How Financial Markets Create Superstars

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Abstract

We show that uninformed speculative trading can benefit shareholders by helping targeted firms become intrinsically better. Speculators profit from inflating a firm's stock price, as that can help the firm attract high-quality stakeholders that might have not joined otherwise. This leads to a misallocation of talent and resources. Likely targets are intermediately-transparent firms with highly uncertain prospects, operating in "normal" (i.e., neither hot nor cold) markets. Firms can discourage harmful speculation eroding their stakeholder base by being very transparent or intransparent. Similar to speculators, investors in primary markets can benefit from inflating firms' valuations to unicorn status to attract non-financial stakeholders.

Keywords: Speculation, manipulation, superstar firms, unicorns, market efficiency, stakeholders, high-skilled employees, misallocation of resources.

JEL Classification: D62, D82, D84, G30

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1 Introduction

A month after GameStop's stock price briefly skyrocketed and then crashed — widely believed due to speculation — the firm's stock price started increasing again. In the six months since then, it has stabilized at more than eight times the level of 2020. The new stock price increase was driven by news that Ryan Cohen — an activist investor with an agenda of transforming the firm into an e-commerce technology business — had set this transformation in motion by firing some of the old top executives and appointing a new strategy committee to help achieve the transformation. While there is substantial doubt among pundits whether the new stock price increase is justified or still driven by speculation, since that increase, GameStop has been able to attract a number of key non-financial stakeholders possessing the essential skills and experience needed for the transformation to succeed.[1] In particular, a dozen top-level executives from Amazon and Chewy.com have joined the firm in leading positions, including those of CEO and CFO.

The persistently high stock price accompanying GameStop's transformation raises an important question — can uninformed speculation inflating a firm's stock price trigger positive real feedback effects that make the firm intrinsically better? And, equally important, can uninformed speculators profit from pursuing such speculation? The answer to both questions is negative if speculation misleads managers' investment decisions. In particular, speculators cannot profit from inflating a firm's stock price, as by misleading the management to overinvest, they would be eroding the value of their equity holdings. For this reason, prior work has argued that speculative trading will be the preserve of short-sellers seeking to destroy firm value (Goldstein and Guembel, 2008; Edmans et al., 2015). In this paper, we demonstrate that these predictions reverse when prices in secondary markets do not affect managers' investments decisions but the decisions of prospective high-quality stakeholders — such as business partners, star scientists, or managers — whether to join the firm.

Our paper develops a model in which the release of news about a firm triggers trading in its stock in financial markets. There is a market maker who sets bid and ask prices, anticipating that the order flows may come from noise traders or strategic speculators. The speculators, whose entry is endogenous and profit-motivated, may or may not be able to infer the firm's true prospects from the released news, giving rise to informed or uninformed strategic trading. The central difference to the bulk of prior work is that the firm's prospects are not fixed but depend on whether it can attract crucial stakeholders that only join if they are convinced that the firm will be able to afford to compensate them for their lucrative

[1] See "GameStop's Earnings Don't Justify Its Price, But Investors Don't Care," June 23, 2021, Business Insider.

outside options. Being outsiders, such stakeholders make *rational* (though possibly wrong) inferences about the firm's prospects from its stock price. Indeed, the firm's stock price is an important guide for prospective stakeholders, especially when the payments they are promised depend on the firm's future success (Fombrun and Shanley, 1990; Subrahmanyam and Titman, 2001; Liang et al., 2020). The agglomeration of talent and positive externalities makes the firm intrinsically better and more successful, albeit at the cost of stakeholders not joining firms where they would have created even more value.[2]

Our first main result is that uninformed speculators can benefit from inflating the firm's stock price by placing buy orders as if they had positive information about the firm's prospects. The uninformed speculators' profit comes from their private information about how they intend to trade in future periods and how that will affect prices and, thus, prospective stakeholders' decisions. Unlike informed traders, the speculators mainly profit from their initial trades, executed at low prices. Speculators may have to incur losses on their follow-up buy orders, but that might be needed to inflate the stock price sufficiently to be able to realize a profit on the initial trades. Thus, there is no time inconsistency in such trading.

The difference to prior work studying speculation affecting investment decisions is that speculators and equity holders do not internalize the social cost when prospective stakeholders wrongly extrapolate that high prices reflect good fundamentals and join the firm. The uninformed speculators' profits come at the expense of the stakeholders who are misled into joining the firm and the truly good firms in the economy. In particular, by joining a firm whose fundamentals are not as good as they are led to believe, the stakeholders are, in expectation, underpaid compared to their outside options. Since the stakeholders anticipate that high stock prices may not reflect true fundamentals, the price of their services goes up for firms whose prospects are actually good. Moreover, there is a misallocation of resources, as the stakeholders are not matched with the firms where they create the most value.

Speculators are more likely to target firms with a high upside potential whose prospects are highly uncertain, such as newly-public firms or firms in transition. A trigger for targeting a firm could be the release of news, possibly overhyped by social media. Perhaps surprisingly, we show that speculative trading is more likely to have real effects in "normal" as opposed to hot markets. Intuitively, stakeholders' outside options are likely to be better in hot markets, making it harder to convince them to join the firm, especially when they anticipate that high

[2] The positive externalities of being in a star team are likely to keep stakeholders even if they subsequently observe less positive information. Leaving is also made difficult by contractual agreements and, in the case of employees, by non-compete agreements (Marx et al., 2009; Marx, 2011). Employees are also typically reluctant to leave after less than a year, as such short-tenured job-hopping is considered a major red flag by recruiters (Bullhorn, 2012; Fan and DeVaro, 2020). 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), Agrawal and Matsa (2013), and Choi et al. (2020).

prices might also be due to speculation.

Our second main result is that uninformed speculation is more likely to benefit than harm firms. The reason is that firms can manage their exposure to speculative trading by adjusting their transparency and effectively controlling what speculators can learn from news releases. Since transparency is a central determinant of the price impact of trades, it affects whether uninformed speculators can profit from targeting a firm. That can help firms fend off speculative trading by short-sellers seeking to drive stakeholders away.

More precisely, speculators are most attracted to intermediately transparent firms, as then the speculators' trades only moderately affect prices. Two effects are at play. First, if prices adjust too little, stakeholders are unlikely to be moved to join the firm. That is, speculation is unlikely to have real effects in very opaque markets, as then trading will not be perceived as sufficiently informative. Second, prices should also not adjust to trades too quickly, as then speculators would have no opportunity to make a profit on their initial trades. Taking these effects into account, we obtain that firms can encourage speculative trading that helps them improve their stakeholder base by being intermediately transparent. By contrast, already successful firms with an established stakeholders base can discourage speculative trading by short-sellers that may drive stakeholders away by maintaining either very high or very low transparency. An implication of this analysis is that increasing transparency has an ambiguous impact on efficiency. An increase in transparency (from low to intermediate) can attract uninformed trading and, thus, reduce the informativeness of prices by triggering real feedback effects and worsening the efficient matching between stakeholders and firms.

We extend our paper to show that, similar to uninformed speculators in the secondary markets, uninformed investors in the primary (private) markers might have an incentive to inflate a firm's valuation to mislead stakeholders to join. Specifically, we consider the problem where an entrepreneur raises capital from a venture capitalist before the firm goes public. Following similar arguments to those in the baseline model, we show that the firm and the venture capitalist can make a profit by helping the firm pursue the well-known Silicon Valley mantra of "fake it till you make it" (Braithwaite, 2018; Owen, 2020; Taparia, 2020). The uninformed investors' profit comes again at the expense of new stakeholders and the truly good firms in the economy. Together with our baseline model, these results help explain why unicorns can be created in an apparent discrepancy with fundamentals in the private markets (Gornall and Strebulaev, 2020) and why the "buzz" can persist and have a real positive effect on firm value also in secondary markets.

Related Literature. Our paper primarily relates to the fast-growing literature studying feedback effects from secondary markets on firm value (Dow and Gorton, 1997; Bond et al., 2012).[3] Building on Subrahmanyam and Titman (2001) and extensive work in strategic management (Fombrun and Shanley, 1990; Turban and Greening, 1997), the feedback effect we study is one where non-financial stakeholders, such as potential employees or business partners, learn about a firm's prospects from its stock price and use this information to decide whether to join the firm or do business with it. Our main contribution is to show that uninformed speculators can abuse this effect through speculative trading and to derive predictions about how firms can manage their exposure to such trading by adjusting their transparency.

A central insight from our paper is that the real effects from uninformed speculation when stakeholders learn from prices are opposite compared to when prices affect managers' investment decisions. In particular, we show that firms are more likely to benefit from speculation driving up stock prices rather than suffer from short-selling driving down prices. This asymmetry is in stark contrast to Goldstein and Guembel's (2008) and Edmans et al.'s (2015) insight that, when stock prices affect managers' investment decisions, uninformed speculation will only attract short-sellers and destroy firm value. The reason for the difference in predictions is that the cost of misleading managerial investment decisions is borne by the firm's equity holders. Thus, by buying up the firms' stock, uninformed speculators are harming their own equity positions. By contrast, in our model, the cost of uninformed speculation is borne by outsiders — stakeholders misled into joining the wrong firms and the inherently better firms deprived of such stakeholders.

Our results that firms can affect their exposure to speculation by controlling their transparency adds to work studying the limits to speculative attacks by short-sellers. This work has highlighted that short-sellers often face regulatory constraints or may be countered by large blockholders (Khanna and Mathews, 2012) or stock repurchases (Campello et al., 2020). In our setting, speculators are unlikely to face this type of headwind, as their trading allows shareholders to benefit. Our results further highlight that accounting for speculative trading is important when studying the effects of transparency. In particular, several of our predictions for when firms benefit from higher transparency are opposite to those in Subrahmanyam and Titman (2001), where transparency is also chosen strategically to attract stakeholders, but there is no speculative trading.[4]

[3] Such feedback effects have been empirically supported by Durnev, Morck, and Yeung (2004), Luo (2005), Chen, Goldstein, and Jiang (2007), Bakke and Whited (2007), and Edmans et al. (2017). These papers focus on how managers learn from stock price reactions about the prospects of investments. Baker et al. (2003) and Sunder (2005) further show that stock prices affect firms' access to capital. Fang, Noe, and Tice (2009) show that higher stock liquidity, increasing the information content of prices, improves firm value.

[4] We show that firms hoping to benefit from an inflated stock price will choose intermediate transparency, while those seeking to discourage manipulation by short sellers will choose either low or high transparency. By contrast, Subrahmanyam and Titman (2001) predict that firms seeking to attract stakeholders will choose

Our paper also relates to work on stock price manipulation in which feedback effects are exogenous. Endogenizing feedback effects leads not only to additional but also sometimes opposite predictions. In particular, we show that profitable speculative trading can be initiated by speculators that do not have any shares in the firm. This makes speculative trading opportunities potentially open to *anyone*. By contrast, when feedback effects are exogenous, trading that inflates a firm's stock price is only beneficial for speculators if they already have a sufficiently large position in the firm (Khanna and Sonti, 2004). More broadly, the feedback mechanism we describe adds to other types of trade-based manipulation described in prior work, where uninformed traders profit from pumping up a firm's stock price and selling at a higher price. The main difference to such schemes is that speculative trading in our setting increases the firm's fundamental value.[5,6]

Our extension about private firms raising financing shares the same premise as Khanna and Mathews (2016) that high valuations can help attract stakeholders to private firms by signaling good prospects. The main conceptual differences to 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 these aspects are central to our results that uninformed investors can profit from helping firms "fake it till they make it."

Our result that firms can affect their exposure to speculative trading by controlling their transparency and the informativeness of news adds to work on how transparency affects feedback effects of financial markets. The primary focus of prior contributions has mostly been on how disclosure may crowd in or crowd out information production by traders when such information is potentially useful for guiding managerial decisions (Gao and Liang, 2013; Goldstein and Yang, 2017, 2019). While not our main focus, our model also adds to prior work showing that more transparency does not necessarily make prices more informative (e.g., Banerjee et al., 2018). In our setup, transparency affects not only the firm's equity price but also its fundamental value by determining whether and at what cost it can attract stakeholders. As a result, price efficiency can decline if more transparency attracts not only stakeholders to the firm but also uninformed speculators to the market.[7]

high transparency, while firms seeking to prevent stakeholders from leaving will choose low transparency.

[5] Trade-based manipulation refers to profiting from trading in a way that misleads the market about whether a trader is informed and the nature of her information (Allen and Gorton, 1992; Kumar and Seppi, 1992; Gerard and Nanda, 1993; Chakraborty and Yilmaz, 2004a,b; Aggarwal and Wu, 2006).

[6] 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 et al. (2020) show that speculators can benefit from shorting a firm's stock while buying its competitor.

[7] The idea that the firm's exposure to speculative trading can add value by attracting stakeholders also adds to prior work studying the incentives of managers to manipulate prices to maximize their compensation (Goldman and Strobl, 2013). Related is also the prolific corporate governance literature investigating how

2 Model

We consider a firm whose stock is traded in the financial market. There are four dates, $t \in \{0, 1, 2, 3\}$. At date $t = 0$, the firm chooses its transparency level, e.g., by adjusting its corporate governance and making information about its business model and organization structure public. This choice is sticky and cannot be changed until $t = 3$. The firm then generates a risky investment opportunity. The prospects of that opportunity depend on whether the firm can attract high-quality stakeholders and on the realization of a firm-specific shock $\omega = \{G, B\}$.

The firm-specific shock ω is realized at $t = 1$, followed by news about that shock and 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 3.7).

The crucial feature of our model is that a strategic trader has prior knowledge about the firm. This knowledge could allow the trader to interpret the news as a signal s about ω. With probability α, this knowledge is sufficient, and the speculator's signal perfectly reveals ω. With probability $1 - \alpha$, the speculator's signal is pure noise (i.e., $s = \varnothing$). Since the probability that the speculator can infer ω from the news depends on the firm's transparency, α is effectively controlled by the manager.[8]

At date $t = 3$, stakeholders decide whether to join or do business with the firm. If the firm cannot attract high-quality stakeholders, it generates low cash flows, which are normalized to zero. With high-quality stakeholders, we have in mind talented and efficient workers or business partners that can transform the firm's prospects. If the firm can attract such stakeholders, it has a probability λ_ω to become a "star" and generate $x > 0$. This probability is higher if the shock is good, i.e., $\Delta\lambda \equiv \lambda_G - \lambda_B > 0$. 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 $1 - q_0$.

