Founder Friendly VCs

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Abstract

We provide a theory of founder-friendliness in startups. An informed entrepreneur, who enjoys private benefits of control, proposes either a new or a conventional project. The VC chooses which project to finance and can intervene to replace the entrepreneur in the interim. In equilibrium, the entrepreneur seeks to minimize the likelihood of intervention and recommends the new project even if she knows it will fail. We show that more intervention by the VC worsens project choice, whereas lax monitoring improves it. Competition among VCs improves project choice but does not necessarily lead to founder-friendliness. We characterize implications for information acquisition, control rights, outside directors, and stage financing.

JEL Classification: G24, G32, G34, D83

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1 Introduction

Common wisdom suggests that venture capital (VC) firms should engage in intensive monitoring of the startups they invest in.[1] Yet, current trends in private equity markets appear to be at odds with this intuition. Startups have access to "easy money", permissive governance arrangements and board structures, and face little accountability. As the above quotes suggest, VC firms are often criticized for "looking the other way" and catering to founders in an effort to attract investment opportunities.[2] Instead of carefully choosing and supervising startups, many VC funds have adopted a "spray-and-pray" approach, i.e. they fund a large number of firms with limited oversight.

As Lerner and Nanda (2020) emphasize, such "founder friendly" behavior is puzzling:

> "If the intensive governance provided by venture capitalists is socially beneficial—as generations of academic analyses would suggest—why would groups choose to abandon it? Should not venture firms compete instead by offering entrepreneurs progressively higher valuations (and less dilution of their initial equity stakes), not by abandoning governance provisions?"

We argue that such friendly behavior may, in fact, be socially efficient. We study how monitoring and intervention by the VC affects an entrepreneur's incentives communicate truthfully with a VC, in a setting where the VC has limited commitment. Specifically, the entrepreneur (she) has private information about the profitability of a novel project and communicates this information to the VC (he) via cheap talk. Based on the entrepreneur's recommendation, the VC chooses whether to finance the new project or a conventional one, for which the cash flows distribution is commonly known. Contrary to the prevailing intuition, we show that stricter monitoring and more intervention may distort project choice within the startup, whereas lax monitoring may improve it. As a result, being founder friendly not only benefits the entrepreneur, but also the VC.

We then show that, contrary to common wisdom, increased competition need not always lead to founder-friendliness. Moreover, when it does, the impact of such competition on VC payoffs depends crucially on whether he relies on the entrepreneur's recommendation for project choice. Next, we show that when the entrepreneur's information advantage over the

[1] See e.g. Gorman and Sahlman (1989), Admati and Pfleiderer (1994), and Gompers (1995).
[2] See e.g. Ewens, Nanda, and Rhodes-Kropf (2018) and Lerner and Nanda (2020).

VC is higher, she is more likely to recommend the new project, but the VC is *less* likely to intervene.

Third, in a setting with contingent control rights, we show that project choice improves when the VC retains control for new projects and delegates control for conventional projects. Fourth, we show that if project choice and intervention are separately chosen by a VC and an outside director (with non-overlapping information sets), truth-telling can be sustained even without commitment. This implies that including independent directors on the startup board may improve efficiency. Finally, we explore how stage financing affects communication between the VC and the entrepreneur. We show that staging can improve project choice when intervention is more likely to require additional financing than the initial project, but can lead to worse outcomes otherwise.

Model Overview. Section 3 introduces the model. The startup has access to two projects, a new project and a conventional project, but can only invest in one of them.[3] The entrepreneur and VC both know the distribution of returns for the conventional project. By contrast, the entrepreneur has private information (expertise) about the new project which the VC does not have. Specifically, the entrepreneur is privately informed about whether the new project will succeed and makes a recommendation to the VC. Based on the recommendation, the VC chooses which project to invest in. After the project is implemented, the VC observes a signal about the return of the project and decides whether to intervene and to replace the entrepreneur. Consistent with empirical evidence (e.g. Kaplan and Strömberg (2001), Kaplan and Strömberg (2003), and Kaplan and Strömberg (2004)), we assume that contracting is incomplete and the VC cannot commit to an intervention strategy ex-ante.

The entrepreneur is either honest or strategic, but her type is not known to the VC. An honest entrepreneur always reveals her information truthfully and does not derive any private benefits from operating the project. A strategic entrepreneur's recommendation is a cheap talk message and she enjoys private benefits at the expense of the VC unless she is replaced.[4] The threat of intervention naturally leads to lying by the strategic entrepreneur.

[3]We adopt Manso (2011)'s terminology here. In that paper, there is less knowledge about the new project's payoff compared to the conventional project. In our paper, the VC and entrepreneur know the payoff distribution for the conventional project (though the realized return is still uncertain ex-ante), but the VC has less information about the payoff distribution for the new project, compared to the entrepreneur.

[4]As we discuss in Section 3.1, these private benefits include not only excessive perk consumption and cash diversion, but also potential benefits from shirking or diverting resources towards alternative, "pet projects." A salient example is the mix of investments made by WeWork at the direction of its

We focus on two natural types of informative equilibria: the truth-telling equilibrium and the lying equilibrium, in which the strategic entrepreneur sometimes recommends the new project even if she knows it will not succeed.[5]

Section 4 presents the characterization of equilibria without commitment. The game can be solved backwards. After receiving the entrepreneur's recommendation and implementing a project, the VC chooses whether to intervene. If the VC believes that the new project is likely to succeed or that the entrepreneur is honest, he intervenes less, because the value from continuing the project is higher.

In the first period, the entrepreneur anticipates the VC's decisions and chooses which project to recommend to minimize the likelihood of intervention. The intervention and lying decisions are linked, since the VC's beliefs depend on the entrepreneur's strategy. When the entrepreneur is more likely to lie about the new project, the VC's beliefs that the project succeeds and that the entrepreneur is honest are both lower. This leads the VC to intervene more in the new project, which, in equilibrium, renders lying less appealing.

We show that truth-telling can be sustained either if the VC *never* intervenes (e.g., if the cost of doing so is sufficiently high), or if the VC's conditional expected return from investing in either project is equal after the entrepreneur's recommendation. In either case, the VC intervenes equally often for either project, so the entrepreneur has no incentive to lie.

More generally, however, the strategic entrepreneur first builds trust with the VC by honestly reporting project success with some probability, so that she can exploit this trust to enjoy private benefits of control later. This is because the VC is less likely to intervene when he believes that the entrepreneur is honest. Importantly, this trust-building disciplines the strategic type. If she were to lie more often in equilibrium, the VC would infer that a

founder, Adam Neumann, before he was removed from the firm. In addition to providing Neumann "standard" perks like a private jet, WeWork invested in businesses related to surfing (a hobby of Neumann's) and starting an elementary school (as part of finding schooling for Neumann's children) — see "Surfing, Schools and Jets: WeWork's Bets Follow CEO Adam Neumann's Passions" in the Wall Street Journal, March 5, 2019 (https://www.wsj.com/articles/surfing-schools-and-jets-weworks-bets-follow-ceo-adam-neumanns-passions-11551787200).

[5]In addition to having a natural interpretation, we show that this type of equilibrium Pareto dominates equilibria in which the entrepreneur mixes between recommending both projects when she knows the new project will succeed (see Appendix B.1). Note that as is standard in cheap talk models, there always exists babbling equilibria in which the VC ignores the entrepreneur's recommendation. Our focus is on informative equilibria, in which the VC's project choice depends non-trivially on the entrepreneur's recommendation.

recommendation for the new project is more likely to be a lie, and so would be more likely to intervene. But this would reduce the strategic type's incentive to lie and recommend the new project.

