that $\underline{\alpha}'<\underline{\alpha}$. For $q_0<q^*$, the easiest-to-sustain equilibrium with uninformed speculation is when the speculator buys in the first trading date but does not trade in the second (Lemma C.5). It requires that $\alpha\in[\underline{\alpha}_{10},\overline{\alpha}_{10}]$. To show the claim, it is sufficient to show that $\underline{\alpha}'<\underline{\alpha}_{10}$. Since $\underline{\alpha}_{10}=\max\{\alpha_{10},\alpha^*_{10}\}$, it is sufficient to show that

$\underline{\alpha}' \leq \alpha_{10}^*$. Suppose to a contradiction that $\underline{\alpha}' - \alpha_{10}^* > 0$. It holds

$$\begin{aligned}\underline{\alpha}' - \alpha_{10}^* &= \frac{\frac{1}{9}\beta\left(\frac{q^*}{q_0} - 1\right)}{(1-\beta)(1-q^*)} - \frac{\left(1-\frac{8}{9}\beta\right)\left(1-\frac{q_0}{q^*}\right)}{(1-\beta)(1-q_0)} \\ &= \frac{(q^*-q_0)}{(1-\beta)}\left(\frac{\frac{1}{9}\beta(1-q_0)q^* - \left(1-\frac{8}{9}\beta\right)(1-q^*)q_0}{(1-q^*)q_0(1-q_0)q^*}\right).\end{aligned}$$

which is positive if

$$\beta > \frac{1}{\left(\frac{1}{9}\frac{(1-q_0)q^*}{(1-q^*)q_0} + \frac{8}{9}\right)}. \tag{B.2}$$

However, for an equilibrium with uninformed speculation to exist, it must also be that $\alpha_{10}^* < 1$. That is

$$\frac{\left(1-\frac{8}{9}\beta\right)\left(1-\frac{q_0}{q^*}\right)}{(1-\beta)(1-q_0)} < 1 \iff \frac{1}{\left(\frac{1}{9}\frac{(1-q_0)q^*}{q_0(1-q^*)} + \frac{8}{9}\right)} > \beta,$$

giving a contradiction to condition (B.2). **Q.E.D.**

Appendix C Proofs of Auxiliary Lemmas

Lemma C.1 *Let $id \in \{in, un, no\}$ denote the identity of the speculator, depending on whether she is informed (in), uninformed (un), or a noise trader (no). Let $\Omega_t \subseteq \{-1, 0, 1\}$ be the set of equilibrium actions that can be taken by the informed speculator at date t. Following trades D_1 and D_2, the market maker's and the stakeholders' posterior belief that the firm-specific shock is $\omega = G$ is*

$$q_{D_1D_2} = \frac{\sum_{id=\{in,un,no\}} \Pr(id)\Pr(D_1, D_2|id, G)\Pr(G)}{\sum_{id=\{in,un,no\}} \Pr(id)\sum_{\omega=\{G,B\}} \Pr(D_1, D_2|id,\omega)\Pr(\omega)} \text{ if } D_1 \in \Omega_1, D_2 \in \Omega_2, \tag{C.1}$$

and $q_{D_1D_2} = q_0$ if $D_1 \notin \Omega_1$ or $D_2 \notin \Omega_2$. Furthermore, after observing a trade D_1 at $t = 1$, the market maker assigns the following probability that the trader will play D_2 at $t = 2$:

$$\pi_{D_1D_2} = \frac{\sum_{id=\{in,un,no\}} \Pr(id)\sum_{\omega=\{G,B\}} \Pr(D_1, D_2|id,\omega)\Pr(\omega)}{\sum_{id=\{in,un,no\}} \Pr(id)\sum_{\omega=\{G,B\}} \Pr(D_1|id,\omega)\Pr(\omega)}. \tag{C.2}$$

The stock price at date $t = 2$ is given by

$$p_{D_1D_2} = \begin{cases} (\lambda_B + q_{D_1D_2}\Delta\lambda)\left(x - \frac{\overline{w}}{\lambda_B + q_{D_1D_2}\Delta\lambda}\right)\mathbf{1}_{q_{D_1D_2} \geq q^*} & \text{if } D_1 \in \Omega_1, D_2 \in \Omega_2 \\ (\lambda_B + q_0\Delta\lambda)\left(x - \frac{\overline{w}}{\lambda_B + q_0\Delta\lambda}\right)\mathbf{1}_{q_0 \geq q^*} & \text{otherwise,} \end{cases} \tag{C.3}$$

where $\mathbf{1}_{q_{D_1D_2}\geq q^*} = 1$ *if* $q_{D_1D_2} \geq q^*$ *and zero otherwise. The price at date* $t = 1$ *is*

$$p_{D_1} = \begin{cases} \sum_{D_2=\{-1,0,1\}} \pi_{D_1D_2} p_{D_1D_2} & \text{if } D_1 \in \Omega_1 \\ (\lambda_B + q_0\Delta\lambda)\left(x - \frac{\overline{w}}{\lambda_B+q_0\Delta\lambda}\right)\mathbf{1}_{q_0\geq q^*} & \text{otherwise.} \end{cases} \tag{C.4}$$