In what follows, we will sometimes refer to stakeholders "joining" the firm, but we em-

trading affects shareholders' incentives to intervene to discipline management (Kahn and Winton, 1998; Maug, 1998), vote (Levit et al., 2020), or exert pressure through the threat of exit (Edmans, 2009; Edmans and Manso, 2011).

[8] To illustrate what we mean in the context of the GameStop example, noise traders and the market maker do not know how to interpret the news that GameStop has fired its CFO. However, strategic traders, following the news on GameStop, might be able to infer the news' true information content if they already know a lot about the firm.

phasize that the model applies not only to workers joining but also to other non-financial stakeholders that can be instrumental for increasing firm value. The workers' outside option of working for a different firm is $\overline{w}$, and their decision whether to join the firm may depend on the stock price. Contracting with prospective stakeholders is straightforward. Since the firm is protected by limited liability, it can only offer a base compensation of zero if the firm generates zero. Thus, stakeholders receive compensation, denoted with w, only in the high cash flow state. Note that our theory is not restricted to attracting new stakeholders. An alternative interpretation of the model is that existing workers need to be incentivized to take an action that increases the firm's value but has a private cost $\overline{w}$ for the workers. Another interpretation is that workers need to be persuaded not to leave for an outside option, paying $\overline{w}$.

Once the stakeholders join the firm, the project is implemented, and all cash flows are realized. We assume that all players are risk-neutral, and there is no time discounting. In Section 3.6, 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 3.6 where they are needed.

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. The prices are equal to the firm's expected value, conditional on the information revealed by the trades. Specifically, price p_{D_1} at $t = 1$ is conditional on the order flow D_t 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. Subscripts D_1 and $D_1 D_2$ refer to the fact that stock price is a function of trading orders at both trading dates.

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 speculator has neither long nor short positions in the firm.

The equilibrium concept is Perfect Bayesian Equilibrium, where: (i) the speculator submits her trading orders to maximize her expected final period payoff by taking into account her information at the time of trading, the price-setting rule by the market maker, the contract offered to prospective stakeholders' and their strategy; (ii) the prospective stakeholders' contract maximizes firm value subject to the condition that they receive at least

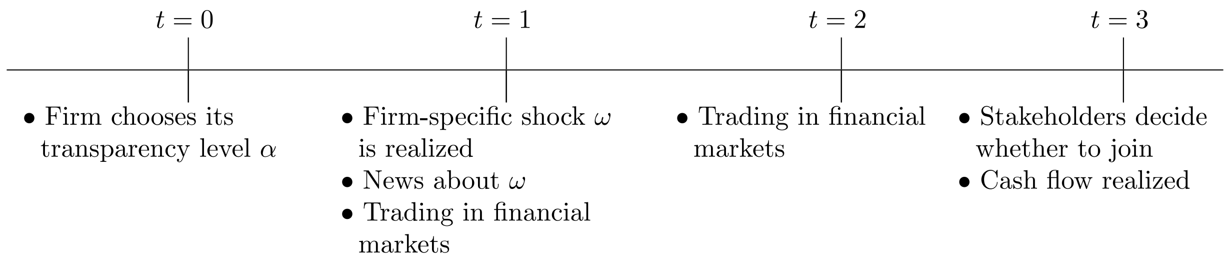

Figure 1: Timeline.

their outside option $\overline{w}$; (iii) the price-setting strategy allows the market maker to break even in expectation; (iv) all agents use Bayes' rule to update their beliefs, and; (v) each player's beliefs about the other players' strategies are correct in equilibrium. We restrict attention to pure strategies (except for the noise trader).

Discussion: Transparency and Nature of Speculators' Information. The choice of transparency in our model can relate to disclosure by firms that makes it easier for outsiders to infer the firm's prospects from the released news (e.g., Fishman and Hagerty, 1989; Banerjee et al., 2018). Examples include the firm's choice of trading venue, quality of auditor, the number of items it reports in its financial reports, the accuracy of such reports, the intensity of discussion of items such as R&D expenses, capital expenditures, product and segment data, and major business partners (Bushman et al., 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.[9] The evidence supports our premise that a more detailed corporate disclosure policy has a key impact on the informativeness of stock prices (Healy et al., 1999; Gelb and Zarowin, 2002).

An important aspect for the model's interpretation is that we do not assume that financial markets are better-informed than the firm's management about the firm's prospects. This allows to consider information not only about more-generic aspects, such as market demand, industry trends, or competition as in prior work (see Bond et al., 2012 for an overview) but also about firm-specific aspects. Assuming that experienced professional investors, who often specialize in collecting market- and firm-specific information, are better-informed about some aspects than non-financial stakeholders seems plausible in many circumstances.

[9] Empirical work measures transparency also with the number of analysts following a firm and the precision of their earnings forecasts (Anderson et al., 2009). The accuracy of such forecasts depends on the quality of information shared by the firm's management in earnings calls.

Difference Between Financial and "Star"-Capital. Our setting could in principle be reinterpreted as raising $\overline{w}$ from uninformed external financiers who learn about the firm's prospects from its stock price. However, we believe that this interpretation is potentially less relevant. First, professional investors are more likely to rely on their own detailed due diligence before providing capital rather than on learning from the firm's stock price. At the very least, it is plausible that they will be just as informed as the strategic speculator in our model. Second, passive financiers, such as banks or investors in public equity markets, may help in monitoring but not in changing the intrinsic quality of the firm's investment opportunities.[10] By contrast, the agglomeration of talent not only increases firm value but also has positive externalities making it easier to attract and retain more stakeholders (Subrahmanyam and Titman, 2001).[11] Third, our interpretation of $\overline{w}$ as stakeholders' outside option implies that it is more *difficult* to mislead stakeholders in hot markets. This insight will contrast with the standard prediction that firms find it easier to raise capital in hot markets.

3 Stakeholders and Market Prices

A fundamental aspect of this model is that trading in financial markets shapes stakeholders' beliefs about whether it would be worth it for them to join the firm. In turn, the stakeholders' decisions determine the firm's value, which, in a rational expectation setting, is reflected in the stock price. As it is standard, we solve the model backward by characterizing, first, the stakeholders' decision to join the firm at $t = 3$. We analyze, then, the trading game at $t = 2$ and $t = 1$ and, subsequently, discuss the firm's optimal choice of transparency at $t = 0$.

The stakeholders join the firm at date $t = 3$ if their posterior beliefs about the firm-specific shock ω indicate that the shock is sufficiently likely to be G and can offer them in expectation at least their outside option $\overline{w}$. We denote the stakeholders' posterior beliefs that the firm-specific shock is $\omega = G$ with $q_{D_1D_2}$. The subscripts D_1D_2 make explicit that the beliefs depend on the prices, which depend on the trades observed in the financial market. The firm is able to attract the stakeholders if and only if they believe that the firm can generate at least

$$(\lambda_B + q_{D_1D_2}\Delta\lambda)\, x \geq \overline{w},$$

[10] Even though there is evidence that hands-on investors that can create value, such as venture capitalists, sometimes continue to provide capital to firms after they go public (Iliev and Lowry, 2020), these investors are highly-sophisticated and well-informed about the firm. Thus, it is unlikely that speculators can mislead such investors by manipulating the firm's stock price.

[11] If a firm finds itself on a negative trajectory, however, it may suffer from negative contagion effects where stakeholders start leaving because others are leaving. Equity-based compensation makes firms especially susceptible to such contagion risks (Vladimirov, 2020).

which is equivalent to

$$q_{D_1D_2} \geq q^* \equiv \frac{\overline{w} - \lambda_B x}{\Delta\lambda x}. \tag{1}$$

For now, we assume that the prior probability that the firm-specific shock is G is $q_0 < q^*$. That is, without positive feedback from the market, the stakeholders will not join the firm, as they believe their alternative options to be more attractive.

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 aid their decision whether to work for or do business with a firm. This could be rational if they also observe the firm-specific shock ω. In this case, speculators cannot benefit from speculative trading in an attempt to affect stakeholders' decision to join the firm.

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 while sell orders to a price decrease. Relegating all formal proofs to the Appendix, we can summarize this benchmark case as:

Lemma 1 *If stakeholders do not rely on prices to learn the firm's value, the speculator never trades if she is uninformed.*

Intuitively, Lemma 1 states that an uninformed trader cannot beat a market in which she is the worst-informed player. Our first main result, in what follows, is that the prediction from Lemma 1 breaks down if potential stakeholders learn from market prices about the firm. In that case, an uninformed trader can make a profit, as she is better informed about the direction of her follow-up trades and whether these trades are likely to affect the stakeholders' decision to join the firm.

3.2 How Uninformed Speculation Creates Superstars

The central question in this paper is how traders can make a profit and create stars out of firms about which they are uninformed. The main effect responsible for this result is that uninformed traders can affect the stakeholders' decision to join the firm by moving prices with their trading orders. Interestingly, the fact that trades move prices made it impossible for uninformed traders to make a profit when stakeholders did not learn from financial markets (Lemma 1). However, when stakeholders use the firm's stock price to learn about the nature of the firm-specific shock, a high stock price could make the stakeholders believe that the shock is G. Hence, speculators and equity holders can benefit from uninformed speculation inflating the firm's stock price, as that could attract stakeholders and give the firm a shot at becoming successful. In what follows, we make this intuition more precise.

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, and the stakeholders join the firm if and only if they observe a buy order in each period. Clearly, for such an equilibrium to exist, it must be that the stakeholders' posterior beliefs, q_{11}, that the firm-specific shock is G after observing two buy orders are higher than the critical value given by expression (1), i.e., $q_{11} > q^*$. The firm, then, optimally sets the stakeholders' compensation such that the stakeholders just break even for these beliefs, i.e.,

$$(\lambda_B + q_{11}\Delta\lambda)\, w = \overline{w}. \tag{2}$$

For such an equilibrium to exist, it must be that the speculator does not have an incentive to deviate regardless of her signal s. Since it is a standard result that an informed trader can profit from her information advantage by trading with her information, we focus the exposition on the case in which the speculator is uninformed.

Consider the pricing of the firm's equity. Since the market maker must account for the probability that the buy orders come from uninformed or noise traders, the price does not fully adjust to the firm's true value even after two buy orders that attract the stakeholders. Specifically, the price p_{11} at $t = 2$ after two buy orders and p_1 at $t = 1$ after one buy order, respectively, are

$$\begin{aligned} p_{11} &= (\lambda_B + q_{11}\Delta\lambda)\,(x - w) && (3)\\ p_1 &= \pi_{11} p_{11}, && (4) \end{aligned}$$

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 $t = 1$. Note that the firm's value is zero if there is no trade or if there is a sell order, as the stakeholders perceive that as negative information and do not join the firm. In particular, in these latter two cases, the stakeholders' posterior belief that $\omega = G$ is $q_0 < q^*$, and they do not join.

The uninformed speculator's valuation of the firm if she can mislead the stakeholders into joining by buying in both periods is

$$(\lambda_B + q_0 \Delta\lambda)\,(x - w)\,. \tag{5}$$

Though price p_{11} at which the speculator buys at $t = 2$ is higher than this value (as $q_{11} > q_0$), price p_1 at which she buys at $t = 1$ can be lower (as $\pi_{11} < 1$).[12] If that price is sufficiently low, the uninformed trader could make an overall profit. By contrast, her profit from not trading or selling is zero, as the stakeholders do not join the firm following such trades.

The reason uninformed speculation can be profitable is that the uninformed trader is better informed about how she intends to trade at $t = 2$ and that her trades will mislead the stakeholders into joining. By contrast, the market maker must take into account the probability that the stakeholders will not join the firm, as the trades could be coming from noise traders. For this reason, the price p_1 at $t = 1$ may react only slowly, allowing the uninformed speculator to make a profit on her first-period trade.

Since the uncertainty about whether the stakeholders will join is resolved after the speculator places her second buy order, the price adjusts more steeply at $t = 2$, and the speculator makes a loss on her second trade. The reason is that, by misleading the market that she has positive information about the firm, the price adjusts to a level above the uninformed speculator's valuation of the firm's fundamental value. Despite that loss, there is no time-inconsistency in the speculator's trading strategy, as, without her second trade, she would not be able to inflate the price sufficiently to convince the stakeholders to join. The speculator would then not be able to realize a profit on her first trade.

The central insight is that for equilibria with uninformed speculation to occur, buy orders should have an intermediate impact on the market maker's and stakeholders' posterior beliefs and the resulting prices. On the one hand, if prices were to increase too steeply, the speculator would not be able to profit from buying, as she is, after all, not sure about the true nature of the firm-specific shock. On the other hand, if the prices were to increase too little, the stakeholders would not join. Moreover, it could become optimal also for a negatively-informed speculator (i.e., a speculator observing $s = B$) to buy in both periods. Such deviations would undermine the proposed uninformed speculation equilibrium.[13]

Proposition 1 *There are thresholds $\underline{\alpha}$ and $\overline{\alpha}$, such that if the probability that the speculator is informed is intermediate, $\alpha \in [\underline{\alpha}, \overline{\alpha}]$, there are multiple pure-strategy equilibria with uninformed speculation. In these equilibria, an uninformed speculator ($s = \varnothing$) mimics the*

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

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

trading strategy of a positively-informed speculator ($s = G$) and misleads the stakeholders into joining the firm.

The proof of Proposition 1 also considers an alternative equilibrium in which a speculator observing $s \in \{G, \varnothing\}$ buys at $t = 1$ and does not trade at $t = 2$. The intuition behind this equilibrium is the same: the uninformed speculator is able to make a profit on her initial speculative trade because she is privately informed about the direction of her future trades and that the resulting inflated prices will attract the stakeholders.