If the potential upside of the new project is sufficiently high, the entrepreneur always lies and recommends the new project irrespective of whether it is successful. If not, the equilibrium features "partial lying:" when she knows that the new project will not succeed, the entrepreneur mixes between recommending either project. In this case, the entrepreneur must be indifferent between recommending either project and, therefore, the VC must be equally likely to intervene.[6] The probability of lying in equilibrium ensures that the likelihood of intervention by the VC, which depends on the VC's beliefs about the project and about the entrepreneur's type, is the same across projects.

We show that the equilibrium probability of lying about the new project increases with the ex-ante probability of success for the new project and its potential upside, and decreases with the cost of intervention. More interestingly, the probability is non-monotonic in the prior belief about the entrepreneur's honesty and can decrease in the entrepreneur's ability to divert resources.

Since the entrepreneur's incentive to over-recommend the new project arises due to the possibility of ex-post intervention, Section 5 explores how the VC's ability to commit to an intervention strategy affects outcomes. In practice, such commitment may come from the VC holding a large portfolio, which makes monitoring each individual startup more difficult, or from building a reputation for being founder-friendly. When the VC can commit to intervention ex-ante, we show that truth-telling can be sustained. In that case, the VC intervenes equally often for either project so that the strategic entrepreneur has no incentive to lie. More interestingly, we show that the likelihood of intervention with commitment is *lower* than it is in the corresponding (lying) equilibrium without commitment. This implies that both the VC and the entrepreneur are better off when the VC can commit to being more "friendly" since this leads to less intervention and more efficient project choice.

Our main model is stylized for clarity and does not consider contracts between the entrepreneur and VC. In Section 6, we show that allocating equity to the entrepreneur can improve outcomes. Specifically, as the entrepreneur's equity share increases, she recom-

[6] If, for example, the VC intervenes less in the new project, she always recommends it, which renders her recommendation uninformative.

mends the new project less often. Intuitively, the entrepreneur cares about both her private benefits and the value of the project. As a result, she is less willing to lie by recommending the new project if she knows it will fail. The optimal equity split trades off the VC's value from reducing lying against the cost of ceding cash flow rights to the entrepreneur.

Implications. Our model's results can be applied more generally to other principal-agent settings (e.g., when senior managers monitor employees within a firm). However, the key assumptions of (i) intervention by the VC, (ii) trust-building by the entrepreneur, (iii) the choice between new and conventional projects, and (iv) limited scope for contracting make it particularly well suited to studying the relation between VC's and founders (see e.g., Kaplan, Sensoy, and Strömberg (2009), Gompers, Gornall, Kaplan, and Strebulaev (2020), and Kerr and Nanda (2015)). As such, our model sheds light on recent trends in the VC industry.

First, our analysis helps explain why a "hands-off" approach is so popular in the VC industry, and why VC firms go to great lengths to ensure they are perceived as "founder friendly."[7] At the face of it, this attitude is particularly puzzling given that monitoring has long been recognized as one of the key advantages of VC financing and a large literature highlights its benefits.[8] Lerner and Nanda (2020) argue that the recent decline in governance role of VC financing can be explained in part by increased competition among VC funds, lower costs of starting new ventures, and greater diversification (the "spray and pray" approach). However such explanations suggest that while entrepreneurs benefit from "founder friendly" VCs, the VCs themselves are likely to be worse off.

In Section 7, we adapt our framework to formally incorporate the impact of competition among VCs. Specifically, we assume that there is a perfectly competitive market for VCs, so that VCs make zero profit, and that VCs compete via the equity share they demand from

[7]For instance, consider Benchmark Capital, a veteran venture capital firm with a large number successful investments (including Twitter, Snap, Dropbox, Grubhub, Yelp and Uber). Despite its history of past successes, critics argue that its recent involvement in pushing out Travis Kalanick out of Uber and Adam Neumann out of WeWork might hurt its ability to attract the best startup investments going forward (see "Benchmark's role ousting the CEOs of WeWork and Uber could be the end of the 'founder friendly' reputation that made it one of Silicon Valley's hottest VC firms" in the Business Insider, October 13, 2019 (https://www.businessinsider.com/is-benchmark-capital-founder-friendly-2019-10)).

[8]See e.g. Sahlman (1988), MacMillan, Kulow, and Khoylian (1989), Admati and Pfleiderer (1994), Gompers (1995), Lerner (1995), and more recently Kaplan and Strömberg (2001), Kaplan and Strömberg (2003), Ueda (2004), and Bernstein, Giroud, and Townsend (2016). Of course, our model is stylized to highlight a specific economic channel, and abstracts from other important features of the VC-entrepreneur relation. As such, it should not be interpreted as a blanket recommendation against monitoring or intervention by VCs.

the entrepreneur. We show that competition need not generate founder-friendliness: when financing the startup is sufficiently costly, VCs engage in excessive monitoring even when they are perfectly competitive. Beyond the perfect competition benchmark, we show that increased competition indeed leads the VC to be more founder-friendly, though generally the VC still intervenes too frequently relative to the truth-telling benchmark.

The impact of this higher friendliness depends crucially on whether the VC relies on the entrepreneur's recommendation for project choice. When there is communication between the entrepreneur and the VC, more founder-friendliness can lead to better project choice, as in our baseline analysis. However, in the absence of communication, the reduction in intervention does not improve project choice, which leaves the VC worse off. As such our analysis highlights a novel prediction: increased friendliness resulting from more competition can leave VCs better off when feedback from the entrepreneur is sufficiently important, but leaves them worse off otherwise.

In Section 8, we further explore the implications of our model for information acquisition, control rights, board composition, and staging in the context of VC financing. In recent years, the information asymmetry between VCs and founders has arguably increased (see Kerr, Nanda, and Rhodes-Kropf, 2014). The existing theoretical literature (e.g. Harris and Raviv (1996)) suggests that this should lead to more monitoring by VCs, which makes their apparent "friendliness" more puzzling. In Section 8.1, we study the impact of information asymmetry by assuming that the entrepreneur's information about the project is noisy. We show that when information asymmetry is larger (i.e., the entrepreneur's information is more precise), the entrepreneur lies more, but paradoxically, the VC intervenes *less*. Intuitively, if a better informed entrepreneur recommends the new project, the likelihood that the project succeeds is higher. This leads the VC to intervene less, which, in turn, makes it more appealing to recommend the new project. Overall, project choice is more distorted towards new projects which are more likely to fail, yet the VC intervenes less because the entrepreneur's recommendation is sufficiently informative.

Contingent control rights are a common feature of VC contracts (e.g., see Kaplan and Strömberg, 2003). In Section 8.2, we show that such allocation of control rights can also improve communication. We assume that with some given probabilities, the VC is assigned control (i.e. given the ability to intervene) in either project. With the complementary probabilities, the entrepreneur retains control and the VC cannot intervene. We show that if

the VC is more likely to receive control over the new project, the entrepreneur's incentive to lie by recommending the new project is lower. In fact, by appropriately choosing the control allocation across projects, we show that truth-telling can be sustained. As such, contingent control rights may serve to improve incentives for communication in addition to punishing misbehavior.