The speculator's expected profit from both trades is

$$\Pi(s) = \left(v\left(s, q_{D_1D_2}\right) - p_{D_1}\right) D_1 + \left(v\left(s, q_{D_1D_2}\right) - p_{D_1D_2}\right) D_2, \tag{C.5}$$

where

$$v\left(s, q_{D_1D_2}\right) = \left(\lambda_B + q(s)\Delta\lambda\right)\left(x - \frac{\overline{w}}{\lambda_B + q_{D_1D_2}\Delta\lambda}\right)\mathbf{1}_{q_{D_1D_2}\geq q^*}$$

Proof of Lemma C.1. Expressions (C.1) and (C.2) follow from a simple application of Bayes' rule. The prices reflect the market maker's rational expectation about the firm's fundamental value given the trades D_1 and D_2 and the trader's equilibrium trading strategies. **Q.E.D.**

Lemma C.2 *The contract* $\{R, \Delta R\}$ *offered by the firm to stakeholders satisfies their participation constraint (1) with equality. If the stakeholders observe the firm-specific shock* ω*, the firm can attract them if and only if* $\omega = G$ *in which case* $q_{D_1D_2}$ *is replaced by one in expression (1).*

Proof of Lemma C.2. If the firm and the stakeholders have the same information, which they infer from the firm's stock price, it is optimal for the firm to satisfy the worker's participation constraint with equality by offering (for $y = R = 0$)

$$\Delta R = \frac{\overline{w}}{\lambda_B + q_{D_1D_2}\Delta\lambda}. \tag{C.6}$$

Offering more is strictly suboptimal as it does not affect whether or not the firm can attract stakeholders, while it increases the cost of doing so.

Offering contract (C.6) is optimal also in the case in which the firm observes the firm-specific shock ω, while the stakeholders form their beliefs based on the firm's stock price. The argument is standard. In the resulting signaling game, the unique equilibrium contract is pooling and must satisfy condition (C.6).[43] Since the contract offered by the firm is uninfor-

[43] If the firm generates positive cash flows, $y > 0$, also in the low cash flow state, the proof is slightly more tedious but standard. In particular, the firm will offer $R = y$ and $\Delta R = \frac{\overline{w}-y}{\lambda_B+q_{D_1D_2}\Delta\lambda}$. We omit the full proof, as it is standard. See Nachman and Noe (1994) and Inderst and Vladimirov (2019) for detailed proofs.

mative about the true firm-specific shock, the stakeholders' posterior beliefs are formed once again from the firm's stock price. Finally, for use in Lemma 1, if the stakeholders observe the firm-specific shock (regardless of whether the firm observes it), it is optimal for the firm to offer a contract for which (1) is satisfied for $q_{D_1D_2} = 1$. Then, the stakeholders will join if and only if they observe that $\omega = G$. **Q.E.D.**

Lemma C.3 *For any feasible* (β, q_0)*, if there is a value for* α*, denoted by* $\overline{\alpha}_{11}$*, for which* $\Pi(\varnothing) = 0$*, then* $\frac{\partial}{\partial\alpha}\Pi(\varnothing) < 0$ *at* $\overline{\alpha}_{11}$*.*

Proof of Lemma C.3. We have two cases depending on whether $\overline{w}$ is larger or smaller than $(\lambda_B + q_0\Delta\lambda)\,x$.

Case: $q_0 < q^*$ (equivalently, $\overline{w} > (\lambda_B + q_0\Delta\lambda)\,x$). From expression (A.1), the uninformed speculator's profit is

$$\Pi_{11}(\varnothing) = ((2q_0 - (1+\pi_{11})\,q_{11})\,\Delta\lambda + (1-\pi_{11})\,\lambda_B)\left(x - \frac{\overline{w}}{\lambda_B + q_{11}\Delta\lambda}\right). \tag{C.7}$$

Since by construction $x \geq \frac{\overline{w}}{\lambda_B + q_{11}\Delta\lambda}$ for $\alpha > \alpha^*_{11}$, it suffices to analyze the first term in brackets in expression (C.7), $C_1 := ((2q_0 - (1+\pi_{11})\,q_{11})\,\Delta\lambda + (1-\pi_{11})\,\lambda_B)$. A sufficient condition that this term is always positive is that $2q_0 \geq (1+\pi_{11})\,q_{11}$. Plugging in for π_{11} and q_{11}, we obtain that this is the case if $\alpha \leq \frac{1-\frac{2}{3}\beta-\sqrt{\left(1-\frac{2}{3}\beta\right)^2-\frac{4}{9}\beta\left(1-\frac{8}{9}\beta\right)}}{2(1-\beta)(1-q_0)}$.