Winners and Losers From Uninformed Speculation and Resource Misallocation. Three main parties lose when uninformed speculators inflate the firm's stock price. The first losing side is the high-quality stakeholders, as the true expected value of their compensation is $q_0 w < q_{D_1 D_2} w = \overline{w}$. The second losing side is the truly good firms in the economy. These are either firms that face a firm-specific shock $\omega = G$ that need to overpay for talent, as $\lambda_G w > \overline{w}$ or firms that are deprived of talent altogether (i.e., the firms offering the outside option $\overline{w}$). That is, there is a misallocation of talent and resources, as the stakeholders do not take their outside option of joining another firm where they would have generated more value (at least $\overline{w}$). Third, noise traders also lose out. The clear beneficiaries from speculative trading are the speculators and potentially the firm's initial equity holders, as speculation increases the firm's likelihood of attracting stakeholders and becoming successful.

3.3 When Does Uninformed Speculation Occur?

In light of the distortions introduced by uninformed speculation, it is important to study the factors that make such distortions more likely. We discuss, in turn, the role of the stakeholders' outside option $\overline{w}$, and the upside from hiring, x.

A central comparative static of Proposition 1 is that equilibria with uninformed speculation exist only if the outside option $\overline{w}$ is neither too high nor too low. On the one hand, if $\overline{w}$ is very high, the stakeholders' posterior beliefs need to be very high to convince them to join. However, this is unlikely if they expect that the stock price increase could have also be driven by uninformed speculation. On the other hand, if $\overline{w}$ is very low, so that condition (1) is always satisfied, the stakeholders join the firm regardless of its stock price. Hence, the trades of uninformed speculators have no feedback effects and they cannot make a profit (Lemma 1). Thus, uninformed speculation can only sway stakeholders' decision to join if $\overline{w}$ is intermediate. In Section 4, we will build on this insight to argue that the uninformed speculation we describe is more characteristic of "normal" rather than hot markets.

The upside from attracting stakeholders also plays an important role. The main effect is that a higher upside is more likely to attract stakeholders, making uninformed speculation aimed at attracting such stakeholders more likely to succeed. In particular, the range $[\underline{\alpha}, \overline{\alpha}]$ that supports equilibria with uninformed speculation increases in x.

Interpreting a larger parameter range in which an equilibrium with uninformed speculation can be supported as a higher likelihood that such an equilibrium is played, it holds:

Proposition 2 *There is a threshold $\overline{w}^*$ such that equilibria with uninformed speculation:*
(i) exist only if the stakeholders' outside option $\overline{w}$ is intermediate, $\lambda_B x < \overline{w} < \overline{w}^*$;
(ii) are more likely if the upside, x, from attracting stakeholders is higher.

3.4 Equilibria Without Uninformed Speculation

Financial markets are not always susceptible to speculation by uninformed traders. Next to the speculative trading equilibria characterized in Proposition 1, there are also equilibria without uninformed speculation. What is common for all these equilibria is that prices either adjust very steeply — in which case uninformed speculators have no opportunities to make a profit — or not sufficiently — in which case stakeholders do not join. We summarize the main insights from the analysis of the different types of non-speculation equilibria in this Lemma, and relegate the details to the Appendix:

Lemma 2 *There is a threshold $\underline{\alpha}'$, such that there are multiple equilibria without speculation in which the uninformed speculator does not trade if the ex ante probability that the speculator is informed is $\alpha > \underline{\alpha}'$.*

The minimum threshold for α for supporting equilibria without uninformed speculation is lower than for equilibria with uninformed speculation. To illustrate this simply, suppose that α is lowered from just above to just below $\underline{\alpha}$, so that an equilibrium with uninformed speculation cannot be supported. Since uninformed speculators are no longer involved, there is a discrete jump in the probability that the stakeholders are facing a good firm after observing two buy orders even though the probability, α, that the speculator is informed has decreased only marginally. Thus, the stakeholders are happy to join and informed traders will trade on their positive information.

Proposition 3 *Equilibria with uninformed speculative trading coexist with non-speculation equilibria.*

News as a Focal Point. Proposition 3 shows the coexistence of equilibria with and without speculation, which raises the question of how market participants will coordinate on any given equilibrium. What makes the question even more pertinent is that, in practice, single market participants are unlikely to be able to move the price. Our model set-up suggests an answer. We anticipate that uninformed speculation is likely to follow news about firms whose prospects are highly uncertain. The news can then act as a focal point for speculators to target a given firm.

3.5 Transparency and Efficiency

In this section, we study the impact of potential policy interventions aiming at improving efficiency. Regulations could pertain to transparency or trading. However, regulations concerning trading seem less realistic. To make speculative trading prohibitively costly and prevent resource misallocations, such regulations would have to aim at increasing the price impact of trading, which would make not only uninformed but also informed trading less profitable. The impact of mandating higher transparency is also not clear-cut, as, in practice, the intermediate range of α for which speculation equilibria can be supported is likely to differ across firms. Hence, mandating higher transparency could mean that, for some firms, there is a shift from non-speculation to speculation equilibria (Proposition 1).

Corollary 1 *Higher transparency requirements can lead to less efficient allocations of talent and resources.*

A closely related effect of higher transparency is that it might decrease price efficiency, defined by the difference between the firm's fundamental value and its stock price. To give a simple example, if transparency is very low, the firm cannot attract high-quality stakeholders and there is no uncertainty about its fundamental value. There is then no pricing error. As transparency increases and the firm is able to attract stakeholders, the price set by the market maker is in general different from its fundamental value — that is, the pricing error increases.

The crucial aspect is that the firm's stock price affects its fundamental value by affecting stakeholders' decision to join the firm and the cost of attracting stakeholders. By making informed trading more likely, higher transparency lowers that cost and increases the firm's equity value. Though the stock price adjusts, it does not do so fully, as the market maker must account for the probability that the trades come from uninformed or noise traders. As a result, the pricing error can increase not only when there is a switch from one equilibrium to another, but also when the same equilibrium is played for different transparency levels.

Proposition 4 *Higher transparency requirements can lead to a larger discrepancy between the firm's fundamental value and its stock price.*

3.6 Speculative Short-Selling and the Firm's Choice of Transparency

Before we turn to the question of how firms should choose their transparency level, we briefly discuss the possibility that stakeholders, who are initially optimistic about a firm, decide not to join it after observing a declining stock price. Speculative trading, in this case, is possible if the firm-specific shock ω affects firm value even if the stakeholders do not join the firm.[14] To extend our model to consider this possibility, we assume that if the firm-specific shock is $\omega = G$, the firm has a small chance σ of achieving the upside x even if it does not attract the stakeholders. In this extension, we assume that

$$(\lambda_B + q_0 \Delta\lambda)\, x - \overline{w} > \sigma x \geq \frac{1}{1 + \frac{(1-q_0)(9-6\beta)}{2\beta q_0}} \left((\lambda_B + q_0 \Delta\lambda)\, x - \overline{w} \right). \tag{6}$$

The first inequality guarantees that hiring when there is no information about the firm leads, in expectation, to higher firm value than not hiring. The second inequality is a sufficient condition that a speculator with positive information ($s = G$) cannot profit when mimicking the trading strategy of a negatively-informed speculator by selling.[15]

This extension delivers the mirror image to Propositions 1-3 that uninformed speculation occurs for intermediately high levels of the probability that the speculator is informed. As before, if the price adjusts too quickly (i.e., α is high), the uninformed speculator would not be able to make a profit; and if the prices adjust too slowly (i.e., α is low), it will not affect the stakeholders' decision.

Lemma 3 *Suppose that the firm can achieve the high cash flow state with probability σ if the firm-specific shock is G and if it does not attract stakeholders. Suppose further that $q_0 > q^*$, so that the stakeholders' default decision is to join the firm. There are thresholds $\underline{\alpha}''$ and $\overline{\alpha}''$ such that there are equilibria with uninformed speculative short selling if and only if $\alpha \in [\underline{\alpha}'', \overline{\alpha}'']$. Equilibria without speculative trading coexist with speculation equilibria.*

Propositions 1 and Lemma 3 suggest that the speculator can make a profit from uninformed speculative trading if she can change the stakeholders' default decision regarding

[14] If there is no uncertainty about the firm's value if the workers do not join, the speculator's expected payoff from short selling would not depend on her signal. Hence, also her trading strategy will not depend on her signal, and trading will not affect the workers' beliefs.

[15] The last condition can be relaxed, but it shortens the proof of Lemma 3 below.

joining the firm. That is, the speculator benefits from such trading if that helps the firm attract high-quality stakeholders (and become a star) or helps dissuade such stakeholders from joining or working with the firm. This implies that, depending on the stakeholders' prior beliefs about whether they should join the firm, some firms will try to avoid while other will try to encourage speculative trading.

A firm can affect whether it is subject to speculative trading by adjusting its transparency. In particular, firms can prevent speculation by short-sellers eroding their stock price by choosing to be either very transparent or very opaque. In contrast, firms that believe that they can benefit from speculation inflating their stock price and helping them attract key stakeholders can encourage this type of speculation by choosing intermediate transparency. In Proposition 5, we show that there is a wide range of parameter values for which a firm can benefit from setting a transparency level encouraging speculative trading.

Proposition 5 *If $q_0 < q^*$, the firm can benefit from speculative trading leading stakeholders to join, while if $q_0 > q^*$ the firm can be harmed by speculative trading, causing stakeholders not to join. The firm can encourage the former type of speculation by choosing an intermediate level of transparency $\alpha \in [\underline{\alpha}, \overline{\alpha}]$, while discourage the latter by choosing to be either very transparent ($\alpha > \overline{\alpha}''$) or very intransparent ($\alpha < \underline{\alpha}''$).*

Proposition 5 implies that opportunities for speculative trading will be asymmetric. However, while prior work predicts that speculative trading with real feedback effects on managers' investment decisions can only harm firms (Goldstein and Guembel, 2008), we predict the opposite. There are two main reasons for this contrast in predictions. First, the speculative trading described in prior work is detrimental to the firm and is, therefore, at the expense of equity holders. By contrast, in our model, speculative trading is at the expense of stakeholders and can benefit firms. Second, opportunities for such trading are endogenous and controlled by the firm.

Corollary 2 *Since the firm's management can affect opportunities for speculative trading with its choice of transparency, opportunities for such trading are likely to be asymmetric, with more opportunities for speculators to manipulate upward (rather than downward) the firm's stock price.*

3.7 Endogenous Entry of Speculators

The speculator in our model can make positive trading profits regardless of whether she is informed, raising the question of whether this profit opportunity dissipates if we would allow for free entry of speculators attracted by it. This is not the case.

To model the possibility of free entry by speculators, we modify the baseline model 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. 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 takes place. We continue to assume that the probability 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

$$\mathrm{E}\Pi\left(\beta\right) \equiv \alpha\Pi^{inf}\left(\beta\right) + \left(1-\alpha\right)\Pi^{uninf}\left(\beta\right) = \kappa. \tag{7}$$

The intuition is straightforward. If the expected profit from entry were positive, that would attract more entry. If it were negative, speculators would not enter. Thus, for any given level of transparency α and entry cost κ, condition (7) defines the equilibrium shares of noise traders, β, and speculators, $1-\beta$. In what follows, we show that there is a wide parameter range for κ for which the speculation equilibria described in Proposition 1 arise in a setting with endogenous entry.

Proposition 6 *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 (7).*

3.8 Creating Unicorns 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 exploiting this feedback effect can start already while the firm is still private and raises growth financing. The cost of manipulation is once again at the expense of good firms and stakeholders. Moreover, the only feasible manipulation is one that presents the firm to be better than it is.[16]

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

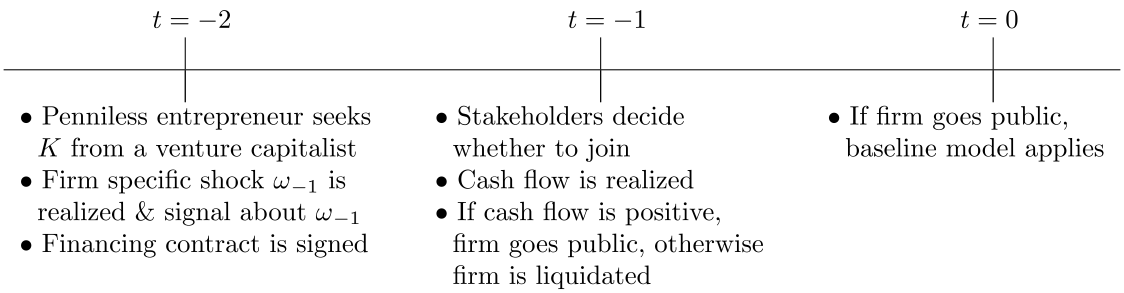

Figure 2: Timeline — Raising Start-Up Capital.

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 to start the firm. Apart from this start-up capital, the firm also needs to attract high-quality stakeholders with an outside option of $\overline{w}$. Before the financing contract is signed, the entrepreneur and the venture capitalist, but not the stakeholders, observe a signal $s_{-1} \in \{G, B, \varnothing\}$, which shows the firm-specific shock, ω_{-1} that determines the firm's likelihood of generating high cash flows at $t = -1$. The firm-specific shock ω_{-1} 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 s_{-1} is fully informative with probability α and pure noise, i.e., $s_{-1} = \varnothing$, otherwise. The prior probability that the firm-specific shock is good is q_{-2}. If firm-specific shock is good, the firm has a probability λ_G of generating high cash flows at date $t = -1$ if it attracts the stakeholders. If the shock is bad, this probability is λ_B.

To keep the analysis simple, we assume that the firm is liquidated if its cash flow at $t = -1$ is zero. If the firm generates x, it goes public, and the venture capitalist sells out.[17] The game continues then with the baseline model starting at date $t = 0$. That is, the price at which the venture capitalist sells its contracts is equal to the firm's expected value given the anticipated outcome of the trading game from the baseline model.

Results. Consider date $t = -2$ at which an entrepreneur seeks capital K to start the firm. With perfect price competition among investors, if venture capitalists observe signal $s_{-1} = G$, they demand an equity stake γ that satisfies

$$\gamma \lambda_G \left(x - w_0 + p_0\right) = K. \tag{8}$$

[17] 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 typically, indeed, exit their investments at the time of a firm's initial public offering (Gompers, 1996).