As startups evolve, the composition of their boards changes. Independent directors are commonly brought in at later stages and, given the conflict of interest between entrepreneurs and VCs, often end up with the tie-breaking vote (see Ewens and Malenko (2020)). Yet, outside directors are commonly criticized as lacking specific expertise, which potentially renders them ineffective (e.g. Ferris, Jagannathan, and Pritchard (2003)). Such concerns are especially relevant for startups, which, by definition, are highly novel and require highly specific expertise to govern. In Section 8.3, we show that outside directors are beneficial, precisely because they are less informed. Essentially, delegating decision power to a less informed outsider at a later stage can enhance communication in the early stage. Intuitively, since the outsider's intervention decision is now less sensitive to the entrepreneur's communication, her incentives to lie are weaker. In fact, we show that if the outsider's information is sufficiently imperfect, truth-telling can be implemented using this two-stage process.

Finally, in Section 8.4, we explore how stage financing affects communication between the entrepreneur and the VC. Stage financing is a ubiquitous feature of venture capital investment (e.g., Kaplan and Strömberg (2003), Kaplan and Strömberg (2004)). We extend the benchmark model by assuming that the project requires additional (late) financing with some probability, after the VC's intervention decision. We show that when intervention is costly, and requires late financing with a higher likelihood than the initially chosen project, then staging can improve communication and project choice. On the other hand, if the original project is more likely to require late financing, then staging leads to worse project choice than in the benchmark model.

The rest of the paper is organized as follows. The next section reviews the relevant literature and discusses our incremental contribution. Section 3 presents the model and discusses the key assumptions. Section 4 characterizes the equilibrium with no commitment and compares this to the first best, while Section 5 considers the case where the VC can commit to an intervention strategy ex-ante. Sections 6 and 7 study equity allocation and compe-

tition, respectively, while Section 8 presents the extensions discussed above, and Section 9 concludes. All proofs are in the Appendix.

2 Related literature

Our key building blocks are cheap talk (Crawford and Sobel (1982)) and delegation. In our setting, partially informative communication can be sustained because the strategic entrepreneur has an incentive to pool with the honest type by telling the truth. She benefits from this because the VC is less likely to intervene for a more honest entrepreneur. A number of papers study reputation building in cheap-talk models: Sobel (1985), Benabou and Laroque (1992), Morris (2001), and Olszewski (2004).[9] Unlike our model, these papers feature repeated advice: the sender sends a message each period and the receiver implements an action. However, there is no intervention decision and our results on intervention, truth-telling, and project choice cannot be obtained in these frameworks.

Our paper is also related to the literature on incomplete contracts and contingent control (e.g., Grossman and Hart (1986), Hart and Moore (1988), Aghion and Bolton (1992)). The closest paper is Adams and Ferreira (2007), who study whether boards should be independent. In their model, a CEO can share information with a board and the board serves as both monitor and advisor. The CEO faces a tradeoff: sharing information with the board improves their advice, but makes intervention more likely (which the CEO dislikes). The paper argues that friendly boards, who are less likely to monitor, may be optimal because they improve information sharing between the CEO and the board.

Our results, which we view as complementary, are driven by different underlying economic forces. First, as discussed above, communication is sustained by the entrepreneur's endogenous incentive to appear honest in our model, and not exogenous benefits of advice. Second, there is "too much" monitoring in equilibrium in our setting, but "too little" monitoring in theirs. Importantly, this implies that friendliness is socially inefficient in their setting but socially efficient in ours. Finally, the focus of our analysis is on explaining the behavior of VCs and our results on equity shares, contingent control, outsiders, and staging are also

[9] In these papers, reputation is about whether the sender's and receivers preferences are aligned. Ottaviani and Sørensen (2006) study a repeated advice game in which reputation is about whether the sender is informed.

absent from their paper.

Levit (2020) also considers a setting in which intervention affects communication. He considers a principal who sends a recommendation to the agent and who can intervene later to partially undo the agent's action at a cost. He shows that the threat of future intervention can make the principal's communication less credible, since the agent distorts his action to preempt the intervention. The key difference from our setting is that in Levit's model, the principal is simultaneously the sender and the monitor, and the principal's inability to commit to not intervene makes his communication less credible. In contrast, the roles are split in our setting: the receiver's (VC's) ability to intervene induces the sender (strategic entrepreneur) to lie in equilibrium.[10]

Dessein (2005) studies intervention in an incomplete contracting framework and shows that the allocation of control rights can be used to signal. In our main model, control rights are fixed and we instead focus on communication between entrepreneur and VC, which is absent from Dessein's paper. Burkart, Gromb, and Panunzi (1997) show that control by shareholders implies a threat of expropriation, which reduces non-contractible investments. Similarly, Almazan and Suarez (2003) study how the possibility of intervention by the board can reduce the incentives of a CEO to undertake costly actions. In this sense, monitoring may be detrimental. Our paper features a fundamentally different mechanism: monitoring distorts communication between the entrepreneur and VC and leads to inefficient project choice. Chakraborty and Yilmaz (2017) study a model of cheap talk between boards and managers. A board whose preferences are closely aligned with the manager's improves communication, at the cost of distorting decisions. There is no intervention or reputation in their model, which is central to our results, however. Gregor and Michaeli (2020) derive the opposite result to Chakraborty and Yilmaz (2017), i.e. having less closely aligned boards improves communication, in a model with Bayesian persuasion between a CEO and board members. Manso (2011) shows that less intervention may be beneficial in an experimentation model with new and conventional projects. Our focus is instead on communication which is absent from Manso's paper. A series of papers, Harris and Raviv (1998, 2005, 2008), considers delegation and communication between a decision maker and an agent, in the context of boards or multi-division firms.[11] These papers do not feature reputation which is

[10] Levit's model also does not feature reputation concerns.

[11] Also related is Levitt and Snyder (1997). In that model, an agent exerts unobservable effort which

central to our analysis.

Finally, a substantial literature studies contracting between founders and entrepreneurs (e.g., Schmidt (2003), Casamatta (2003), Repullo and Suarez (2004), and Hellmann (2006)) and characterizes the securities issued by the VC or entrepreneur. Povel and Strobl (2019) consider a moral hazard problem in which it may be optimal to allow the agent to manipulate signals to prevent false negatives. By contrast, we abstract from optimal contracting and focus on communication, which is absent from this literature.[12]

3 The model

Environment. A startup firm, founded by an entrepreneur (E, she), is seeking funding from a venture capitalist (VC, he). The firm has access to two types of projects: conventional or a new project, which we denote by $t \in \{c, n\}$, respectively.[13] The conventional project has a distribution of returns which is knows to both the entrepreneur and the VC, and it generates a (net) return of R with probability 1, where $R \sim f(\cdot)$ and $R \geq 0$. The return R is not ex-ante observable to the entrepreneur or the VC. The return on the new project additionally depends on the entrepreneur's private information. The entrepreneur learns whether the new project is successful, which we denote with $\theta \in \{0, 1\}$, where the prior probability of success is $\Pr(\theta = 1) = p_0$. Conditional on success (i.e., $\theta = 1$), the new project generates zR, where $z \geq 1$. Conditional on failure (i.e., $\theta = 0$), the new project generates zero.