We show, now, that if $\alpha > \frac{1-\frac{2}{3}\beta-\sqrt{\left(1-\frac{2}{3}\beta\right)^2-\frac{4}{9}\beta\left(1-\frac{8}{9}\beta\right)}}{2(1-\beta)(1-q_0)}$, C_1 crosses zero at most once from above. Taking derivative of C_1 with respect to α, we have

$$\begin{aligned} & -\frac{\partial}{\partial\alpha}(q_{11} + \pi_{11}q_{11})\,\Delta\lambda - \frac{\partial}{\partial\alpha}\pi_{11}\lambda_B \\ = \; & -\left(\frac{q_0(1-\beta)(1-q_0)\left(1-\frac{8}{9}\beta\right)}{\left((1-\beta)\,\alpha q_0 + (1-\beta)(1-\alpha) + \beta\frac{1}{9}\right)^2} + \frac{q_0(1-\beta)(1-q_0)\left(1-\frac{8}{9}\beta\right)}{\left((1-\beta)\,\alpha q_0 + (1-\beta)(1-\alpha) + \beta\frac{1}{3}\right)^2}\right)\Delta\lambda \\ & + \frac{\frac{2}{9}\beta(1-\beta)(1-q_0)}{\left((1-\beta)\,\alpha q_0 + (1-\beta)(1-\alpha) + \beta\frac{1}{3}\right)^2}\lambda_B \end{aligned} \tag{C.8}$$

Suppose, now, that the speculator's profit is zero at some $\alpha > \alpha^*_{11}$. From expression (C.7), we can then express $\lambda_B = \frac{-(2q_0-(1+\pi_{11})q_{11})\Delta\lambda}{(1-\pi_{11})}$. Plugging in for λ_B, expression (C.8) can be simplified to

$$\begin{aligned}&6q_0(1-\beta)(1-q_0) \qquad \text{(C.9)}\\&\times\frac{((1-\beta)81\alpha(1-q_0)-144(1-\beta)-18)(1-\beta)\alpha(1-q_0)+(9-8\beta)^2+(9-8\beta)\beta}{(3(1-\beta)\alpha(1-q_0)+2\beta-3)(9\alpha(1-\beta)(1-q_0)+8\beta-9)^2}\Delta\lambda.\end{aligned}$$

Observe now that the numerator in expression (C.9) is positive for any (α, q_0). To see this, denote $A := \alpha(1-q_0)$, and observe that the numerator of (C.9) is convex in A, obtaining a minimum value at $A = \frac{8\beta-9}{9\beta-9} > 1$ for any $\beta \in [0,1]$. Since $\alpha \in [0,1]$ and $q_0 \in [0,1]$, the minimum value of the numerator is achieved at $A = 1$, for which the numerator becomes equal to $\beta(9-7\beta) > 0$. Furthermore, observe that expression $(3(1-\beta)\alpha(1-q_0)+2\beta-3)$ in the denominator is negative for any (α, q_0), since $3(1-\beta)A+2\beta-3 \leq -\beta < 0$. Hence, we obtain that $\frac{\partial}{\partial\alpha}\Pi_{11}(\varnothing) < 0$ for any α for which $\frac{\partial}{\partial\alpha}\Pi_{11}(\varnothing) = 0$, as was to be shown. ■

Case: $q_0 \geq q^*$ (equivalently, $\overline{w} \leq (\lambda_B + q_0\Delta\lambda)x$). From expression (A.1), the uninformed speculator's profit simplifies to

$$\Pi_{11}(\varnothing) = \frac{(q_{11}-q_0)\Delta\lambda}{\lambda_B + q_{11}\Delta\lambda}(2\overline{w} - (\lambda_B + q_{11}\Delta\lambda)(1+\pi_{11})x).$$

After plugging in for q_{11} and π_{11}, the term after the fraction can be rewritten as

$$\begin{aligned}C_2 \; : \; &= 2\overline{w} - \left(\lambda_B + \frac{\left(1-\frac{8}{9}\beta\right)q_0}{(1-\beta)(1-\alpha(1-q_0))+\beta\frac{1}{9}}\Delta\lambda\right)\\&\times\left(2 - \frac{\beta\frac{2}{9}}{(1-\beta)(1-\alpha(1-q_0))+\beta\frac{1}{3}}\right)x.\end{aligned}$$