In this expression, $\lambda_G (x - w_0)$ is the firm's expected cash flow at $t = 0$ net of the compensation w_0 promised to stakeholders, and p_0 is the price of equity if the firm goes public at $t = -1$.

The central insight from this section is that the venture capitalist and the firm can profit from mimicking being positively informed and agreeing on an equity stake γ even if they are *uninformed* about the state ω_{-1}. For the venture capitalist to break even with such a contract, she can demand an additional payment, undisclosed to outsiders, increasing her payoff at $t = -1$ to S. The contract then converts to an equity stake γ upon an initial public offering.[18] Such convertible contracts promising venture capitalists higher payoffs in some states and converting to equity upon an initial public offering are common in venture capital financing (Hellmann, 2006; Gornall and Strebulaev, 2020). Defining $\overline{\lambda} \equiv \lambda_B + q_{-2}\Delta\lambda$, the venture capitalist's contract when observing $s_{-1} = \varnothing$ must satisfy

$$\overline{\lambda} (S + \gamma p_0) = K. \tag{9}$$

Since the stakeholders anticipate that the venture capitalist and the firm might be uninformed, their participation constraint is

$$\left(\frac{\alpha q_{-2}}{\alpha q_{-2} + 1 - \alpha} \lambda_G + \frac{1 - \alpha}{\alpha q_{-2} + 1 - \alpha} \overline{\lambda} \right) w_0 = \overline{w}, \tag{10}$$

where the term before λ_G is the probability that stakeholders attribute to the venture capitalist being positively-informed, and the term before $\overline{\lambda}$ is the probability that the venture capitalist is uninformed. To show that the firm and the investors can benefit from pretending to have observed a good signal in order to attract the stakeholders (even if they have observed $s = \varnothing$), it suffices to show that it is feasible to construct contracts that satisfy the three break-even conditions (8)–(10). Similar to Proposition 2, 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 not too high.

Proposition 7 *If*

$$\overline{w} \leq \left(\frac{\alpha q_{-2} \lambda_G + (1 - \alpha) \overline{\lambda}}{\alpha q_{-2} + (1 - \alpha)} \right) \left(x + p_0 - \frac{K}{\overline{\lambda}} \right), \tag{11}$$

there is a feasible contract S that converts to an equity stake $\gamma \in (0, 1)$ if the firm goes public at $t = -1$, for which the firm is able to attract high-quality stakeholders at $t = -2$ even if the entrepreneur and the venture capitalist are uninformed about the true firm-specific shock.

[18] We implicitly assume that stakeholders cannot condition their decisions on the payments the firm subsequently makes to the venture capitalist. This assumption is realistic, and relaxing it is possible.

4 Empirical Implications

High-quality employees and business partners often only join a firm if they believe that it is good enough to make forgoing highly-attractive outside opportunities worth it. This stylized fact has been widely documented in the strategic management and finance literature, which shows that two of the most important aspects considered by prospective employees are its profitability and stock market value (Dowling, 1986; Fombrun and Shanley, 1990; Turban and Greening, 1997; Bergman and Jenter, 2007).[19] A firm's stock price matters also for business partners and suppliers, deciding whether to expand their relationship with a firm by making firm-specific investments (Liang et al., 2020). While short-run stock price increases are unlikely to convince stakeholders to join, price increases following news can persist for months, giving firms sufficient time to benefit from an improved image (see Huberman and Regev (2001), Cooper et al. (2001), and the GameStop example in the Introduction). Indeed, speculative trading taking place over many months is common (Aggarwal and Wu, 2006), and once the firm has attracted a critical mass of high-quality stakeholders, the positive externalities of being in a star team on an upward trajectory are likely to keep stakeholders even if they observe less-positive information after joining.

Our model predicts that firms are more likely to become a target of speculative trading when there is uncertainty about their prospects but there is a potentially high upside. Newly-public firms or firms undergoing a transition or restructuring are typical examples. Firms that are highly-dependent on intangible and high-skilled human capital are especially likely to benefit from being able to build up their stakeholder base (Proposition 2).

Implication 1 *Firms whose prospects are highly uncertain but have a high upside potential, such as recently-listed firms or firms undergoing a transition or restructuring, are especially likely to benefit from buyer-induced manipulation that helps them build up their stakeholder base.*

Speculation in "Normal" Times. When will uninformed speculation occur? We argue that firms are likely to become the target of speculative trading following the release of news, possibly overhyped by social media. Such events can act as a focal point for uninformed speculators to target a firm.

Furthermore, we show that market conditions need to be "normal." If, instead, markets were hot, it would be harder to convince stakeholders to abandon their lucrative outside options, especially when they anticipate that high prices might be due to speculation.[20] Thus,

[19] Exceptional stock market performance not only draws new talent but also leads to a rise in the number of college students choosing to major in related fields (Choi et al., 2020).

[20] Real wages and business opportunities are typically pro-cyclical (Keane et al., 1988; Kudlyak, 2014).

our paper's predictions contrast with irrational exuberance theories where firms can free ride on a positive market sentiment, helping them cheaply attract financial and possibly non-financial capital (Baker and Wurgler, 2002). We show that rational uninformed speculation is less profitable in such market conditions. Speculation is unlikely to have real effects also if stakeholders' outside options are bad, as then stakeholders are likely to join even if the firm's prospects do not appear stellar (Proposition 2).

Implication 2 *Speculative trading with real feedback effects on stakeholders' decisions is more likely in "normal" markets and less likely in booms and recessions. News releases about a firm, possibly overhyped by social media, could act as trigger concentrating speculative trading in a firm.*

Our predictions that news events can act as a focal point for speculation proposes an alternative explanation to the well-documented fact that the release of news about a firm can trigger stock price increases, which subsequently reverse (Barber and Odean, 2008).[21] Reversals of momentum patterns in the data are typically attributed to overreaction and other behavioral biases (Jegadeesh and Titman, 2001; Daniel et al., 1998; Daniel et al., 2020). By contrast, in our model, the stock price increases are entirely rational, driven by speculation, and likely to reverse only partially. We predict that the price reversals will be less-pronounced for firms, such as GameStop, that manage to use the increase in their stock price to attract high-quality employees and business partners. Indeed, six months after the February 2021 reversal in GameStop's share price, the firm is still valued more than ten times its pre-January levels.

Implication 3 *Price increases following news and social media hype will reverse less for firms that can use the hype to attract high-quality employees and valuable business partners.*

Asymmetric Speculation Opportunities. Firms can affect the likelihood of becoming a target for speculation by controlling their transparency and the informativeness of their news. In particular, managers have substantial leeway in choosing how much to disclose about the firm's business over and above what is mandated by regulators and how informative and frequent they want the firm's press releases to be.[22] This leeway to strategically control the flow of information implies that firms are more likely to benefit from speculation helping

[21] Interestingly, Van Wesep and Waters (2021) show that the presence of "all in" investors that always buy up a firm's stock up to their margin limit can lead to unstable asset prices, potentially explaining sudden surges and crashes in stocks such as GameStop.

[22] More disclosure and transparency is 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).

them attract stakeholders than suffer from seller-induced speculation eroding firm value and scaring off stakeholders.[23]

Implication 4 *Opportunities for speculative trading that attracts stakeholders to a firm and creates value for equity holders will be more likely than opportunities for speculative trading harming equity holders by scaring off stakeholders. In particular, the firms' exposure to speculative trading is endogenously affected by their choice of transparency:*
(i) Firms aspiring to become stars can facilitate speculative trading inflating the firm's stock price by maintaining intermediate transparency.
(ii) Firms trying to retain stakeholders can discourage speculative trading by choosing either low or high transparency.

Implication 4 is strengthened by the fact that large blockholders are likely to trade against manipulative short-sellers (Khanna and Mathews, 2012) but are unlikely to interfere with speculative trading increasing the value of their equity holdings. Moreover, short selling constraints (such as the up-tick rule in the U.S.) will further limit arbitrage opportunities to correct an inflated stock price, and will make corrective trading aimed at bringing down inflated prices more difficult.[24] By contrast, there is barely any regulation preventing the inflation of a firm's stock price. Overall, shifting the focus toward how prices affect the decisions of stakeholders leads to opposite predictions compared to prior work, studying the effect of prices on investment decisions. Contrary to Implication 4, such work predicts that uninformed speculation will only be pursued by short-sellers and will always harm targeted firms (Goldstein and Guembel, 2008; Edmans et al., 2015).

Inflating Valuations in Primary Markets. The fact that the number of publicly listed firms has steadily decreased over the last decades (Gao et al., 2013; Doidge et al., 2017) raises the question of whether manipulation of the type we describe is becoming less relevant. We do not believe this to be the case, as manipulation 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 particular, firms and investors can benefit from misleading stakeholders that the firm's prospects are stellar by agreeing on very high valuations. This practice seems particularly common in the world of venture capital. Indeed, Gornall and Strebulaev (2020) show that close to half of unicorns would lose their unicorn status once properly accounting

[23] For evidence that decreasing stock prices may harm firms by inducing managers to cut investment, see Dessaint et al. (2018).

[24] Arbitrage capital may also be slow to flow in some cases if informed arbitrageurs are financially constrained. Worse, once the price has moved in one direction even for nonfundamental reasons, it might stay there even after the shock is removed (Dow et al., 2020).

for the complexity of VC contracts. Furthermore, venture capitalists are often accused of abating 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 is (Braithwaite, 2018; Owen, 2020; Taparia, 2020). Notably, manipulation is again asymmetric, as firms and financiers cannot benefit from manipulation that erodes firm value.

Implication 5 *Both firms and investors providing financing can profit from inflating a firm's valuation to unicorn status when that helps the firm attract important stakeholders.*

5 Conclusion

In this paper, we argue that uninformed speculation, inflating a firm's stock price, can create value for both speculators and targeted firms. Loosely speaking, a high stock price helps the firm "fake it till it makes it." It does so by attracting high-quality stakeholders, such as key employees and business partners, that would have otherwise not joined the firm. The speculators' and the firm's equity holders' profits come at the expense of stakeholders who are misled into joining a firm that will not fully pay them what they expect. The true superstars in the economy who end up overpaying for talent or are deprived of it, suffer as well. Uninformed speculative trading is most effective when it targets firms about which there is substantial uncertainty, such as newly-listed firms or firms in transition. It could be triggered by events, such as news releases, possibly gone viral through social media, that could serve as a focal point attracting speculators to trade in the firm's stock. Notably, uninformed speculation is most likely to occur in normal as opposed to hot markets. In particular, when stakeholders' outside options are very good, it becomes more difficult for inflated stock prices, likely driven by speculative trading, to convince stakeholders to join.

We show that opportunities for speculative trading benefiting firms will be more likely than opportunities for short-sellers, harming firms by misleading stakeholders into abandoning it. In particular, firms can make such speculation unprofitable by choosing either very high or very low transparency, as then prices will either adjust too quickly for speculators to profit or too slowly to have a meaningful impact on stakeholders. Instead, when the objective is to encourage speculative trading, managers will choose intermediate transparency. Because speculation opportunities are endogenous, we obtain that they are asymmetric and more likely to benefit firms. This prediction is in stark contrast to prior work, which has focused on how prices affect investment decisions and shows that uninformed speculation can only come from short-sellers and harm targeted firms.

Asymmetric manipulation that benefits firms can occur not only in secondary markets but already early on in a firm's life when it raises capital in private markets. In such cases, firms and investors can benefit from agreeing to inflate the firm's valuation in order to attract high-quality stakeholders. Hence, our model rationalizes why venture capitalists and entrepreneurs might knowingly agree on unrealistic valuations elevating firms to unicorns and why such an inflated image can persist in secondary markets and subsequently become a reality.

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Appendix A Proofs

Lemma A.1 *If the firm attracts the stakeholders, then, regardless of whether it observes the firm-specific shock ω, it offers a contract such that the stakeholders' participation constraint binds*

$$(\lambda_B + q_{D_1D_2}\Delta\lambda)\, w = \overline{w}, \tag{A.1}$$

where $q_{D_1D_2}$ is the stakeholders' posterior belief that the state is $\omega = G$ based on the market price $p_{D_1D_2}$ at $t = 2$. If the stakeholders observe the firm-specific shock ω, they join if and only if $\omega = G$ in which case $q_{D_1D_2}$ is replaced by one in expression (A.1).

Proof of Lemma A.1. We need to distinguish between several cases depending on what the firm and the stakeholders know at $t = 3$. First, 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. The stakeholders' compensation is then given by

$$w = \frac{\overline{w}}{\lambda_B + q_{D_1D_2}\Delta\lambda}. \tag{A.2}$$

Second, offering contract (A.2) is optimal also if 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 (A.2).[25] Since the contract offered by the firm is uninformative about the true firm-specific shock, the stakeholders' posterior beliefs are formed once again from the stock prices. Finally, 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 (A.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 A.2 *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*

$$q_{D_1D_2} = \frac{\sum_{id=\{in,un,no\}} \Pr(id) \Pr(D_1, D_2|id, G) \Pr(G)}{\sum_{id=\{in,un,no\}} \Pr(id) \sum_{\omega=\{G,B\}} \Pr(D_1, D_2|id, \omega) \Pr(\omega)} \quad \text{if } D_1 \in \Omega_1, D_2 \in \Omega_2, \tag{A.3}$$

[25] See Nachman and Noe (1994) and Inderst and Vladimirov (2019) for detailed proofs.