Private Information. The entrepreneur is privately informed about whether the new project will be successful (i.e., the realization of θ), and can be of one of two types: honest or strategic, i.e., $E \in \{H, S\}$. An honest entrepreneur ($E = H$) truthfully reports her

affects the informativeness of an interim signal about the project value, which the agent may misreport. Inderst and Mueller (2010) consider a model related to Levitt and Snyder (1997), where a CEO exerts effort but may learn that he becomes ineffective at an interim date. As in Levitt and Snyder (1997), the optimal compensation contract seeks to incentivize both effort and truth-telling. In our paper, the agent is endowed with information and does not exert any ex-ante effort. Instead, the agent recommends which type of project to implement. Levitt and Snyder (1997) and Inderst and Mueller (2010) feature no such notion.

[12] Outside of venture capital, Fu and Trigilia (2018) study voluntary disclosure in a moral hazard framework.

[13] Here, we adopt the terminology from Manso (2011). In that paper, players know less about the new project than the conventional project. Here, the entrepreneur and VC are symmetrically informed about the conventional project and asymmetrically informed about the unconventional project.

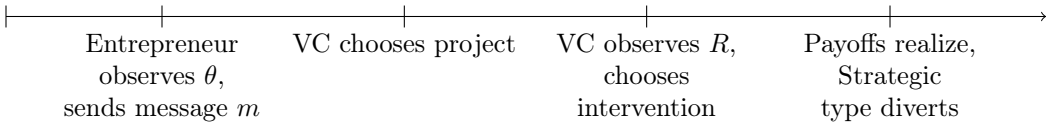


Figure 1: Timeline

information to the VC and does not divert resources when the project is implemented. A strategic entrepreneur ($E = S$) sends a cheap talk message to the VC (as in Crawford and Sobel, 1982), and opportunistically diverts δ.[14] The ex-ante probability of an honest entrepreneur is $\Pr(E = H) = q_0$.

Timing. After the project is implemented, the VC observes the realization of R and can optimally decide whether to intervene and to replace the entrepreneur to eliminate diversion (i.e. "fire the entrepreneur"). Intervention yields R_0 to the VC and ensures the entrepreneur cannot divert δ.

Figure 1 illustrates the timeline, which is as follows:

1. The entrepreneur observes θ and sends a recommendation for the new ($m = 1$) or conventional ($m = 0$) project to the VC.
2. The VC chooses whether to invest in the new project or the conventional project.
3. The VC observes R and chooses whether to intervene.
4. The payoffs are realized.

Payoffs. Denote the payoffs to the investor and to the strategic entrepreneur by U_{VC} and U_S, respectively. Conditional on no intervention, the payoffs from the conventional project are:

$$U_{VC} = R - \delta 1_{\{E=S\}} \quad \text{and} \quad U_S = \delta, \tag{1}$$

[14] To ensure that the entrepreneur cannot divert more than the project value, we can alter the model to assume that $R \geq \delta$ with probability one. Doing so does not qualitatively affect our results. The key mechanic is that diversion hurts the VC and he prefers to avoid it.

and the payoffs from the new project are:

$$U_{VC} = \theta z R - \delta 1_{\{E=S\}} \quad \text{and} \quad U_S = \delta. \tag{2}$$

Instead, if the VC intervenes, then the payoffs for either project are:

$$U_{VC} = R_0 \quad \text{and} \quad U_S = 0. \tag{3}$$

Note that R_0 captures the *net* payoff from intervention. An increase in the cost of intervention decreases R_0, and R_0 is allowed to be negative (i.e., intervention is costly for the VC).

3.1 Discussion of assumptions

Lack of Commitment and Incomplete Contracts Startups often face rapid changes, which lead contracts to be highly incomplete (e.g. Kaplan and Strömberg (2001), Kaplan and Strömberg (2003), and Kaplan and Strömberg (2004)). We follow the incomplete contracting literature and assume that the VC cannot commit to an intervention strategy at the outset. Instead, he chooses to intervene when additional information becomes available. Such intervention is common in reality. Startup founders are frequently replaced conditional on interim performance (e.g. Kaplan et al. (2009)) and there appears to be little ex-ante commitment about such decisions.[15] In principle, VCs could commit to not intervene by giving up their control rights (e.g. by surrendering board seats). In practice, VCs retain significant control rights and frequently intervene.

In our benchmark analysis, we follow the cheap talk literature and abstract from particular contractual arrangements. In reality, VC contracts assign cash flow and control rights and are designed to deal with asymmetric information and moral hazard problems (Kaplan and Strömberg (2001)). We consider these arrangements as extensions. In Section 6, we study the equity split between entrepreneur and VC and show that, from the VC's perspective, the equity share is generally interior. In Section 8.2, we study the allocation of control rights contingent on the choice of projects, and in Section 8.3, we study board composition and the role of outside directors. We have relegated analysis to separate extensions for the sake of

[15] See also Dessein (2005), who also assumes that intervention occurs after the VC receives additional information.

clarity, so that our benchmark analysis highlights the underlying forces and the extensions bring the model closer to applications.

The Role of Monitoring The literature generally emphasizes two roles for a VC: providing advice (e.g. Casamatta (2003)) and monitoring entrepreneurs (e.g. Kaplan and Strömberg (2001)). Our paper focuses on the latter role. Consistent with our modeling, Hellmann and Puri (2002) and Kaplan and Strömberg (2004) document how VCs intervene to replace the original CEO. Ewens and Marx (2018) provide causal evidence on how such replacement improves ex-post performance, which is consistent with our assumption that the VC intervenes whenever the project value is too low.

In our model, the entrepreneur recommends a project to a VC after the VC has already invested in the firm. Consistent with this assumption, Gompers et al. (2020) document that VCs provide both operational and strategic guidance after investment, while Kaplan and Strömberg (2004) document that VCs expect to be involved in shaping business strategy and simultaneously retain significant control rights over the startup.

Information and Learning In our setting, the entrepreneur knows whether the new project will be successful in advance (i.e., θ) while the investor does not. Indeed, the VC literature has recognized the entrepreneur's information advantage, or expertise, as a key friction since its inception (see Gompers (1995) for seminal work). For example, the new project could represent entry into different market which the entrepreneur has prior experience in, whereas the conventional project may be entry into a market the VC has experience in. Alternatively, it could represent adding new functionality to a product vs. leaving it the same. Such strategic choices are common in early stage startups.

Diversion of Resources We can interpret the private benefit δ in different ways. The strategic entrepreneur may divert cash flows from the project or she may engage in excessive perk consumption. Alternatively, we can interpret δ as the result of shirking or diverting resources towards alternative, "pet projects." For simplicity, we assume that the private benefit is the same across new and conventional projects. Another natural setup would feature $\delta_n > \delta_c$, i.e. the private benefit is larger for the new project. Intuitively, the new project may feature more uncertainty, which makes it easier to divert cash. When $\delta_n > \delta_c$

and δ_n is not too large, our results go through, in the sense that the VC's ability to intervene ex post distorts the entrepreneur's recommendations ex-ante, and the VC may benefit from committing to intervene less. Finally, we do not require that diversion of resources require that the realized payoffs exceed δ — instead, we allow for the net payoff to the VC to be negative.