Observe that C_2 is increasing in β. Furthermore, we can restate C_2 as

$$\begin{aligned}&\frac{2}{\left((1-\beta)(1-\alpha(1-q_0))+\beta\frac{1}{9}\right)\left((1-\beta)(1-\alpha(1-q_0))+\beta\frac{1}{3}\right)}\\&\times\left(\overline{w}\left((1-\beta)(1-\alpha(1-q_0))+\beta\frac{1}{9}\right)\left((1-\beta)(1-\alpha(1-q_0))+\beta\frac{1}{3}\right)\right.\\&-\left(\left((1-\beta)(1-\alpha(1-q_0))+\beta\frac{1}{9}\right)\lambda_B + \left(1-\frac{8}{9}\beta\right)q_0\Delta\lambda\right)\\&\quad\times\left.\left((1-\beta)(1-\alpha(1-q_0))+\beta\frac{2}{9}\right)x\right).\end{aligned}$$

Denoting $A := (1-\alpha(1-q_0))$, the numerator in the above expression can be restated as

$$\begin{aligned} &\overline{w}\left((1-\beta)A+\beta\frac{1}{9}\right)\left((1-\beta)A+\beta\frac{1}{3}\right) \\ &-\left(\left((1-\beta)A+\beta\frac{1}{9}\right)\lambda_B+\left(1-\frac{8}{9}\beta\right)q_0\Delta\lambda\right)\left((1-\beta)A+\beta\frac{2}{9}\right)x. \end{aligned} \tag{C.10}$$

Furthermore, for any (α, q_0), expression (C.10) evaluated at $\beta = 1$ becomes

$$\frac{1}{27}\left(w-\frac{2}{3}x\left(\lambda_B+q_0\Delta\lambda\right)\right).$$

Hence, a necessary condition for the speculator's profit to be positive is that $\overline{w} \geq \frac{2}{3}x(\lambda_B + q_0\Delta\lambda)$. We will use this property in what follows to show that expression (C.10) increases in A when (C.10) is zero. Since $\frac{\partial A}{\partial \alpha} < 0$, this will imply that if $\Pi_{11}(\varnothing) = 0$ for some α, then $\frac{\partial \Pi_{11}(\varnothing)}{\partial \alpha} < 0$ at that α.

The derivative of expression (C.10) with respect to A is

$$\begin{aligned} &\overline{w}\frac{2}{9}(1-\beta)(9A(1-\beta)+2\beta) \\ &-\left(\frac{1}{9}(1-\beta)(18A\lambda_B+3\beta\lambda_B+9\Delta_\lambda q_0-18A\beta\lambda_B-8\beta\Delta_\lambda q_0)\right)x \end{aligned}$$

where, by using that $\overline{w} \geq \frac{2}{3}x(\lambda_B + \Delta_\lambda q_0)$, this derivative is larger than

$$\begin{aligned} &\frac{2}{3}x(\lambda_B+\Delta_\lambda q_0)\frac{2}{9}(1-\beta)(9A(1-\beta)+2\beta) \\ &-\left(\frac{1}{9}(1-\beta)(18A\lambda_B+3\beta\lambda_B+9\Delta_\lambda q_0-18A\beta\lambda_B-8\beta\Delta_\lambda q_0)\right)x \\ = &\frac{1}{27}(\beta-1)((18A(1-\beta)+\beta)\lambda_B+(27-32\beta-36A(1-\beta))\Delta_\lambda q_0)x. \end{aligned} \tag{C.11}$$

Consider, now, a value of α, which we denote as $\overline{\alpha}_{11}$, for which expression (C.10) is zero (and so $C_2 = \Pi_{11}(\varnothing) = 0$). Using again that $\overline{w} \geq \frac{2}{3}x(\lambda_B + \Delta_\lambda q_0)$, it holds

$$
\begin{aligned}
0 &= \overline{w}\left((1-\beta)A + \beta\frac{1}{9}\right)\left((1-\beta)A + \beta\frac{1}{3}\right) \\
&\quad - \left(\left((1-\beta)A + \beta\frac{1}{9}\right)\lambda_B + \left(1 - \frac{8}{9}\beta\right)q_0\Delta_\lambda\right)\left((1-\beta)A + \beta\frac{2}{9}\right)x \\
&> \frac{2}{3}(\lambda_B + \Delta_\lambda q_0)\left((1-\beta)A + \beta\frac{1}{9}\right)\left((1-\beta)A + \beta\frac{1}{3}\right)x \\
&\quad - \left(\left((1-\beta)A + \beta\frac{1}{9}\right)\lambda_B + \left(1 - \frac{8}{9}\beta\right)q_0\Delta_\lambda\right)\left((1-\beta)A + \beta\frac{2}{9}\right)x \\
&= \frac{1}{27}(\beta - 1)\left(A(9A(1-\beta) + \beta)\lambda_B + \left(27A + 6\beta - 18A^2(1-\beta) - 32A\beta\right)\Delta_\lambda q_0\right)x,
\end{aligned}
$$