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* $t = 2$*:*

$$\pi_{D_1D_2} = \frac{\sum_{id=\{in,un,no\}} \Pr(id) \sum_{\omega=\{G,B\}} \Pr(D_1, D_2|id, \omega) \Pr(\omega)}{\sum_{id=\{in,un,no\}} \Pr(id) \sum_{\omega=\{G,B\}} \Pr(D_1|id, \omega) \Pr(\omega)}. \tag{A.4}$$

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

$$p_{D_1D_2} = \begin{cases} (\lambda_B + q_{D_1D_2}\Delta\lambda)(x - w) & \text{if } D_1 \in \Omega_1, D_2 \in \Omega_2 \\ 0 & \text{otherwise} \end{cases} \tag{A.5}$$

and the price at date $t = 1$ *is*

$$p_{D_1} = \begin{cases} \sum_{D_2=\{-1,0,1\}} \pi_{D_1D_2} p_{D_1D_2} & \text{if } D_1 \in \Omega_1 \\ 0 & \text{otherwise} \end{cases}. \tag{A.6}$$

The speculator's expected profit from both trades is

$$\Pi(s) = (v(s) - p_{D_1}) D_1 + (v(s) - p_{D_1D_2}) D_2, \tag{A.7}$$

where

$$v(s) = \begin{cases} \lambda_\omega (x - w) & \text{if the firm attracts stakeholders and } s = \omega \\ (\lambda_B + q_0\Delta\lambda)(x - w) & \text{if the firm attracts stakeholders and } s = \varnothing \\ 0 & \text{if the firm does not attract stakeholders} \end{cases}.$$

Proof of Lemma A.2. Expressions (A.3) and (A.4) follow from a simple application of Bayes' rule

$$\begin{aligned} q_{D_1D_2} &= \Pr(G|D_1, D_2) = \frac{\Pr(D_1, D_2|G)\Pr(G)}{\Pr(D_1, D_2)} \\ \pi_{D_1D_2} &= \Pr(D_2|D_1) = \frac{\Pr(D_1, D_2)}{\Pr(D_1)}. \end{aligned}$$

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.**

Proof of Lemma 1. We proceed backward. At $t = 3$, the stakeholders join the firm if and only if the firm-specific shock is G. As argued in Lemma A.1, it is optimal for the firm to offer a compensation of $w = \frac{\overline{w}}{\lambda_G}$. 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 stakeholders do not join, and the firm's value is zero.

Let $\mu_t \in \{0, 1\}$ be the probability that a trader that has received signal $s = G$ buys in period t. There is no equilibrium in which $\mu_t = 0$ in both periods. To see this, suppose to a contradiction that $\mu_1 = \mu_2 = 0$. The price set by the market maker depends also on the equilibrium strategies in case the trader observes $s \in \{B, \varnothing\}$. However, for any such strategies, the market maker's price is at most

$$q_0 \lambda_G (x - w) = q_0 (\lambda_G x - \overline{w}) \tag{A.8}$$

since the stakeholders join only if the firm-specific shock is G. Thus, by deviating and buying in both periods, the positively-informed trader would be able to gain at least

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

Thus, in any equilibrium of the trading game, it must be that $\mu_t = 1$ in at least one of the trading periods.

In any such equilibrium, it holds that the prices set by the market maker at dates $t = 1$ and $t = 2$ are higher than $q_0 (\lambda_G x - \overline{w})$. To see this, observe that from expression (A.3), the market maker's posteriors beliefs at $t = 2$ after he observes a trading pattern which is consistent with that of a positively-informed speculator' equilibrium strategy Ω_t is

$$q_{D_1 D_2} > q_0 \text{ if } D_1 \in \Omega_1, D_2 \in \Omega_2.$$

Hence, the price set by the market maker will be

$$q_{D_1 D_2} (\lambda_G x - \overline{w}) > q_0 (\lambda_G x - \overline{w}).$$

For any other strategies that the trader may pick from (i.e., $D_1 \notin \Omega_1$ or $D_2 \notin \Omega_2$), the price at $t = 2$ will be equal to $q_0 (\lambda_G x - \overline{w})$. Furthermore, the price at $t = 1$ is

$$p_{D_1} = \sum_{D_2 = \{-1,0,1\}} \Pr(D_2 | D_1) p_{D_1 D_2} > q_0 (\lambda_G x - \overline{w}) \text{ if } D_1 \in \Omega_1$$

and $p_{D_1} = 0$ if $D_1 \notin \Omega_1$.

It is now straightforward to show that the uninformed speculator will never trade. Her expected profit when she follows the same trading strategy as when she observes $s = G$ is

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

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 in a way that, on the equilibrium path, can only come from a noise trader. For such trades, the price will be equal to $q_0\left(\lambda_G x - \overline{w}\right)$, which is the same as the speculator's expected value of the firm, leading to a trading profit of zero. The argument that the trader will sell in at least one of the periods if she observes $s = B$ and that she will have no incentives to follow the same trading strategy if she is uninformed is symmetric. **Q.E.D.**

Proof of Proposition 1. In what follows, we verify the existence of several equilibria with manipulation. For each equilibrium, we use Lemma A.2 to derive the posterior beliefs and the prices at the trading dates $t = 1$ and $t = 2$ (Step 1). Subsequently, we verify that the trading strategies at $t = 2$ and $t = 1$ are optimal given these stock prices, the subsequent trading, and the stakeholders' decision to join the firm (Steps 2 and 3).

(i) **Claim**: *There is an equilibrium in which the speculator buys at $t = 1$ and $t = 2$ after observing $s \in \{G, \varnothing\}$ and sells at $t = 1$ and $t = 2$ if $s = B$. There are also equilibria in which the speculator follows the same strategies if $s \in \{G, \varnothing\}$ but does not trade (instead of selling) at $t = 1$ and/or $t = 2$ if $s = B$. There are thresholds $\underline{\alpha}_{11}$, $\overline{\alpha}_{11}$ and $\overline{w}^*_{11}$, such that these equilibria can be supported if the probability that the speculator is informed is intermediate*

$$\alpha \in \left[\underline{\alpha}_{11}, \overline{\alpha}_{11}\right], \tag{A.9}$$

and $\overline{w} < \overline{w}^*_{11}$.

Proof. We consider, first, the equilibria in which the speculator buys in both periods ($D_1 = D_2 = 1$) if she observes $s \in \{G, \varnothing\}$. There are four possible such equilibria that differ in whether the speculator trades in one, both, or none of the trading dates if $s = B$. We start with the proof for the case in which $D_1 = D_2 = -1$ if $s = B$.

Step 1: posterior beliefs, prices, and equilibrium payoffs. From expression (A.3), the market maker's posterior belief that the firm-specific shock is $\omega = G$ is

$$\begin{aligned} q_{11} &= \frac{\left((1-\beta) + \beta\frac{1}{9}\right) q_0}{(1-\beta)\,\alpha q_0 + (1-\beta)(1-\alpha) + \beta\frac{1}{9}} > q_0 \\ q_{-1-1} &= \frac{\beta\frac{1}{9} q_0}{(1-\beta)\,\alpha\,(1-q_0) + \beta\frac{1}{9}} < q_0 \end{aligned}$$

and $q_{D_1D_2} = q_0$ for all other orders D_1 an D_2. Note that $\frac{\partial q_{11}}{\partial \alpha} > 0$. Since the stakeholders join only if $q_{11} \geq q^*$, there is a threshold $\alpha^*_{11} \equiv \frac{\left(1-\frac{8}{9}\beta\right)\left(1-\frac{q_0}{q^*}\right)}{(1-\beta)(1-q_0)}$, such that they join if $\alpha \geq \alpha^*_{11}$.

Furthermore, from expression (A.4), the market maker's belief that the trader chooses $D_2 = 1$ after she has chosen $D_1 = 1$ is

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

From expressions (A.5) and (A.6), the prices at $t = 2$ and $t = 1$ are

$$\begin{array}{ll} p_{11} = (\lambda_B + q_{11}\Delta\lambda)\,(x-w) & \text{if } D_1 = D_2 = 1 \\ p_1 = \pi_{11}p_{11} & \text{if } D_1 = 1 \\ p_{D_1} = p_{D_1D_2} = 0 & \text{otherwise} \end{array}.$$

The speculator's expected payoff is given by expression (A.7). Her equilibrium expected payoff if $s = B$ is $\Pi(B) = 0$. Denoting with $q(s)$ the speculator's posterior beliefs that the firm-specific shock is G after observing signal $s \in \{G, \varnothing\}$, the speculator's expected payoff from buying in both trading periods is

$$\begin{aligned} \Pi(s) &= 2\,(\lambda_B + q(s)\,\Delta\lambda)\,(x-w) - p_{D_1} - p_{D_1D_2} \\ &= ((2q(s) - (1+\pi_{11})\,q_{11})\,\Delta\lambda + (1-\pi_{11})\,\lambda_B)\,(x-w) \end{aligned} \tag{A.10}$$

Since $q(s) = 1$ if $s = G$, the speculator's expected payoff is positive if she observes $s = G$.

If the speculator observes $s = \varnothing$, then $q(s) = q_0$. For $\alpha > \alpha^*_{11}$ (i.e., $x - w > 0$), her expected payoff is $\Pi(\varnothing) \geq 0$ if and only if the first term in brackets in (A.10) is positive. This term is positive at $\alpha = 0$ and decreasing in α. Thus, it is zero for some $\overline{\alpha}_{11} > 0$. This cutoff $\overline{\alpha}_{11}$ is unique. We can show that if $\Pi(\varnothing) = 0$ for $\alpha > \alpha^*_{11}$, it must be that $\frac{\partial}{\partial\alpha}\Pi(\varnothing) < 0$.[26] Since $\Pi(\varnothing)$ is continuous in α, this implies that (for $\alpha > \alpha^*_{11}$) $\Pi(\varnothing)$ crosses zero at most once from above. Hence, $\Pi(\varnothing) > 0$ if $\alpha \in [\alpha^*_{11}, \overline{\alpha}_{11}]$.

The set $[\alpha^*_{11}, \overline{\alpha}_{11}]$ is not empty if the stakeholders' outside option, $\overline{w}$, is below a threshold $\overline{w}^*_{11}$, implicitly defined by $\alpha^*_{11} \equiv \overline{\alpha}_{11}$. Specifically, α^*_{11} is increasing in q^* with $\alpha^*_{11} \to 0$ for $q^* \to q_0$, while $\overline{\alpha}_{11}$ does not depend on q^*. Hence there is a cutoff for q^*, defined by $\alpha^*_{11} \equiv \overline{\alpha}_{11}$ such $[\alpha^*_{11}, \overline{\alpha}_{11}]$ is not empty for q^* below this cutoff. Since q^* is, in turn, increasing in $\overline{w}$, we obtain that there is a cutoff $\overline{w}^*$ such that the set $[\alpha^*_{11}, \overline{\alpha}_{11}]$ is non-empty for $\overline{w} < \overline{w}^*_{11}$.

Step 2: Trading Strategies at $t = 2$. We start by verifying that after the speculator has played $D_1 = 1$ at $t = 1$, she will not trade as a noise trader by choosing $D_2 \in \{-1, 0\}$. If

[26] The details omitted for brevity, but available on request.

she does so, the stakeholders and the market maker will believe that the trades come from a noise trader. Thus, the stakeholders do not join, the firm's value will be zero, and the price set by the market maker will be $p_{1D_2} = 0$. The speculator's expected payoff is then $(0 - p_1) + (0 - p_{1D_2}) D_2 < 0$, which is less than what she obtains on the equilibrium path if $s \in \{G, \varnothing\}$. Similarly, a negatively-informed speculator ($s = B$) will also not deviate after playing $D_1 = -1$ at $t = 1$. Since the firm's value and the price after any deviation will be $p_{-1D_2} = 0$, the speculator's expected payoff will be $(0 - p_{-1D_2}) D_2 = 0$, which is the same as what she obtains on the equilibrium path.

Step 3: Trading Strategies at $t = 1$. We continue by verifying that the speculator will not deviate at $t = 1$. 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 stakeholders not joining the firm, the firm's value is zero, and the price set by the market maker at both trading dates is $p_{D_1} = p_{D_1 D_2} = 0$. The speculator's expected payoff is then $(0 - p_{D_1}) D_1 + (0 - p_{D_2}) D_2 = 0$, which is less than what she obtains on the equilibrium path. The same argument applies if $s = B$, but the speculator deviates to $D_1 = 0$. That is, the speculator would make a deviation profit of zero, which is less than her equilibrium expected payoff.

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., $D_1 = D_2 = 1$. The speculator's expected payoff, in this case, is given by expression (A.10) where $q(s) = 0$. Since this expression decreases in α, there is a threshold $\alpha_{11} \geq 0$, defined by $\Pi(B) = 0$, such that $\Pi(B) < 0$ for $\alpha \geq \alpha_{11}$. Note that since $\Pi(s)$ is increasing in $q(s)$ and $q(G) = 1 > q(B) = 0$, it always holds that $\alpha_{11} < \overline{\alpha}_{11}$. Defining $\underline{\alpha}_{11} \equiv \max\{\alpha_{11}, \alpha^*_{11}\}$, we obtain that there is no profitable deviation from the proposed equilibrium if $\alpha \in [\underline{\alpha}_{11}, \overline{\alpha}_{11}]$. As discussed in Step 1, this set is non-empty if $\overline{w} < \overline{w}^*_{11}$.

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 in 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.

(ii) **Claim**: *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 also equilibria in which the speculator follows the same strategy if $s \in \{G, \varnothing\}$ but does not trade (instead* *of selling) at $t = 1$ and/or $t = 2$ is $s = B$. 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

$$\alpha \in [\underline{\alpha}_{10}, \overline{\alpha}_{10}], \tag{A.11}$$

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

Proof. 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 $s = B$.

Since the proof is very similar to that of part (i), we only explain the differences. From expressions (A.3) and (A.4), 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

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

The speculator's equilibrium expected payoff is given by expression (A.7). It holds that $\Pi(B) = 0$ (i.e., if $s = B$). Furthermore

$$\begin{aligned} \Pi(s) &= (\lambda_B + q(s) \Delta\lambda) (x - w) - p_{D_1} \\ &= ((q(s) - q_{10}) \Delta\lambda + (1 - \pi_{10}) \lambda_B) (x - w). \end{aligned} \tag{A.12}$$

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 part (i), as the speculator makes a profit only on her first trade, which is at the same price as in part (i). If the speculator observes $s = \varnothing$, $q(s) = q_0$ and we obtain again that $\Pi(\varnothing) > 0$ if and only if $\alpha < \overline{\alpha}_{10}$, where $\overline{\alpha}_{10}$ is a threshold implicitly defined by $\Pi(\varnothing) = 0$. The uninformed speculator's profit is higher than in the equilibrium in part (i) since she trades at $t = 1$ at the same price as in part (i) 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 implicitly defined by $\alpha^*_{11} \equiv \overline{\alpha}_{10}$.