Other Modeling Assumptions Our modeling is deliberately stylized for tractability and to illustrate the economic mechanism clearly. For instance, we assume that payoff from intervention does not depend on the entrepreneur's private information θ for simplicity. Allowing for this dependence would yield qualitatively similar results. Similarly, we assume that diversion does not reduce welfare in our model. We can alternatively assume that the VC loses δ and the entrepreneur only receives $\lambda\delta$ where $\lambda < 1$, but, again, the results are qualitatively unchanged. Finally, in the spirit of the incomplete contracting literature, we can understand the realized payoff as being non-contractible (or, alternatively, emerging from some exogenous contract). Taking contractual incompleteness as given, whether or not payoffs are verifiable do not affect the results.

4 Analysis

We solve the model by working backwards. Suppose that after the entrepreneur's recommendation m, the VC's posterior belief about the new project's success is given by $p(m) = \Pr(\theta = 1|m)$ and the belief that the entrepreneur is honest is given by $q(m) = \Pr(E = H|m)$.

The VC's payoff from intervention is constant (i.e., $U_{VC} = R_0$) but the expected payoff from not intervening is increasing in R. This implies that the optimal intervention decision is given by a threshold strategy, i.e., the VC intervenes if and only if $R \leq \bar{R}_t$, where the threshold $\bar{R}_t$ depends on the type $t \in \{c, n\}$ of project chosen. Note that conditional on implementing the new project, the investor intervenes if and only if the payoff from intervention exceeds the expected payoff from non-intervention, i.e.,

$$R_0 \geq pzR - \delta(1 - q), \tag{4}$$

while conditional on implementing the conventional project, the investor intervenes if and only if

$$R_0 \geq R - \delta(1-q). \tag{5}$$

This implies that the intervention thresholds for the new and conventional projects are given by

$$R_n(p,q) = \frac{R_0 + \delta(1-q)}{pz}, \tag{6}$$

and

$$R_c(q) = R_0 + \delta(1-q), \tag{7}$$

respectively. As a result, the payoff to a strategic entrepreneur from the new project is

$$U_S(r) = \delta(1 - F(R_n)), \tag{8}$$

and the payoff from the conventional project is

$$U_S(s) = \delta(1 - F(R_c)). \tag{9}$$

Note that since the entrepreneur derives the same private benefit from either project, she only cares about the likelihood of intervention by the VC: her payoffs do not depend on the success of the projects directly.[16]

As is common in cheap talk games, there always exist babbling equilibria in which the entrepreneur's messages are ignored by the VC. In this case, the VC invests in the new project if and only if $p_0 z > 1$, and then intervenes using the thresholds $R_n(p_0, q_0)$ and $R_c(p_0, q_0)$. We instead focus on *informative* equilibria, in which the VC's project choice depends on the messages sent by the entrepreneur. Specifically, our analysis focuses on the following two types of equilibria.

Definition 1. A **truth-telling equilibrium** is one in which the strategic entrepreneur always communicates her signal truthfully i.e., $m(\theta) = \theta$ for $\theta \in \{0,1\}$, and where the VC chooses to invest in the new project if and only if $m = 1$.

Definition 2. A **lying equilibrium** is one in which the strategic entrepreneur is truthful

[16] As mentioned before, this is purely for simplicity. Section 6 shows that our results are similar if the entrepreneur holds equity in the project.

when $\theta = 1$ but lies with probability $l \in (0, 1]$ when $\theta = 0$ i.e.,

$$m(1) = 1, \text{ and} \tag{10}$$

$$m(0) = \begin{cases} 1 & \text{with probability } l \\ 0 & \text{with probability } 1 - l \end{cases}. \tag{11}$$

Moreover, the VC chooses to invest in the new project if and only if $m = 1$. We shall say that the strategic entrepreneur **always lies** if $l = 1$.

Thus, in a lying equilibrium, the entrepreneur over-recommends the new project, i.e. she sends message $m = 1$ even though she knows that the new project will fail, which leads to excessive risk-taking by the startup. As we show in Appendix B.1, there exist other informative equilibria in which the strategic entrepreneur mixes between both messages in each state. However, the lying equilibrium of the type we consider Pareto dominates these other equilibria, since recommending the conventional project when $\theta = 1$ makes the VC worse off, but (in equilibrium) leaves the entrepreneur indifferent.

We begin with an immediate observation that serves as a benchmark.

Lemma 1. *Suppose that $R_0 < -\delta$ so the VC never intervenes. Then, truth-telling can be sustained.*

Intuitively, when the net benefit of intervention is sufficiently low (or equivalently, the cost of intervention is sufficiently high), the VC never intervenes for either project and so the entrepreneur is indifferent between which project is chosen. In this case, truth-telling can be sustained. The result highlights that the very possibility of monitoring is what harms communication in our setting.

In what follows, we assume that $R_0 > -\delta$ so that there is intervention with positive probability. The following result characterizes sufficient conditions for the existence of informative equilibria.

Proposition 1. *If $z = 1$, then the unique informative equilibrium features truth-telling. If $z > 1$, then a unique lying equilibrium exists in which the entrepreneur over-recommends the new project. Moreover, there exists a $\bar{z}$, such that when $z \geq \bar{z}$, the strategic entrepreneur always lies (i.e., $l = 1$).*

Thus, in equilibrium, the entrepreneur recommends the new project knowing that it will fail. Intuitively, since the entrepreneur only cares about the likelihood of intervention, her behavior responds to how intervention thresholds change with the VC's beliefs. In a truth-telling equilibrium, conditional on the recommendation of a new project, the VC's posterior belief is $p = 1$. To ensure that the entrepreneur does not have an incentive to deviate by lying, we must ensure that the VC intervenes (weakly) as often for the new project as for the conventional project i.e., $F(R_n) \geq F(R_c)$, but this implies we need $z = 1$ (see equations (6) and (7)).

In a lying equilibrium, the VC's posterior beliefs about the success of the new project and the entrepreneur's honesty are given by:

$$p(m) = \begin{cases} \frac{p_0}{p_0+(1-p_0)(1-q_0)l} \equiv p_1(l) & m = 1 \\ 0 & m = 0 \end{cases} \text{ and } q(m) = \begin{cases} q_0 p_1(l) & m = 1 \\ \frac{q_0}{1-(1-q_0)l} & m = 0 \end{cases}, \tag{12}$$

respectively. Note that the VC becomes more optimistic about the project success after the entrepreneur recommends the new project (i.e., $m = 1$), but he is more pessimistic about the entrepreneur's honesty. On the other hand, a recommendation for the conventional project (i.e., $m = 0$) makes the VC more pessimistic about the new project, but more optimistic about the entrepreneur.

Since the entrepreneur must be indifferent between recommending the two projects when she knows the new project will not succeed, at the equilibrium level of lying, l, the intervention thresholds for the new and the conventional project must be the same:[17]

$$R_n(p(1), q(1)) = R_c(p(0), q(0)), \tag{13}$$

or equivalently,

$$\frac{R_0 + \delta(1 - q_0 p_1(l))}{z p_1(l)} = R_0 + \delta\left(1 - \frac{q_0}{1-(1-q_0)l}\right). \tag{14}$$

First, note that when $z > 1$ and there is no lying (i.e., $l = 0$), the intervention threshold

[17] If she strictly prefers recommending the conventional project in this case, we have truth-telling; if she strictly prefers recommending the new project, we have the babbling equilibrium.

for the new project is lower than the threshold for the conventional project, i.e., $R_n < R_c$. Second, note that as the likelihood of lying increases, the intervention threshold for the new project increases (i.e., $\partial R_n/\partial l > 0$), while the intervention threshold for the conventional project decreases (i.e., $\partial R_c/\partial l < 0$). Intuitively, for a new project, the VC becomes more pessimistic as l increases (both the likelihood of success and the beliefs about the entrepreneur's honesty decrease), which leads to more intervention. On the other hand, the VC becomes more optimistic about the entrepreneur's honesty after she recommends a conventional project as l increases, and this leads to less intervention. The intervention thresholds are equal at some intermediate level of l, unless z is large. If $z > \bar{z}$, we have $R_n < R_c$ even when the entrepreneur always lies. Intuitively, if the new project is very profitable, the VC intervenes less even if he believes that it is unlikely to succeed. Then, the entrepreneur always prefers to send $m = 1$, so that the new project is implemented.