which implies that $(\beta - 1)\lambda_B < -(\beta - 1)\frac{\left(27A+6\beta-18A^2(1-\beta)-32A\beta\right)}{A(9A(1-\beta)+\beta)}\Delta_\lambda q_0$. Hence, expression (C.11) at $\overline{\alpha}_{11}$ is larger than

$$
\begin{aligned}
&\frac{1}{27}(\beta - 1)\Bigg(-(18A(1-\beta) + \beta)\frac{27A + 6\beta - 18A^2 + 18A^2\beta - 32A\beta}{(9A^2 + A\beta - 9A^2\beta)} \\
&\qquad +27 - 32\beta - 36A(1-\beta)\Bigg)\Delta_\lambda q_0 x \\
&= \frac{\frac{1}{9}(1-\beta)}{A(9A + \beta - 9A\beta)}\left(90A^2\beta^2 - 171A^2\beta + 81A^2 - 36A\beta^2 + 36A\beta + 2\beta^2\right)\Delta_\lambda q_0 x.
\end{aligned}
$$

Since $A \in [0,1]$, the term in brackets has a minimum at $A = 2\frac{\beta}{10\beta - 9}$, but since $A \leq 1$, the minimum of the above expression as obtained at $A = 1$ as

$$
\frac{\frac{1}{9}(1-\beta)}{A(9A + \beta - 9A\beta)}\left(56\beta^2 - 135\beta + 81\right)\Delta_\lambda q_0 x > 0 \text{ for any } \beta \in [0,1].
$$

Hence, the derivative of expression (C.10) at any α for which the speculator's profit is zero is positive with respect to A. Since $\frac{\partial A}{\partial \alpha} < 0$, the claim follows. ■

The proofs of the two cases complete the proof. **Q.E.D.**

Lemma C.4 *There is an equilibrium in which an uninformed speculator buys in both periods if $q_0 \geq q^*$.*

Proof of Lemma C.4. It only remains to prove Step 4 from Proposition 1 for the case where $q_0 \geq q^*$. In particular, we continue by verifying that the speculator will not deviate at $t = 1$. Clearly, deviating to $\{D_1, D_2\} = \{0, 0\}$ is never strictly optimal, as the speculator's deviation payoff is zero. In what follows, we provide sufficient conditions for which deviations do not occur, followed by concrete parametric examples that satisfy all these conditions.

Ruling Out Deviations to $\{D_1, D_2\} = \{0, -1\}$ and $\{D_1, D_2\} = \{1, -1\}$. If the speculator deviates to $\{D_1, D_2\} = \{0, -1\}$ or $\{D_1, D_2\} = \{1, -1\}$, which are trades that can only come from a noise trader on the equilibrium path, her expected payoff is

$$\left(\left(\lambda_B + q\left(s\right)\Delta\lambda\right)\left(x - \frac{\overline{w}}{\left(\lambda_B + q_0\Delta\lambda\right)}\right) - p_1 \right) D_1 \\ - \left(\left(\lambda_B + q\left(s\right)\Delta\lambda\right)\left(x - \frac{\overline{w}}{\left(\lambda_B + q_0\Delta\lambda\right)}\right) - p_0 \right). \tag{C.12}$$

Case $q_0 \geq q^* \geq q_{-1-1}$: In this case, expression (C.12) reduces to $p_0 - p_1 < 0$ if $D_1 = 1$ and $\left(q_0 - q\left(s\right)\right)\Delta\lambda\left(x - \frac{\overline{w}}{\left(\lambda_B + q_0\Delta\lambda\right)}\right)$ if $D_1 = 0$. The latter is (weakly) negative for signals $s = \{G, \varnothing\}$. For signal $s = B$, we need to compare (C.12) to the negatively informed speculator's expected payoff from selling twice. If $q_0 \geq q^* \geq q_{-1-1}$, the difference is

$$\left(\left(1 - \pi_{-1-1}\right)\left(\lambda_B + q_0\Delta\lambda\right) - q_0\Delta\lambda\right)\left(x - \frac{\overline{w}}{\left(\lambda_B + q_0\Delta\lambda\right)}\right),$$

which is positive (i.e., deviating is not profitable) if and only if $\lambda_B > \frac{\pi_{-1-1}}{\left(1-\pi_{-1-1}\right)} q_0\Delta\lambda$ and negative otherwise. Since π_{-1-1} is increasing in α, we obtain that if $\lambda_B > \frac{9\alpha(\beta-1)(q_0-1)+\beta}{2\beta} q_0\Delta\lambda$, there is no deviation. And if $\lambda_B \in \left[\frac{1}{3} q_0\Delta\lambda, \frac{9\alpha(\beta-1)(q_0-1)+\beta}{2\beta} q_0\Delta\lambda\right]$, there is a threshold $\alpha_{u1} \in [0, 1]$, such that a deviation by the negatively informed speculator can be prevented if $\alpha \leq \alpha_{u1}$. For $\lambda_B < \frac{1}{3} q_0\Delta\lambda$, the speculator always deviates.