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 part (i) of the proof. The only differences are that the speculator's equilibrium expected payoff is given by (A.12) 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 part (i). 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 $\Pi(B) = 0$. Defining $\underline{\alpha}_{10} \equiv \max\{\alpha_{10}, \alpha_{10}^*\}$, 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, $\Pi(B)$ is higher than in part (i). Thus, it holds that $\underline{\alpha}_{10} > \underline{\alpha}_{11}$.

Modifying this proof to show that there is 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.

To complete the proof of Proposition 1, we finally define $\underline{\alpha} \equiv \min\{\underline{\alpha}_{11}, \underline{\alpha}_{10}\} = \underline{\alpha}_{11}$, $\overline{\alpha} \equiv \max\{\overline{\alpha}_{11}, \overline{\alpha}_{10}\} = \overline{\alpha}_{10}$, and $\overline{w} \equiv \min\{\overline{w}_{11}, \overline{w}_{10}\}$. **Q.E.D.**

Proof of Proposition 2. The proof of part (i) is contained in the Proof of Proposition 1. For part (ii), we present the equilibrium where the speculator buys in both periods. In order to show that equilibria with uninformed speculation are more likely, it suffices to show that the parameter range which supports such equilibria is larger. More specifically, we show that $\overline{\alpha}_{11} - \underline{\alpha}_{11}$ is (weakly) increasing in x. Recall that $\overline{\alpha}_{11}$ is defined by $\Pi(\varnothing) = 0$, where $\Pi(\varnothing) = ((2q_0 - (1 + \pi_{11})\, q_{11})\, \Delta\lambda + (1 - \pi_{11})\, \lambda_B)\,(x - w)$. We focus on the solution which corresponds to $((2q_0 - (1 + \pi_{11})\, q_{11})\, \Delta\lambda + (1 - \pi_{11})\, \lambda_B) = 0$ and abstract from the less interesting case where $(x - w) = 0$, that would imply that the firm's profit is zero. Hence, $\overline{\alpha}_{11}$ is defined by $((2q_0 - (1 + \pi_{11})\, q_{11})\, \Delta\lambda + (1 - \pi_{11})\, \lambda_B) = 0$, which is not a function of x. Recall that $\underline{\alpha}_{11} \equiv \max\{\alpha_{11}, \alpha_{11}^*\}$, where α_{11} is defined by $\Pi(B) = 0$, and for the reasons explained above, is not a function of x. Finally, for α_{11}^* (defined by (1)), $\frac{\partial \alpha_{11}^*}{\partial x} = \frac{(-9+8\beta)\Delta\lambda q_0 \overline{w}}{9(1-\beta)(1-q_0)(\overline{w}-\lambda_B x)^2} < 0$. Hence, $\overline{\alpha}_{11} - \underline{\alpha}_{11}$ is either increasing in x (when $\underline{\alpha}_{11} = \alpha_{11}^*$), or unaffected (when $\underline{\alpha}_{11} = \alpha_{11}$). **Q.E.D.**

Proof of Lemma 2. We show the proofs for the case in which the speculator sells if she observes $s = B$. Just as in Proposition 1, modifying the arguments to the case in which the speculator does not trade if $s = B$ is trivial, as in either case, the market maker sets a price of zero.

(i) We start by showing that there is an equilibrium in which the trader submits $D_1 = 0$ and $D_2 = 1$ if $s = G$, and does not trade if $s = \varnothing$ and sells 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

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

The stakeholders join the firm if and only if $q_{01} > q^*$. Thus, there is again a threshold $\alpha^{**} \equiv \frac{\frac{1}{9}\beta\left(\frac{q^*}{q_0}-1\right)}{(1-\beta)(1-q^*)}$ such that the stakeholders join only if $\alpha > \alpha^{**}$. The prices set by the market maker are as follows:

$$\begin{array}{ll} p_{01} = \left(\lambda_B + q_{01}\Delta\lambda\right)(x-w) & \text{if } D_1 = 0 \text{ and } D_2 = 1 \\ p_{D_1} = p_{D_1 D_2} = 0 & \text{if } D_1 \in \{-1,1\} \text{ or } D_2 \in \{-1,0\}. \end{array}$$

The speculator's expected payoff from $D_1 = 0$ and $D_2 = 1$ is

$$\begin{aligned} \Pi(s) &= \left(\lambda_B + q(s)\Delta\lambda\right)(x-w) - p_{D_1 D_2} \\ &= \left(q(s) - q_{01}\right)\Delta\lambda\,(x-w). \end{aligned}$$

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 $s \in \{B, \varnothing\}$. Furthermore, observe that for any other trading orders, the stakeholders do not join, the firm's value is zero, and the market maker sets a price of zero. Hence, the speculator has no strict incentive to deviate for any signal s.

(ii) Next, we show that there is an equilibrium in which the speculator buys in both trading dates ($D_1 = D_2 = 1$) if she observes $s = G$, sells if $s = B$, and does not trade if $s = \varnothing$. The stakeholders' and market maker's posteriors are then given by $\widehat{q}_{11} = q_{01}$ (we use $\widehat{q}_{11}$ to make it clear that the posterior is different from q_{11} in part (i) of Proposition 1) and

$$\widehat{\pi}_{11} = \frac{\left(1-\beta\right)\alpha q_0 + \beta\frac{1}{9}}{\left(1-\beta\right)\alpha q_0 + \beta\frac{1}{3}},$$

and the stakeholders join only if $\alpha \geq \alpha^{**}$. The proof is almost the same as that of Proposition 1 with the exception that the uninformed speculator should not have an incentive to mimic the trading strategy $D_1 = D_2 = 1$. Similar to Proposition 1, the speculator's expected payoff is given by

$$\Pi(s) = \left(\left(2q(s) - \left(1+\pi_{11}\right)\widehat{q}_{11}\right)\Delta\lambda + \left(1-\widehat{\pi}_{11}\right)\lambda_B\right)(x-w).$$

Since this expression is positive if $s = G$, the speculator has no incentives to trade as a negatively-informed or noise trader, as that would lead to a deviation payoff of zero.

Similar to Proposition 1, for $\alpha > \alpha^{**}$, it holds that $\frac{\partial}{\partial\alpha}\Pi(\varnothing) < 0$ at $\Pi(\varnothing) = 0$, implying that there is a cutoff α_b, defined by $\Pi(\varnothing) = 0$, such that the speculator does not mimic the trading strategy $D_1 = D_2 = 1$ when she is uninformed if and only if $\alpha \geq \alpha_b$. Note that if the speculator does not mimic if $s = \varnothing$, she has even less of an incentive to do so if $s = B$. Defining $\underline{\underline{\alpha}}_{11} \equiv \max\{\alpha^{**}, \alpha_b\}$, the claim of the Proposition follows.

(iii) Next, we show that there is an equilibrium in which the speculator does not trade at $t = 2$ but buys at $t = 1$ ($D_1 = 1$, $D_2 = 0$) if she observes $s = G$, sells in both periods if $s = B$, and does not trade if $s = \varnothing$. The stakeholders' and market maker's posteriors are then given by $\widehat{q}_{10} = \widehat{q}_{11}$ and $\widehat{\pi}_{10} = \widehat{\pi}_{11}$ and the stakeholders join only if $\alpha \geq \alpha^{**}$. The rest of the proof is almost the same as that of Proposition 1 with the exception that the uninformed should not have an incentive to mimic the trading strategy $D_1 = 1$ and $D_2 = 0$. Similar to Proposition 1 (ii), the speculator's expected payoff is given by

$$\Pi(s) = ((q(s) - \widehat{q}_{10})\,\Delta\lambda + (1 - \widehat{\pi}_{10})\,\lambda_B)\,(x - w)\,.$$

Since this expression is positive if $s = G$, the speculator has no incentives to trade as a negatively-informed or noise trader, as that would lead to a deviation payoff of zero.

Similar to Proposition 1, for $\alpha > \alpha^{**}$, it holds that $\frac{\partial}{\partial\alpha}\Pi(\varnothing) < 0$ at $\Pi(\varnothing) = 0$, implying that there is a cutoff α_c, defined by $\Pi(\varnothing) = 0$, such that the speculator does not mimic the trading strategy $D_1 = 1$ and $D_2 = 0$ when uninformed if and only if $\alpha \geq \alpha_c$. Note that if the speculator does no mimic if $s = \varnothing$, she has even less of an incentive to do so if $s = B$. Defining $\underline{\underline{\alpha}}_{10} \equiv \max\{\alpha^{**}, \alpha_c\}$, the claim of the Proposition follows.

(iv) Finally, we show that there is an equilibrium of the trading game in which the speculator never trades and the stakeholders never join the firm. We argue to a contradiction. Suppose that the speculator could benefit from deviating and submitting a buy or sell order in one of the trading dates. Since such orders are attributed to noise traders, the market maker's and the stakeholders' posterior beliefs are unchanged and the stakeholders do not join, as $q_0 < q^*$. Thus, the price in all trading dates is $p_{D_1} = p_{D_1 D_2} = 0$ for any D_1 and D_2. Since this price is equal to the firm's true fundamental value when the stakeholders do not join, the speculator cannot make a profit and cannot benefit from the deviation. **Q.E.D.**

Proof of Proposition 3. The easiest-to-sustain non-manipulation equilibrium involving trade is given by Lemma 2 (i). It requires that $\alpha > \alpha^{**}$. The easiest-to-sustain manipulation equilibrium is given by Proposition 1 (ii). It requires that $\alpha \in [\underline{\alpha}_{10}, \overline{\alpha}_{10}]$. To show that non-manipulation equilibria exist whenever manipulation equilibria exist, we show that $\alpha^{**} < \underline{\alpha}_{10}$.

Since $\underline{\alpha}_{10} = \max\{\alpha_{10}, \alpha^*_{10}\}$, it is sufficient to show that $\alpha^{**} \leq \alpha^*_{10}$. Suppose to a contradiction that $\alpha^{**} - \alpha^*_{10} > 0$. It holds

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

which is positive if

$$\beta > \frac{1}{\left(\frac{1}{9}\frac{(1-q_0)q^*}{(1-q^*)q_0} + \frac{8}{9}\right)}. \tag{A.13}$$

However, for a manipulation equilibrium to exist, it must also be that $\alpha^*_{10} < 1$. That is

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

giving a contradiction to condition (A.13). **Q.E.D.**

Proof of Proposition 4. We define price efficiency as the expectation of the squared error between the value of the firm and the price at which its equity is traded

$$E\left[\left(v(s) - p_{D_1}\right)^2 + \left(v(s) - p_{D_1D_2}\right)^2\right],$$

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

The pricing error in the equilibrium from part (i) of Lemma 2 is

$$\begin{aligned}&q_0\left((1-\beta)\alpha + \frac{1}{9}\beta\right)\left(\lambda_G\left(x - \frac{\overline{w}}{\lambda_B + q_{01}\Delta\lambda}\right) - p_{01}\right)^2 \\ &+(1-q_0)\frac{1}{9}\beta\left(\lambda_B\left(x - \frac{\overline{w}}{\lambda_B + q_{01}\Delta\lambda}\right) - p_{01}\right)^2.\end{aligned}$$

Plugging in for p_{01} and q_{01} and reformulating, we obtain

$$\frac{\left((1-\beta)\alpha + \frac{1}{9}\beta\right)\frac{1}{9}\beta}{(1-\beta)\alpha q_0 + \beta\frac{1}{9}} q_0(1-q_0)\Delta\lambda^2\left(x - \frac{\overline{w}}{\lambda_B + q_{01}\Delta\lambda}\right)^2. \tag{A.14}$$

Taking the derivative of this expression with respect to α, we obtain

$$\frac{q_0\left(1-\beta\right)\left(\frac{1}{9}\left(1-q_0\right)\Delta\lambda\beta\right)^2}{\left(\left(1-\beta\right)\alpha q_0+\beta\frac{1}{9}\right)^2}\left(x-\frac{\overline{w}}{\lambda_B+q_{01}\Delta\lambda}\right)$$
$$\times\quad\left(x-\frac{\overline{w}}{\lambda_B+q_{01}\Delta\lambda}+2\frac{\left(\left(1-\beta\right)\alpha+\frac{1}{9}\beta\right)q_0}{\left(1-\beta\right)\alpha q_0+\beta\frac{1}{9}}\frac{\Delta\lambda\overline{w}}{\left(\lambda_B+q_{01}\Delta\lambda\right)^2}\right)>0.$$

Hence, the pricing error in this equilibrium increases in the transparency parameter α.

To see that the effect is non-monotone, consider the case in which $\alpha=\underline{\alpha}_{11}$, and consider a switch to the equilibrium being played in part (i) of Proposition 1. If λ_B is sufficiently low, we have that $\underline{\alpha}_{11}=\alpha^*_{11}$ and $x-\frac{\overline{w}}{\lambda_B+q_{11}\Delta\lambda}=0$. At this degenerate equilibrium, the firm's fundamental value is zero regardless of whether the stakeholders join, as all cash flows are paid out as wages. Hence, the firm's price and the pricing errors are also zero regardless of how the speculator trades. **Q.E.D.**

Proof of Lemma 3. See Appendix B.

Proof of Proposition 5. The manager can avoid manipulation by choosing α such that the feasibility conditions for manipulation (A.9), (A.11), (B.1), and (B.2) are not satisfied.

It only remains to show that there are cases in which equity holders benefit from encouraging manipulation. We do so for the case in which the firm learns the firm-specific shock between $t=0$ and $t=3$, which means that the firm does not rely on the subsequent trading to form its beliefs about the firm-specific shock. As argued in Lemma A.1, even if the equity holders observe ω before hiring the stakeholders, this does not affect contracting, as the unique equilibrium contract is a pooling contract satisfying $w=\frac{\overline{w}}{\lambda_B+q_{D_1D_2}\Delta\lambda}$.