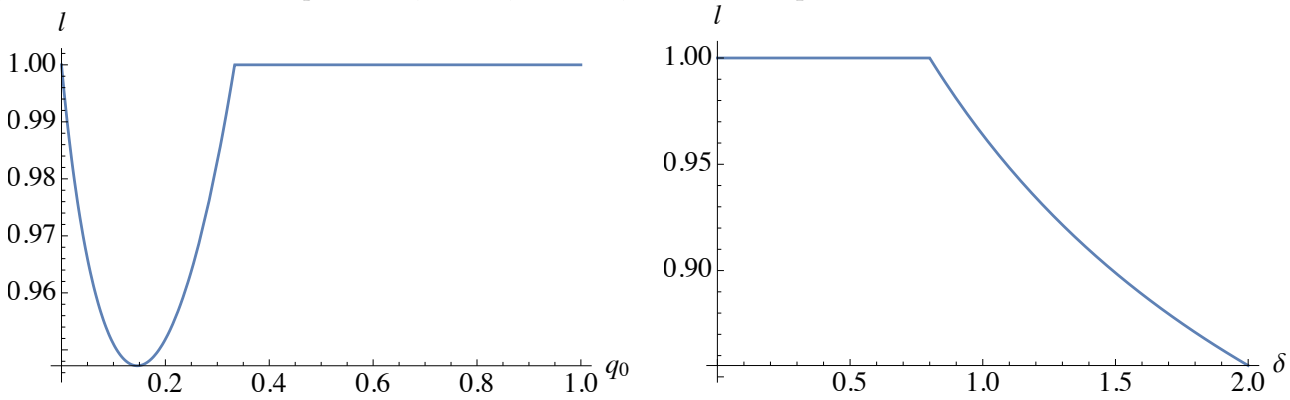
The indifference condition that pins down the equilibrium likelihood of lying also immediately implies the following.

Corollary 1. *In the lying equilibrium, the probability of recommending the new project increases with R_0, p_0 and z (unless the strategic entrepreneur always lies).*

These results can be shown using implicit differentiation of equation (13) and are intuitive. All else equal, an increase in R_0 raises the likelihood of intervention for the conventional project more than for the new project (see Equation (13)). As a result, this makes recommending the new project more attractive to the entrepreneur. Similarly, when the likelihood of success p_0 or the potential upside z for the new project are higher, the intervention threshold decreases, making recommending the new project more attractive. As Figure 2 illustrates, the effect of beliefs about the entrepreneur's honesty and her ability to divert resources on the likelihood of lying are more nuanced. In particular, the likelihood of lying is U-shaped in the prior beliefs about the entrepreneur's honesty (i.e., q_0), and can *decrease* in the entrepreneur's ability to divert resources (i.e., δ).

To gain some intuition for the effect of q_0, it is useful to consider two extreme beliefs. When the entrepreneur is always believed to be strategic (i.e., $q_0 = 0$), the strategic entrepreneur always lies since there is no benefit from truth-telling (i.e., $l = 1$). That is, the entrepreneur cannot convince the VC that she is honest by lying less. From this extreme, increasing the ex-ante likelihood of an honest type reduces lying since the strategic

Figure 2: Lying versus prior honesty (q_0) and ability to divert (δ)
The figure plots the equilibrium likelihood of lying l as a function of the prior probability that the entrepreneur is honest (q_0) and the amount she can divert (δ). Unless specified, parameters are set to: $p_0 = 0.6$, $z = 2$, $R_0 = 2$, $\delta = 1$, and $q_0 = 0.25$.



(a) l versus q_0 (b) l versus δ

entrepreneur can now benefit from pooling with the honest type. At the other extreme, when the prior likelihood of being honest is sufficiently high (i.e., q_0 sufficiently high), increasing the probability of lying does not decrease the VC's belief about the entrepreneurs honesty much, but leads to more optimism for the new project. In this region, the probability of lying is increases in q_0; eventually, the strategic type always lies (i.e., $l = 1$).

Recall that the intervention thresholds for both projects increase with δ, but

$$\frac{\partial R_n}{\partial \delta} = \frac{(1 - q(1))}{z p_1(l)} \text{ and } \frac{\partial R_c}{\partial \delta} = 1 - q(0). \tag{15}$$

Note that the posterior beliefs about the entrepreneur's honesty are lower after a recommending the new project than after recommending the conventional project (i.e., $q(1) < q(0)$) but the posterior beliefs about the new project are higher (i.e., $p_1(l) z > 1$). When z is sufficiently large, this implies the marginal increase in the intervention threshold for the new project is lower than the increase in the intervention threshold for the conventional project. In this case, the probability of lying must decrease with δ to ensure that the strategic entrepreneur remains indifferent (i.e., equation (13) holds). In contrast, when z is sufficiently small, the marginal increase in the threshold is for the conventional project lower and the probability of lying increases with δ.

Comparison to First-Best The VC faces two sources of uncertainty: the project's type and the entrepreneur's honesty. In the first-best, there is no asymmetric information, and the VC knows both. Then, the VC always implements the conventional project when $\theta = 0$ and always implements the new project when $\theta = 1$. If the entrepreneur is honest, the VC intervenes whenever

$$R_0 \geq R$$

for the conventional project and

$$R_0 \geq zR$$

for the new project. If the entrepreneur is strategic, the VC instead intervenes whenever

$$R_0 \geq R - \delta$$

for the conventional project and

$$R_0 \geq zR - \delta$$

for the new project. Thus, the equilibrium in Proposition 1 features two distortions relative to the first-best: (1) the VC implements the new project even though it is bad with positive probability and (2) the VC's intervenes too much in the new project and too little in the conventional project.[18]

4.1 Benefits of Monitoring

In Proposition 1, we emphasize the negative role of monitoring. Specifically, our results imply that higher likelihood of intervention can lead to more lying and, consequently, less efficient outcomes. In addition to the VC's advisory role, the literature on venture capital also highlights the benefits of monitoring and intervention.[19] From the VC's perspective, monitoring also plays a positive role, as it prevents stealing. Because of this, the VC generally benefits from the ability to monitor, even if monitoring is excessive in equilibrium.

Proposition 2. *For δ sufficiently large, the VC is better off in equilibrium compared to not*

[18] That is, in equilibrium, we have $R_n = R_c$, i.e. the intervention thresholds are identical, whereas in the first-best, we have $R_c > R_n$, both when the entrepreneur is strategic and when he is honest.

[19] See e.g. Gorman and Sahlman (1989), Admati and Pfleiderer (1994), Gompers (1995), Kaplan and Strömberg (2001).

being able to monitor.