Case: $q_{-1-1} \geq q^*$: Similar to the previous case, the difference between the negatively informed speculator's expected payoff and her payoff (C.12) from deviating to $\{0, -1\}$ is

$$2q_{-1-1}\Delta\lambda\left(x - \frac{\overline{w}}{\lambda_B + q_{-1-1}\Delta\lambda}\right) + \left(1 - \pi_{-1-1}\right)\left(q_0 - q_{-1-1}\right)\Delta\lambda x - q_0\Delta\lambda\left(x - \frac{\overline{w}}{\left(\lambda_B + q_0\Delta\lambda\right)}\right) \tag{C.13}$$

which is strictly positive for $\alpha \to 0$ or $\beta \to 1$. Hence, there is a threshold $\alpha_{u2} \in (0, 1]$, implicitly defined by the lowest root of (C.13) and, if this root does not exist, by $\alpha_{u2} = 1$, such that deviating is not profitable for $\alpha \leq \alpha_{u2}$.

Ruling Out Deviations to $\{D_1, D_2\} = \{0, 1\}$ or $\{D_1, D_2\} = \{1, 0\}$. Next, if the speculator deviates to $\{D_1, D_2\} = \{0, 1\}$ or $\{D_1, D_2\} = \{1, 0\}$, which is only consistent with noise trading on the equilibrium path, her expected payoff is

$$\mathbf{1}_{q_0 \geq q^*}\left(\lambda_B + q\left(s\right)\Delta\lambda\right)\left(x - \frac{\overline{w}}{\left(\lambda_B + q_0\Delta\lambda\right)}\right) - p_{D_1 D_2}, \tag{C.14}$$

where $p_{D_1D_2} = p_0$ if $D_1 = 0$ and $p_{D_1D_2} = p_1$ if $D_1 = 1$. In either case, (C.14) is (weakly) negative if $s = \{B, \varnothing\}$. If $s = G$, the speculator's equilibrium profit from $\{D_1, D_2\} = \{1, 0\}$ is less than from buying in both periods i.e., $\{D_1, D_2\} = \{1, 1\}$. Subtracting the expected profit from $\{D_1, D_2\} = \{0, 1\}$

$$\mathbf{1}_{q_0 \geq q^*}\left(\left(q\left(s\right) - q_0\right)\Delta\lambda\left(x - \frac{\overline{w}}{\left(\lambda_B + q_0\Delta\lambda\right)}\right)\right),$$

from the equilibrium expected payoff, we obtain

$$\Delta\lambda\left(\left(2\frac{\left(q_{11} - q\left(s\right)\right)}{\lambda_B + \Delta\lambda q_{11}} + \frac{q\left(s\right) - q_0}{\left(\lambda_B + q_0\Delta\lambda\right)}\right)\overline{w} + \left(q\left(s\right) - q_{11} - \pi_{11}\left(q_{11} - q_0\right)\right)x\right). \tag{C.15}$$

Plugging in for q_{11} and π_{11}, this difference becomes $(1 - q_0)\left(x - \frac{\overline{w}}{\lambda_B + q_0\Delta\lambda}\right)\Delta\lambda \geq 0$ for $\alpha \to 0$. Hence, there is a threshold, $\alpha_{u3} \in (0, 1]$, implicitly defined by the lowest root of (C.15), such that the positively informed speculator does not deviate for $\alpha \leq \alpha_{u3}$.

Ruling Out Deviations to $\{D_1, D_2\} = \{1, 1\}$ or $\{-1, -1\}$. Since the IC of the uninformed speculator is the most restrictive, the relevant incentive constraints are $\Pi_{11}(\varnothing) \geq \Pi_{-1-1}(\varnothing)$ and $\Pi_{-1-1}(B) \geq \Pi_{11}(B)$.