We now compare the equity holders' expected profit when there is manipulation, Π_m, and no manipulation, Π_{nm}, by choosing the manipulation equilibrium easiest to sustain (i.e., $D_1=1$ and $D_2=0$) and the non-manipulation equilibrium easiest to sustain ($D_1=0$ and $D_2=1$). We compare the equilibrium profits at $\alpha=\overline{\alpha}_{10}$. At this value of $\overline{\alpha}_{10}$, an uninformed speculator's expected payoff from not trading and manipulating is the same (and equal to zero):

$$\left(\left(q_0-q_{10}\right)\Delta\lambda+\left(1-\pi_{10}\right)\lambda_B\right)\left(x-\frac{w}{\lambda_B+q_{10}\Delta\lambda}\right)=0,$$

and by marginally increasing α, the equity holders can ensure that there is no manipulation. Thus, if we can show that the difference in expected profits $\Pi_m-\Pi_{nm}$ is strictly positive for $\alpha=\overline{\alpha}_{10}$, then by the continuity of the equity holders' expected payoff when there is no manipulation, a marginally lower α (for which a manipulation equilibrium exists) will still lead to a positive difference in profits. It holds

$$\begin{aligned}\Pi_m &= \left((1-\beta)\left(\alpha q_0+(1-\alpha)\right)+\beta\frac{1}{9}\right)(\lambda_B+q_0\Delta\lambda)\left(x-\frac{\overline{w}}{(\lambda_B+q_{10}\Delta\lambda)}\right),\\ \Pi_{nm} &= \left((1-\beta)\alpha q_0+\beta\frac{1}{9}\right)(\lambda_B+q_0\Delta\lambda)\left(x-\frac{\overline{w}}{(\lambda_B+q_{01}\Delta\lambda)}\right).\end{aligned}$$

Taking the difference and plugging in for q_{10} and q_{01}, we obtain

$$\begin{aligned}&\Pi_m-\Pi_{nm}\\ =&\left((1-\beta)(1-\alpha)x-\left(\frac{\left((1-\beta)\left(\alpha q_0+(1-\alpha)\right)+\beta\frac{1}{9}\right)}{\lambda_B+\frac{\left((1-\beta)+\beta\frac{1}{9}\right)q_0}{(1-\beta)(\alpha q_0+(1-\alpha))+\beta\frac{1}{9}}\Delta\lambda}-\frac{\left((1-\beta)\alpha q_0+\beta\frac{1}{9}\right)}{\lambda_B+\frac{\left((1-\beta)\alpha+\beta\frac{1}{9}\right)q_0}{(1-\beta)\alpha q_0+\beta\frac{1}{9}}\Delta\lambda}\right)\overline{w}\right)\\ &\times(\lambda_B+q_0\Delta\lambda).\end{aligned}$$

We only need to show that there are parameter values for which this expression is positive, $\overline{\alpha}_{10}<1$ and $\overline{w}<\overline{w}^*_{10}$ (i.e., a manipulation equilibrium in which $D_1=1$ and $D_2=0$ exists), $q_{10}>q^*>q_0$, and $\alpha>\alpha^{**}$ (a non-manipulation equilibrium in which $D_1=0$ and $D_2=1$ exists). It is straightforward to verify that there is a wide range of parameter values for which these conditions are satisfied. One example is for $x=1$, $\overline{w}=0.25$, $\beta=0.8$, $q_0=0.36$, $\lambda_B=0.1$, $\Delta\lambda=0.4$. **Q.E.D.**

Proof of Proposition 6. We only make the argument for the equilibrium with uninformed speculation in which the uninformed speculator buys in both periods. Similar intuition applies to each equilibrium 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 show that an equilibrium with uninformed speculation exists if $\beta\in[\underline{\beta}_{11},\overline{\beta}_{11}]$. 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 (1).

Observe, now, that for any $\beta\in[\underline{\beta}_{11},\overline{\beta}_{11}]$, there is a unique $\kappa^*(\beta)\equiv \mathrm{E}\Pi(\alpha,\beta)$, for which condition (7) holds. That is, there is an equilibrium with endogenous entry and uninformed speculation in which the share of noise traders is $\widetilde{\beta}$ if the entry cost is $\kappa^*(\widetilde{\beta})$. 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 $\underline{\kappa}=\min_{\beta\in[\underline{\beta}_{11},\overline{\beta}_{11}]}\mathrm{E}\Pi(\alpha,\beta)$ and $\overline{\kappa}=\max_{\beta\in[\underline{\beta}_{11},\overline{\beta}_{11}]}\mathrm{E}\Pi(\alpha,\beta)$. 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.**

Proof of Proposition 7. From the break even condition (8) of a venture capitalist who has observed $s_{-1} = G$, we obtain

$$\gamma = \frac{K}{\lambda_G (x - w_0 + p_0)}. \tag{A.15a}$$

If the venture capitalist has observed $s_{-1} = \varnothing$, from the break even condition (9), we can derive

$$S = \frac{K}{\overline{\lambda}} - \gamma p_0. \tag{A.16}$$

The latter expression is strictly positive since $\lambda_G > \overline{\lambda}$ (see expressions (8) and (9)).

From the stakeholders' break even condition (10), we have

$$w_0 = \frac{\overline{w}}{\left(\frac{\alpha q_{-2}\lambda_G + (1-\alpha)\overline{\lambda}}{\alpha q_{-2} + (1-\alpha)}\right)}. \tag{A.17}$$

It remains to show that these contracts satisfy the feasibility restrictions $\gamma \in [0,1]$ and $0 \leq S + \gamma p_0 + w_0 \leq x + p_0$. 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

$$\begin{aligned} 0 &\leq (x + p_0) - (S + \gamma p_0 + w_0) \\ &= x + p_0 - \frac{K}{\overline{\lambda}} - \frac{\overline{w}}{\left(\frac{\alpha q_{-2}\lambda_G + (1-\alpha)\overline{\lambda}}{\alpha q_{-2} + (1-\alpha)}\right)}. \end{aligned} \tag{A.18}$$

Finally, we need to show that

$$\gamma = \frac{K}{\lambda_G (x - w_0 + p_0)} = \frac{K}{\lambda_G \left(x + p_0 - \frac{\overline{w}}{\left(\frac{\alpha q_{-2}\lambda_G + (1-\alpha)\overline{\lambda}}{\alpha q_{-2} + (1-\alpha)}\right)} \right)} < 1,$$

which can be restated as

$$0 < x + p_0 - \frac{K}{\lambda_G} - \frac{\overline{w}}{\left(\frac{\alpha q_{-2}\lambda_G + (1-\alpha)\overline{\lambda}}{\alpha q_{-2} + (1-\alpha)}\right)}. \tag{A.19}$$

Observe that condition (A.19) is satisfied if condition (A.18) is satisfied. Thus, from condition (A.18), we obtain condition (11). **Q.E.D.**

Appendix B For Online Publication

Proof of Lemma 3. **Claim**: *There is an equilibrium in which the speculator buys in both periods if $s = G$ and sells in both periods if $s \in \{B, \varnothing\}$, in which case the stakeholders do not join the firm, if and only if*

$$\alpha \in \left[\underline{\alpha}_{-1-1}, \overline{\alpha}_{-1-1}\right]. \tag{B.1}$$

There is also a second equilibrium with uninformed speculative trading in which the speculator buys in both periods if $s = G$, but sells at $t = 1$ and does not trade at $t = 2$ if $s \in \{B, \varnothing\}$, if and only if

$$\alpha \in \left[\underline{\alpha}_{-10}, \overline{\alpha}_{-10}\right] \tag{B.2}$$

where $\underline{\alpha}_{-1-1}$, $\overline{\alpha}_{-1-1}$, $\underline{\alpha}_{-10}$, and $\overline{\alpha}_{-10}$ are defined in Appendix B. Equilibria without speculative trading coexist with speculation equilibria.

Proof. The proof is the mirror image of Propositions 1–3. In what follows, we verify the existence of the proposed equilibria in turn. For each equilibrium, we use Lemma A.2 to derive the posterior beliefs and the prices at the trading dates $t = 1$ and $t = 2$ (Step 1). Subsequently, we verify that the trading strategies at $t = 2$ and $t = 1$ are optimal given these stock prices, the subsequent trading, and the stakeholders' decision to join the firm (Steps 2 and 3).

(i.a) We consider, first, the equilibrium in which the speculator sells in both trading dates ($D_1 = D_2 = -1$) if she observes $s \in \{B, \varnothing\}$ and buys in both trading dates ($D_1 = D_2 = 1$) if $s = G$.

Step 1: Posterior beliefs, prices, and equilibrium payoffs. From expressions (A.3) and (A.4), the market maker's posterior belief that the firm-specific shock is $\omega = G$ is

$$\begin{aligned} q_{-1-1} &= \frac{\left((1-\beta)(1-\alpha) + \beta\frac{1}{9}\right) q_0}{(1-\beta)\left(\alpha(1-q_0) + (1-\alpha)\right) + \beta\frac{1}{9}} \\ q_{11} &= \frac{\left((1-\beta)\alpha + \beta\frac{1}{9}\right) q_0}{(1-\beta)\alpha q_0 + \beta\frac{1}{9}} \end{aligned}$$

and $q_{D_1D_2} = q_0$ for all other orders. Note that $\frac{\partial q_{-1-1}}{\partial \alpha} < 0$. Since the stakeholders decide not to join only if $q_{-1-1} < q^*$, there is a threshold $\underline{\alpha}_{-1-1} \equiv \frac{\left(1-\frac{8}{9}\beta\right)\left(1-\frac{q^*}{q_0}\right)}{(1-\beta)(1-q^*)}$, such that they do not join if they observe two sell orders and $\alpha > \underline{\alpha}_{-1-1}$. The market maker's beliefs that he will observe $D_2 = -1$, conditional on observing $D_1 = -1$, and his belief that he will observe

$D_2 = 1$, conditional on observing $D_1 = 1$, are

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

Defining $v_0 \equiv (\lambda_B + q_0\Delta\lambda)\left(x - \frac{\overline{w}}{\lambda_B+q_0\Delta\lambda}\right)$, the prices at $t = 2$ and $t = 1$ are

$$\begin{array}{ll} p_{-1-1} = q_{-1-1}\sigma x & \text{if } D_1 = D_2 = -1 \\ p_{11} = (\lambda_B + q_{11}\Delta\lambda)\left(x - \frac{\overline{w}}{\lambda_B+q_{11}\Delta\lambda}\right) & \text{if } D_1 = D_2 = 1 \\ p_{-1} = \pi_{-1-1}p_{-1-1} + (1-\pi_{-1-1})\,v_0 & \text{if } D_1 = -1 \\ p_1 = \pi_{11}p_{11} + (1-\pi_{11})\,v_0 & \text{if } D_1 = 1 \\ p_{D_1} = p_{D_1D_2} = v_0 & \text{otherwise.} \end{array}$$

The speculator's equilibrium expected payoff if she observes $s = G$ is

$$\Pi(G) = 2\lambda_G\left(x - \frac{\overline{w}}{\lambda_B+q_{11}\Delta\lambda}\right) - p_1 - p_{11} > 0.$$

The inequality follows from the fact that $\lambda_G\left(x - \frac{\overline{w}}{\lambda_B+q_{11}\Delta\lambda}\right) > p_{11} > p_1$. The speculator's equilibrium expected payoff if she observes $s \in \{B, \varnothing\}$ is

$$\begin{aligned} \Pi(s) &= -(2q(s)\,\sigma x - p_{-1} - p_{-1-1}) \\ &= ((1+\pi_{-1-1})\,q_{-1-1} - 2q(s))\,\sigma x + (1-\pi_{-1-1})\,v_0. \end{aligned} \tag{B.3}$$

If the speculator observes $s = B$, we have that $q(s) = 0$, and expression (B.3) is always positive.

Consider, now, the case in which $s = \varnothing$. Plugging in for π_{-1-1} and q_{-1-1} into (B.3), we have that for $\alpha \to 0$

$$\Pi(\varnothing) = \frac{\beta\frac{2}{9}}{1-\beta\frac{2}{3}}\left((\lambda_B+q_0\Delta\lambda)\left(x - \frac{\overline{w}}{\lambda_B+q_0\Delta\lambda}\right) - q_0\sigma x\right) > 0.$$

Taking the derivative of $\Pi(\varnothing)$ with respect to α, we obtain

$$\begin{aligned}\frac{\partial\Pi(\varnothing)}{\partial\alpha} &= -\frac{q_0(1-\beta)\sigma x(1-q_0)\left(1-\frac{8}{9}\beta\right)}{\left((1-\beta)(\alpha(1-q_0)+(1-\alpha))+\beta\frac{1}{9}\right)^2} \\ &\quad -q_0(1-\beta)\frac{\left(\left(1-\frac{6}{9}\beta\right)(1-q_0)+\frac{2}{9}\beta q_0\right)\sigma x+\frac{2}{9}\beta(\lambda_B+q_0\Delta\lambda)\left(x-\frac{\overline{w}}{\lambda_B+q_0\Delta\lambda}\right)}{\left((1-\beta)(\alpha(1-q_0)+(1-\alpha))+\beta\frac{1}{3}\right)^2}\end{aligned}$$

which is strictly negative. Hence, there is a threshold α_d, defined by $\Pi(\varnothing)=0$, such that $\Pi(\varnothing)\geq 0$ if and only if $\alpha\in\left[\underline{\alpha}_{-1-1},\alpha_d\right]$.

Step 2: Trading Strategies at $t=2$. We start by verifying that after the speculator has played $D_1=-1$ at $t=1$, she will not trade as a positively-informed or noise trader at $t=2$. Consider a deviation to $D_2\in\{0,1\}$. For this deviation, the stakeholders and the market maker believe that the trades come from a noise trader. Thus, the stakeholders join, and the firm's valuation conditional on signal s will be $(\lambda_B+q(s)\Delta\lambda)\left(x-\frac{\overline{w}}{\lambda_B+q_0\Delta\lambda}\right)$, and the price set by the market maker will be $p_{-1D_2}=v_0$. The speculator's expected deviation payoff is

$$-\left((\lambda_B+q(s)\Delta\lambda)\left(x-\frac{\overline{w}}{\lambda_B+q_0\Delta\lambda}\right)-p_{-1}\right)+\left((\lambda_B+q(s)\Delta\lambda)\left(x-\frac{\overline{w}}{\lambda_B+q_0\Delta\lambda}\right)-v_0\right)D_2,$$

which is less than what she obtains on the equilibrium path if $s\in\{B,\varnothing\}$.