The intuition for this result is simple. Monitoring allows the VC to guarantee a payoff of R_0 when she learns that R is low, and is simultaneously prevents stealing. If the VC is unable to monitor at all, her payoff is simply given by

$$U_{VC} = z\theta R - \delta$$

for the new project and

$$U_{VC} = R - \delta$$

for the conventional project. Since the VC does not monitor, the entrepreneur always tells the truth, and the VC's expected payoff is simply given by

$$U_{VC} = (p_0 z + 1 - p_0) R - \delta.$$

As δ grows sufficiently large, this payoff eventually reaches zero. By contrast, the ability to monitor always guarantees the VC nonnegative expected payoffs. Hence, when stealing is sufficiently costly for the VC (i.e. δ is large), the VC benefits from monitoring.[20]

However, when δ is not too large, the VC's ability to intervene induces the entrepreneur to lie, which results in worse project choice. As such, the VC may be better off if he is able to commit to an intervention strategy. We explore this possibility in the next section.

5 Commitment to intervention

The strategic entrepreneur's incentive to recommend the new project stems from a desire to reduce ex-post intervention by the VC after the project has been chosen, and in equilibrium, the likelihood of intervention is the same across projects. This suggests that if the VC can commit to a intervention strategy, better outcomes may be achievable.

Specifically, suppose that the VC commits to monitor at thresholds $\bar{R}_n$ and $\bar{R}_c$ for the new and conventional projects, respectively. Suppose that the VC aims to induce truth-

[20] We omit the proof of the proposition, as it is verbally described above. Note that when δ and R_0 are small, then the VC may be worse off compared to not being able to monitor at all. In that case, the value from monitoring is small, but monitoring still distorts the project choice, which is costly for the VC.

telling. Then, we must have $\bar{R}_n = \bar{R}_c = \bar{R}$. Otherwise, if $\bar{R}_n > \bar{R}_c$, the entrepreneur always prefers to recommend the conventional project (i.e., $m = 0$), and if $\bar{R}_n < \bar{R}_c$, she always recommends the new project.

Since the intervention threshold is the same for both projects, the optimal intervention threshold can be characterized as the solution to the following problem:

$$\max_{\bar{R}} \quad (p_0 z + (1 - p_0)) \int_{\bar{R}}^{\infty} Rf(R)\, dR - \delta(1 - q_0) \Pr\left(R > \bar{R}\right) + R_0 \Pr\left(R \leq \bar{R}\right). \tag{16}$$

The first term reflects the expected payoff from the project, conditional on continuing (i.e., when $R > \bar{R}$), and accounts for the fact that in a truth-telling equilibrium, the VC only invests in the new project if it will be successful (i.e., with ex-ante probability p_0). The second term reflects the expected loss due to diversion of cash-flows by the strategic entrepreneur when there is no intervention. In particular, note that the VC cannot update on the honesty of the entrepreneur in a truth telling equilibrium, and so the likelihood of facing a strategic entrepreneur is given by $1 - q_0$. Finally, the third term reflects the payoff to the VC conditional on intervention (i.e., when $R \leq \bar{R}$).

The first order condition to the above objective problem implies that the optimal intervention threshold is given by[21]

$$\bar{R}^* = \frac{R_0 + \delta(1 - q_0)}{p_0 z + 1 - p_0}. \tag{18}$$

The optimal threshold is intuitive. Intervention is more likely when (i) the payoff from intervention R_0 is higher, (ii) the likelihood (i.e., $1 - q_0$) or amount (i.e., δ) of cash diversion is higher, (iii) and the expected payoff from the new project is lower (i.e., $p_0 z$ is lower).

In the proposition below, we verify that inducing truth-telling is indeed optimal under commitment whenever q_0 is sufficiently small, i.e. the entrepreneur is likely to be strategic.[22] Moreover, we show that the VC intervenes less often compared to the case without

[21] The FOC is given by

$$R_0 + \delta(1 - q_0) - (p_0 z + (1 - p_0))\, \bar{R} = 0, \tag{17}$$

which also implies that the SOC for the maximum is satisfied.

[22] If q_0 is sufficiently large instead, the VC may optimally choose $\bar{R}_n \neq \bar{R}_c$ under commitment. Intuitively, by inducing truth-telling the VC's intervention decisions are less efficient conditional on either project being implemented, but the VC is sure to always pick the right project based on the state θ, since the strategic type tells the truth. Whenever q_0 is small, i.e. the entrepreneur is likely to lie, the gain from choosing

commitment.

Proposition 3. *For q_0 sufficiently small, the optimal intervention thresholds with commitment satisfy $\bar{R}_n = \bar{R}_c = \bar{R}^*$. Let $R_n(l) = R_c(l) \equiv R(l)$ be the equilibrium intervention threshold in the lying equilibrium. Then, the equilibrium level of intervention without commitment is higher than with commitment i.e.,*

$$\bar{R}^* \leq R(l). \tag{19}$$

Proposition 3 implies that both the VC and the entrepreneur are better off if the VC is able to commit to intervention ex-ante: the VC is better off because the truth-telling equilibrium can be sustained, and the strategic entrepreneur is better off because of a lower likelihood of intervention.

Intuitively, without commitment, the VC enters a "monitoring trap." Suppose that we start with truth-telling and identical intervention thresholds $\bar{R}^*$. Without commitment, the VC would prefer to deviate and intervene less often in the new project, since the (ex-post) optimal intervention thresholds are $R_c = R_0 + \delta(1 - q_0)$ and $R_n = \frac{R_0 + \delta(1-q_0)}{z} < R_c$. But, this lack of commitment creates an incentive for the strategic entrepreneur to lie by recommending the new project even when she knows it will not succeed. As a result, the VC is now forced to monitor more strictly and intervene more often (i.e., $R_n(l) > \bar{R}^*$).

The literature on startups views monitoring as an important function of VCs, which is integral to the functioning of the market for startup finance.[23] Our results highlight that monitoring is a double-edged sword. While it improves ex-post allocations, it distorts communication between the entrepreneur and the VC and leads to inefficient project choice. As Proposition 3 shows, the VC indeed prefers to commit to less monitoring, if he is able to do so.

projects efficiently outweighs the loss from intervening less efficiently.

[23] See Gorman and Sahlman (1989), Admati and Pfleiderer (1994), Gompers (1995), Kaplan and Strömberg (2001), and many others.

6 Equity allocation

The benchmark analysis of Section 4 highlights the fact that the entrepreneur does not internalize the cost of inefficient project choice, i.e., she is indifferent to whether the new project succeeds or fails. This suggests that there may be more truth-telling when the entrepreneur has more "skin in the game," because part of her payoff depends on the project outcomes.

To explore this effect, we consider a setting in which the project returns are shared between the VC and the entrepreneur. For tractability, we slightly alter the model and assume that for the new project, the VC's value of intervention also depends on θ. Specifically, the payoff from intervention is given by θR_0. Intuitively, we can interpret θ as the viability of the project and we can interpret intervention as replacing the entrepreneur with an outside manager. Now, if the new project is not viable, replacing the entrepreneur does not improve its payoffs.