Case: $q_0 \geq q^* > q_{-1-1}$. The incentive constraints $\Pi_{11}(\varnothing) \geq \Pi_{-1-1}(\varnothing)$ and $\Pi_{-1-1}(B) \geq \Pi_{11}(B)$ are:

$$\begin{aligned}
& 2q_0\Delta\lambda\left(x - \frac{\overline{w}}{\lambda_B + \Delta\lambda q_{11}}\right) + \Delta\lambda\left(\left(1 - \pi_{11}\right)\left(q_{11} - q_0\right)x - 2q_{11}\left(x - \frac{\overline{w}}{\lambda_B + \Delta\lambda q_{11}}\right)\right) \\
\geq\ & \left(1 - \pi_{-1-1}\right)\left(\lambda_B + q_0\Delta\lambda\right)\left(x - \frac{\overline{w}}{\lambda_B + q_0\Delta\lambda}\right) \\
\geq\ & \Delta\lambda\left(\left(1 - \pi_{11}\right)\left(q_{11} - q_0\right)x - 2q_{11}\left(x - \frac{\overline{w}}{\lambda_B + \Delta\lambda q_{11}}\right)\right).
\end{aligned}$$

For $\alpha \to 0$, the latter constraint reduces to $(\lambda_B + q_0\Delta\lambda)\,x \geq w$, which is satisfied, as $q_0 \geq q^*$. Denoting with α_{u4} the lowest value of α for which the constraint continues to be satisfied at least weakly, we obtain that a sufficient condition for which it is satisfied is that $\alpha \in [0, \alpha_{u4}]$. However, if $\alpha \to 0$, the former constraint is not satisfied, but the difference between the left- and the right-hand side of the inequality is increasing in α. Thus, if the constraint is satisfied, there is a threshold α_{l1}, such that it is satisfied for $\alpha > \alpha_{l1}$. Numerically, it can be verified that, for example, for $\beta = 0.8$, $\lambda_B = 0.6$, $\Delta\lambda = 0.4$, $q_0 = .5$, $x = 100$, and $\overline{w} = 80$, there is a wide range of values for α that satisfy all incentive constraints.

Case $q_{-1-1} \geq q^*$. Finally, the incentive constraint that an uninformed speculator will not play the strategy of a negatively informed speculator is

$$2q_0\Delta\lambda\left(x-\frac{\overline{w}}{\lambda_B+\Delta\lambda q_{11}}\right)+\Delta\lambda\left((1-\pi_{11})(q_{11}-q_0)x-2q_{11}\left(x-\frac{\overline{w}}{\lambda_B+\Delta\lambda q_{11}}\right)\right)$$
$$\geq\left((1-\pi_{-1-1})(q_0-q_{-1-1})\Delta\lambda x-2(q_0-q_{-1-1})\Delta\lambda\left(x-\frac{\overline{w}}{\lambda_B+q_{-1-1}\Delta\lambda}\right)\right).$$

For $\alpha\to 0$, this constraint is satisfied with equality, and the difference between the left and right-hand side increases in α at $\alpha\to 0$. Thus, there is a α_{u5}, such that the incentive constraint is satisfied for $\alpha\leq\alpha_{u5}$.

The incentive constraint that a negatively informed speculator will not play the strategy of the positively informed speculator is

$$(1-\pi_{-1-1})(q_0-q_{-1-1})\Delta\lambda x-2(0-q_{-1-1})\Delta\lambda\left(x-\frac{\overline{w}}{\lambda_B+q_{-1-1}\Delta\lambda}\right)$$
$$\geq\Delta\lambda\left((1-\pi_{11})(q_{11}-q_0)x-2q_{11}\left(x-\frac{\overline{w}}{\lambda_B+\Delta\lambda q_{11}}\right)\right).$$

The latter constraint reduces to $(\lambda_B+q_0\Delta\lambda)x\geq w$ for $\alpha\to 0$. Denoting with α_{u6} the lowest value of α for which the constraint continues to be satisfied at least weakly, we obtain that a sufficient condition for which it is satisfied is that $\alpha\in[0,\alpha_{u6}]$. Numerically, it can be verified that, for the same parameter values as above ($\beta=0.8$, $\lambda_B=0.6$, $\Delta\lambda=0.4$, $q_0=0.6$, $x=100$, and $\overline{w}=80$), there is a wide range of values for α that satisfy all incentive constraints. **Q.E.D.**

Lemma C.5 *There is an equilibrium in which the speculator buys at $t=1$ and does not trade at $t=2$ if $s\in\{G,\varnothing\}$ and sells at $t=1$ and $t=2$ if $s=B$. There are thresholds $\underline{\alpha}_{10}$, $\overline{\alpha}_{10}$ and $\overline{w}^*_{10}$, such that these equilibria can be supported if the probability that the speculator is informed is intermediate*

$$\alpha\in[\underline{\alpha}_{10},\overline{\alpha}_{10}], \tag{C.16}$$

and $\overline{w}<\overline{w}^*_{10}$. It holds that $\underline{\alpha}_{10}>\underline{\alpha}_{11},\overline{\alpha}_{10}>\overline{\alpha}_{11}$.