Similarly, a positively-informed speculator ($s=G$) will also not deviate (to the trading strategy of a negatively-informed or noise trader) after playing $D_1=1$ at $t=1$. The speculator's expected payoff from the $t=2$ trade will be $\left(\lambda_G\left(x-\frac{\overline{w}}{\lambda_B+q_0\Delta\lambda}\right)-v_0\right)D_2\leq 0$ for $D_2\in\{-1,0\}$, which is lower than the strictly positive payoff she obtains on the equilibrium path.

Step 3: Trading Strategies at $t=1$. We continue by verifying that the speculator will not deviate at $t=1$. Suppose that the speculator has observed $s\in\{B,\varnothing\}$. The speculator's valuation of the firm if the firm attracts the stakeholders is $v(s)\leq v_0$. Regardless of how the speculator trades at $t=2$, deviating to $D_1\in\{0,1\}$ at $t=1$ will mislead the market maker and the stakeholders to believe that the trade comes from a positively-informed speculator or from a noise trader. In either case, the stakeholders join, and the price set by the market maker at both trading dates will be (weakly) higher that v_0. The speculator's expected payoff is then

$$(v(s)-p_{D_1})D_1+(v(s)-p_{D_1D_2})D_2\leq 0,$$

which is the same or lower compared to what she obtains on the equilibrium path.

If $s=G$, the speculator's expected payoff from a deviation where she sells in both trading periods is (after plugging into expression (B.3)):

$$\left(\frac{2-\beta\frac{14}{9}}{1-\beta\frac{2}{3}}q_0-2\right)\sigma x+\frac{\beta\frac{2}{9}}{1-\beta\frac{2}{3}}\left(\lambda_B+q_0\Delta\lambda\right)\left(x-\frac{\overline{w}}{\lambda_B+q_0\Delta\lambda}\right)<0,$$

which is negative by condition (6).

From the remaining deviations for the speculator when observing $s=G$, the most profitable one is not buying at $t=1$ and buying at $t=2$. If the speculator chooses from $D_1\in\{-1,0\}$ at $t=1$, she is mistaken for a noise trader, but if she sells, she does so at a price lower than v_0 (that takes into account that the stakeholders may not join), leading to a trading loss at $t=1$. The speculator's expected payoff (if $s=G$) from buying only at $t=2$ is

$$\lambda_G\left(x-\frac{\overline{w}}{\lambda_B+q_0\Delta\lambda}\right)-v_0.$$

Compared to her equilibrium expected payoff, we obtain that not deviating is beneficial if

$$2\lambda_G\left(x-\frac{\overline{w}}{\lambda_B+q_{11}\Delta\lambda}\right)-\left(1+\pi_{11}\right)p_{11}-\left(1-\pi_{11}\right)v_0-\left(\lambda_G\left(x-\frac{\overline{w}}{\lambda_B+q_0\Delta\lambda}\right)-v_0\right)>0.$$

After some derivations, we obtain that a sufficient condition is that

$$\alpha<\frac{\beta}{3\sqrt{3}q_0\left(1-\beta\right)}.$$

Defining $\overline{\alpha}_{-1-1}\equiv\min\left\{\alpha_d,\frac{\beta}{3\sqrt{3}q_0(1-\beta)}\right\}$, we obtain that the proposed equilibrium can be supported if $\alpha\in\left[\underline{\alpha}_{-1-1},\overline{\alpha}_{-1-1}\right]$. Thus, equilibria with uninformed speculation can be supported.

(i.b) We consider, next, the equilibrium in which the speculator sells at $t=1$ and does not trade at $t=2$ ($D_1=-1,D_2=0$) if she observes $s\in\{B,\varnothing\}$ and buys in both trading dates ($D_1=1,D_2=1$) if $s=G$. Since the proof is very similar to that of part (i.a), we only explain the differences. From expressions (A.3) and (A.4), the market maker's posterior belief that the firm-specific shock is $\omega=G$ is $q_{-10}=q_{-1-1}$, q_{11} as in part (i.a), and $q_{D_1D_2}=q_0$ otherwise. Furthermore, $\pi_{-10}=\pi_{-1-1}$ and π_{11} is as in part (i.a). The stakeholders join only if $\alpha > \underline{\alpha}_{-10}$, where $\underline{\alpha}_{-10} = \underline{\alpha}_{-1-1}$. The prices at $t = 2$ and $t = 1$ are

$$\begin{array}{ll} p_{11} = (\lambda_B + q_{11}\Delta\lambda)\left(x - \frac{\overline{w}}{\lambda_B + q_{11}\Delta\lambda}\right) & \text{if } D_1 = D_2 = 1 \\ p_{-1} = \pi_{-10} q_{-10}\sigma x + (1 - \pi_{-10})\, v_0 & \text{if } D_1 = -1 \\ p_1 = \pi_{11} p_{11} + (1 - \pi_{11})\, v_0 & \text{if } D_1 = 1 \\ p_{D_1} = p_{D_1 D_2} = v_0 & \text{otherwise.} \end{array}$$

The speculator's equilibrium expected payoff if she observes $s = G$ and buys in both trading periods is

$$\Pi(G) = \left(2\lambda_G\left(x - \frac{\overline{w}}{\lambda_B + q_{11}\Delta\lambda}\right) - p_1 - p_{11}\right) > 0,$$

whereas the speculator's equilibrium expected payoff if $s \in \{B, \varnothing\}$ is

$$\begin{aligned} \Pi(s) &= -(q(s)\,\sigma x - p_{-1}) \\ &= -(q(s) - \pi_{-10} q_{-10})\,\sigma x + (1 - \pi_{-10})\, v_0. \end{aligned} \tag{B.4}$$

Since $q(s) = 0$, the speculator's expected payoff is positive if she observes $s = B$, but this profit is lower than in part (i.a), as the speculator makes a profit only on her first trade at the same price as in part (i.a). If the speculator observes $s = \varnothing$, $q(s) = q_0$ and we obtain again that $\Pi(\varnothing) > 0$ for $\alpha \to 0$ and that $\Pi(\varnothing)$ decreases in α. Hence, $\Pi(\varnothing) \geq 0$ if and only if $\alpha \in \left[\underline{\alpha}_{-1-1}, \alpha_e\right]$, where α_e is a threshold defined by $\Pi(\varnothing) = 0$. The uninformed speculator's profit is higher than in the equilibrium in part (i.a) since she trades at $t = 1$ at the same price as in part (i.a) but does not make a loss from trading at date $t = 2$. Thus, we have again that $\alpha_e > \alpha_d$.

The argument that the speculator cannot benefit from deviation at $t = 2$ after she has played $D_1 = -1$ at $t = 1$ is identical to that in Step 2 of part (i.a) of the proof. The only difference is that the speculator's equilibrium expected payoff is given by (B.4) if $s \in \{B, \varnothing\}$. The deviations then are to $D_2 \in \{-1, 1\}$ if the speculator has observed $s \in \{\varnothing, B\}$. Similarly, there is also no profitable deviation following $D_1 = 1$ to $D_2 \in \{-1, 0\}$ if the speculator has observed $s = G$. In particular, the speculator's expected payoff from such deviations is negative or zero, which is (weakly) less than what she obtains in equilibrium.

The argument that there are no profitable deviations at $t = 1$ is also similar to Step 3 of part (i.a). The only difference is that a speculator who has observed $s = G$, does not mimic $s = B$ by playing $D_1 = -1$ and $D_2 = 0$ if and only if $\alpha > \underline{\alpha}_{-10}$. As argued above, the profit when $D_1 = -1, D_2 = 0$ exceeds the profit when $D_1 = -1, D_2 = -1$. Thus, it holds that $\underline{\alpha}_{-10} > \underline{\alpha}_{-1-1}$. Finally, if $s = G$, the speculator's expected payoff from selling in period one and not trading in period two is negative by condition (6), while her equilibrium payoff is positive. Furthermore, we can show that her expected equilibrium payoff is higher than buying only in one period if $\alpha < \frac{\beta}{3\sqrt{3}q_0(1-\beta)}$. Defining $\overline{\alpha}_{-10} \equiv \min\left\{\alpha_e, \frac{\beta}{3\sqrt{3}q_0(1-\beta)}\right\}$, we obtain that there is no profitable deviation from the proposed equilibrium if $\alpha \in \left[\underline{\alpha}_{-10}, \overline{\alpha}_{-10}\right]$. Thus, equilibria with uninformed speculation can be supported if $\alpha \in [\underline{\alpha}'', \overline{\alpha}'']$, where $\underline{\alpha}'' \equiv \min\{\overline{\alpha}_{-11}, \overline{\alpha}_{-10}\}$ and $\overline{\alpha}'' \equiv \max\{\overline{\alpha}_{-1-1}, \overline{\alpha}_{-10}\}$.

Before moving to the non-manipulation equilibria, observe that there can be no equilibrium in which the positively-informed speculator buys only in one period, as the speculator would always have an incentive to deviate to buying in both periods. First, consider a candidate equilibrium where the positively-informed speculator buys only at $t = 2$. Conditional on that, when $D_1 = D_2 = 1$, the marker maker believes that he is facing a noise trader, and sets $p_1 = p_{11} = v_0$. Hence, by deviating to $D_1 = D_2 = 1$, the positively-informed speculator makes a profit on both trading orders, with her $t = 2$ trading order profit being larger than her equilibrium profit, because $p_{11} = v_0 < p_{01}$. Consider, now, a candidate equilibrium where the positively-informed speculator buys only at $t = 1$. Conditional on that, when $D_1 = D_2 = 1$, the marker maker believes that he is facing a noise trader, and sets $p_{11} = v_0$. Hence, by deviating from $D_2 = 0$ to $D_2 = 1$, the positively-informed speculator makes a profit not only on her $t = 1$ trading order (same as the equilibrium profit), but also on her $t = 2$ trading order, as $\lambda_B\left(x - \frac{\overline{w}}{\lambda_B + q_0\Delta\lambda}\right) > p_{11} = v_0$.

(ii) Next, we show that there is a non-manipulation equilibrium in which the informed trader submits $D_1 = 0$ and $D_2 = -1$ if $s = B$, $D_1 = 1$ and $D_2 = 1$ if $s = G$, and the uninformed trader does not trade. In the proposed equilibrium, the stakeholders' and the market maker's on-equilibrium posterior beliefs are

$$q_{0-1} = \frac{\beta\frac{1}{9}q_0}{(1-\beta)\,\alpha\,(1-q_0) + \beta\frac{1}{9}}$$

and q_{11}, which is defined in part (i.a.). The stakeholders do not join the firm if and only if $q_{0-1} < q^*$. Thus, there is again a threshold $\alpha^{***} \equiv \frac{\frac{1}{9}\beta\left(\frac{q_0}{q^*}-1\right)}{(1-\beta)(1-q_0)}$ such that when $D_1 = 0$, $D_2 = -1$ the stakeholders do not join only if $\alpha > \alpha^{***}$. The prices set by the market maker are as follows:

$$\begin{array}{ll}
p_{0-1} = q_{0-1}\sigma x & \text{if } D_1 = 0, D_2 = -1 \\
p_{11} = (\lambda_B + q_{11}\Delta\lambda)\left(x - \frac{\overline{w}}{\lambda_B + q_{11}\Delta\lambda}\right) & \text{if } D_1 = D_2 = 1 \\
p_1 = \pi_{11}p_{11} + (1-\pi_{11})\,v_0 & \text{if } D_1 = 1 \\
p_{D_1} = p_{D_1D_2} = v_0 & \text{otherwise}
\end{array}$$

where π_{11} defined in part (i.a). The speculator's equilibrium expected payoff when $s = G$ is

$$\Pi(G) = \left(2\lambda_G \left(x - \frac{\overline{w}}{\lambda_B + q_{11}\Delta\lambda}\right) - p_1 - p_{11}\right) > 0$$

since $\lambda_G \left(x - \frac{\overline{w}}{\lambda_B + q_{11}\Delta\lambda}\right) > p_{11} > p_1$. However, since $p_{11} > p_1 > v_0$, the speculator's profit is negative if she plays the same strategy upon observing $s \in (B, \varnothing)$.

The speculator's expected payoff from $D_1 = 0$ and $D_2 = -1$ when $s = B$ is

$$\begin{aligned}\Pi(s) &= -\left(q(s)\sigma x - p_{D_1 D_2}\right) \\ &= \left(q_{0-1} - q(s)\right)\sigma x.\end{aligned}$$

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

Finally, observe that for any other trading orders (i.e., other than $D_1 = 0$, $D_2 = -1$ and $D_1 = 1$, $D_2 = 1$), the stakeholders join and the market maker sets a price of v_0. It is straightforward to show that the speculator has no incentive to deviate if $s \in \{B, \varnothing\}$, as her deviation payoff is (weakly) negative. Ruling out deviations when $s = G$ follows the same steps and conditions as in part (i).

(iii) To show that a non-manipulation equilibrium exists whenever a manipulation equilibrium exists, it is sufficient to show that $\alpha^{***} \leq \underline{\alpha}_{-1-1}$. Suppose to a contradiction that

$$\begin{aligned}0 &< \alpha^{***} - \underline{\alpha}_{-1-1} \\ &= \frac{\frac{1}{9}\beta\left(\frac{q_0}{q^*} - 1\right)}{(1-\beta)(1-q_0)} - \frac{\left(1 - \frac{8}{9}\beta\right)\left(1 - \frac{q^*}{q_0}\right)}{(1-\beta)(1-q^*)} \\ &= (q_0 - q^*)\frac{\frac{1}{9}\beta\frac{(1-q^*)}{q^*} - \left(1 - \frac{8}{9}\beta\right)\frac{(1-q_0)}{q_0}}{(1-\beta)(1-q^*)(1-q_0)}\end{aligned}$$

which requires that

$$\beta > \frac{9q^*(1-q_0)}{q_0 + 8q^* - 9q_0 q^*}. \tag{B.5}$$

However, for a manipulation equilibrium to exist, it must also be that $\underline{\alpha}_{-1-1} < 1$. That is

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

giving a contradiction to condition (B.5). **Q.E.D.**