Proof of Lemma C.5. We consider, next, the equilibria in which the speculator buys at $t=1$ and does not trade at $t=2$ ($D_1=1,D_2=0$) if she observes $s\in\{G,\varnothing\}$. There are again four possible such equilibria that differ in whether the speculator trades in one, both or none of the trading dates if $s=B$. We present in detail again only the proof for the case in which $D_1=D_2=-1$ if $s=B$ and focus on the case where $q_0<q^*$. Extending the proof to the case where $q_0\geq q^*$ follows the same steps as the proof of Lemma C.4.

Since the proof is very similar to that the proof of Proposition 1, we only explain the differences. From expressions (C.1) and (C.2), the market maker's posterior belief that the firm-specific shock is $\omega = G$ is $q_{10} = q_{11}$, $\pi_{10} = \pi_{11}$, q_{-1-1} is the same as above, and $q_{D_1 D_2} = q_0$ for all other orders D_1 and D_2. The stakeholders join only if $\alpha > \alpha^*_{11}$. Furthermore, the prices at $t = 2$ and $t = 1$ are

$$\begin{array}{ll} p_1 = \pi_{10}\left(\lambda_B + q_{10}\Delta\lambda\right)(x - \Delta R) & \text{if } D_1 = 1 \\ p_{D_1} = p_{D_1 D_2} = 0 & \text{if } D_1 \in \{-1, 0\} \text{ or } D_2 \in \{-1, 1\}. \end{array}$$

The speculator's equilibrium expected payoff is given by expression (C.5). It holds that $\Pi(B) = 0$ (i.e., if $s = B$). Furthermore

$$\begin{aligned} \Pi_{10}(s) &= (\lambda_B + q(s)\Delta\lambda)(x - w) - p_{D_1} \\ &= ((q(s) - q_{10})\Delta\lambda + (1 - \pi_{10})\lambda_B)(x - \Delta R). \end{aligned} \tag{C.17}$$

Since $q(s) = 1$, if $s = G$, the speculator's expected payoff is positive if she observes $s = G$. However, this profit is lower than in the proof of Proposition 1, as the speculator makes a profit only on her first trade, which is at the same price as in the proof of Proposition 1. If the speculator observes $s = \varnothing$, $q(s) = q_0$ and we obtain again that $\Pi_{10}(\varnothing) > 0$ if and only if $\alpha < \overline{\alpha}_{10}$, where $\overline{\alpha}_{10}$ is a threshold implicitly defined by $\Pi_{10}(\varnothing) = 0$. The uninformed speculator's profit is higher than in the equilibrium in the proof of Proposition 1 since she trades at $t = 1$ at the same price but does not make a loss from trading at date $t = 2$. Thus, we have that $\overline{\alpha}_{10} > \overline{\alpha}_{11}$. Once again, we have that the set $[\alpha^*_{11}, \overline{\alpha}_{10}]$ is not empty if $w < \overline{w}^*_{10}$, where $\overline{w}^*_{10}$ is the value for $\overline{w}$ for which it holds that $\alpha^*_{11} = \overline{\alpha}_{10}$.

The argument that after playing $D_1 = 1$ at $t = 1$, the speculator cannot benefit from trading as a noise trader at $t = 2$ is identical to that in Step 2 of the proof of Proposition 1. The only differences are that the speculator's equilibrium expected payoff is given by (C.17) if $s \in \{\varnothing, G\}$ and that the deviations, in this case, are to $D_2 \in \{-1, 1\}$. The speculator's expected payoff from such deviations is negative or zero, which is (weakly) less than what she obtains in equilibrium.

Similarly, the argument that there are no profitable deviations at $t = 1$ is identical to Step 3 of the proof of Proposition 1. The only difference is that a speculator who has observed $s = B$ does not mimic $s = G$ by playing $D_1 = 1$ and $D_2 = 0$ if and only if $\alpha > \underline{\alpha}_{10}$, where α_{10} is implicitly defined by $\Pi_{10}(B) = 0$. Defining $\underline{\alpha}_{10} := \max\{\alpha_{10}, \alpha^*_{10}\}$, we obtain that there is no profitable deviation from the proposed equilibrium if $\alpha \in [\underline{\alpha}_{10}, \overline{\alpha}_{10}]$. Finally, as argued above, $\Pi_{10}(B)$ is higher than in the proof of Proposition 1. Thus, it holds that $\underline{\alpha}_{10} > \underline{\alpha}_{11}$.

Modifying this proof to show that there are equilibria in which the speculator buys at

$t = 1$ and does not trade at $t = 2$ if $s \in \{G, \varnothing\}$ and does not trade in one or both trading periods if $s = B$ is again nearly identical to the proof above. **Q.E.D.**