Formally, the payoffs from the conventional project, conditional on no intervention, are

$$U_{VC} = (1-\alpha)\left(R - \delta 1_{\{E=S\}}\right) \quad \text{and} \quad U_S = \alpha\left(R-\delta\right) + \delta. \tag{20}$$

Conditional on intervention, the payoffs are

$$U_{VC} = (1-\alpha) R_0 \quad \text{and} \quad U_S = \alpha R_0.$$

Similarly, the payoffs from the new project are

$$U_{VC} = (1-\alpha)\left(\theta z R - \delta 1_{\{E=S\}}\right) \quad \text{and} \quad U_S = \alpha\left(\theta z R-\delta\right) + \delta \tag{21}$$

without intervention, and

$$U_{VC} = (1-\alpha)\,\theta R_0 \quad \text{and} \quad U_S = \alpha\theta R_0 \tag{22}$$

with intervention. In particular, the entrepreneur retains a fraction α of the project payoffs and the VC receives a fraction $1-\alpha$. When $\alpha = 1$, the entrepreneur retains the payoffs in their entirety. In this case, project choice and intervention are informationally efficient.

The intervention thresholds take similar forms as in equations (6) and (7). They are

given by

$$R_n(p,q) = \frac{R_0}{z} + \frac{\delta(1-q)}{zp} \tag{23}$$

and

$$R_c(q) = R_0 + \delta(1-q). \tag{24}$$

Notably, these thresholds do not explicitly depend on α, since all of the VC's payoffs are scaled by $1-\alpha$.

In a lying equilibrium, the entrepreneur must be indifferent between recommending either project, conditional on $\theta = 0$. The equilibrium likelihood of lying, l, must satisfy the indifference condition $H(l) = 0$, where

$$H(l;\alpha) \equiv U_S(m=1;\theta=0) - U_S(m=0;\theta=0). \tag{25}$$

Here,

$$U_S(m=0;\theta=0) = (1-\alpha)\delta(1-F(R_c)) + \alpha R_0 F(R_c) + \alpha\int_{R_c}^{\infty} Rf(R)\,dR \tag{26}$$

is the entrepreneur's payoff from recommending the conventional project ($m=0$) conditional on $\theta = 0$, and

$$U_S(m=1;\theta=0) = (1-\alpha)\delta(1-F(R_n)) \tag{27}$$

is her payoff from recommending the new project ($m=1$). In such an equilibrium, lying becomes less appealing as the entrepreneur's equity stake increases.

Proposition 4. *Suppose that there exists a lying equilibrium with $l \in (0,1)$. The probability of recommending the new project decreases in the fraction α retained by the entrepreneur.*

The above result is not surprising. As α increases, the relative benefit of recommending the new project decreases for the $\theta = 0$ strategic entrepreneur — this is apparent from equations (26) and (27). To restore the indifference required for equilibrium, the probability of lying must also decrease.

The indifference condition in (25) implies that qualitatively, the results from our benchmark analysis are robust to introducing "skin in the game." However, there are some differences. Note that the equilibrium level of intervention is no longer equal across projects.

Moreover, as the VC's stake increases (i.e., α decreases), the probability of lying increases. In equilibrium, this leads to more intervention for the new project and less intervention for the conventional project. Intuitively, when the VC has a larger share, he becomes more "aggressive" when monitoring new projects and more "lenient" when monitoring conventional ones.

7 Competition and founder-friendliness

Common wisdom suggests that when VCs compete for founders, they may do so by being excessively founder-friendly. That is, they may try to attract founders by intervening less. In this section, we show that this result does not necessarily hold. Even with perfect competition, where VCs make zero profits, they still intervene too much (compared to the commitment benchmark in Proposition 3) whenever the project is sufficiently costly to finance. Thus, competition among VCs does not necessarily lead to founder-friendliness.

To model competition, we introduce an equity stake α into the model, so that the entrepreneur receives share α and the VC receives share $1-\alpha$, just as in Section 6. Additionally, we assume that monitoring is costly, so that whenever the VC intervenes, he must pay a non-pecuniary cost $\kappa > 0$.[24] Starting the project requires funds $I > 0$, which must be raised from VCs. The equity share α is set competitively, so that VCs make zero profit, i.e.[25]

$$E\left[U_{VC}\right] = I.$$

Then, given α, the strategic type chooses l, and the VC chooses whether to intervene given α, R, and l.[26]

Proposition 5. *For δ sufficiently large, there exists a unique α^* for which the VC makes zero profit, and α^* is strictly decreasing in I. Moreover, there exists a threshold $\bar{I}$, such*

[24] Proposition 5 holds without this assumption, i.e. when $\kappa = 0$. When intervention is costless, competition does not affect intervention in the no-communication case (Proposition 3), since the VC's payoffs given intervention and non-intervention are simply scaled by $1 - \alpha$.

[25] Here, the expectation is taken in equilibrium, given the equilibrium likelihood of lying l and the equity share α (see Equations (20) and (21)).

[26] The condition that I is large ensures that α is sufficiently small, so that $l \in (0, 1)$ in equilibrium. If I is too small, the entrepreneur retains sufficient equity to make lying suboptimal. Thus, our results apply to firms for which startup costs are sufficiently large.

that for $I \geq \bar{I}$, the strategic entrepreneur lies with positive probability given α^*, and the VC intervenes too frequently. For $I < \bar{I}$, the strategic entrepreneur tells the truth given α^*.

Thus, competition by itself does not guarantee that VCs are sufficiently founder-friendly. Even when VCs are perfectly competitive and make zero profit, they may still intervene too much.

Alternatively, we may understand competition as lowering the bargaining power of the VC. More competition leads to a lower equity share for the VC, which in turn reduces the VC's incentive to monitor. Since generally, the VC monitors too much in equilibrium, this reduced monitoring incentive induces the entrepreneur to tell the truth more frequently, thereby improving project choice. Thus, while competition does not necessarily ensure that the VC is sufficiently founder-friendly, increased competition is beneficial.

To see this explicitly, we can recast the model as a Nash bargaining game between VC and entrepreneur. Ex-ante, the VC and the entrepreneur bargain about the equity share α, and the VC's bargaining weight is given by ψ. Then, once α is set, the game proceeds as in the baseline model, i.e. the entrepreneur observes θ and chooses which project to recommend, and the VC chooses the project and whether to intervene conditional on observing R.

Corollary 2. *For δ sufficiently large, as ψ decreases, the likelihood of intervention in the new project decreases and the entrepreneur tells the truth with higher probability.*

Intuitively, as ψ decreases, the entrepreneur can retain a larger share of equity subject to VCs breaking even. As we have shown in Proposition 4, this reduces the likelihood of lying, which in turn implies that the VC intervenes less in the new project. The entrepreneur is more likely to recommend the correct project, which increases social welfare. This prediction relies on the entrepreneur's ability to communicate with the VC. Specifically, if the entrepreneur cannot communicate with the VC, then a lower I (i.e. a lower equity share for the VC) decreases intervention but does not improve project choice.

Corollary 3. *Without communication, as ψ decreases, the likelihood of intervention in either project decreases.*

In our model, a lower ψ lowers the VC's propensity to intervene, which may lower or improve social value depending on whether the VC intervenes too much relative to the commitment benchmark, and it improves the entrepreneur's incentive to tell the truth. In

a setting without communication, only the first effect is present. Then, access to cheaper financing may lead to too little intervention, which lowers social value and leaves the VC worse off.

8 Extensions

In this section, we consider a number of extensions to our benchmark analysis. Section 8.1 considers the case where the entrepreneur only has noisy information about the success of the new project. Section 8.2 studies the effect of the allocation of control rights on equilibrium outcomes. Section 8.3 shows how introducing an outside investor can implicitly lead to less intervention and improve value in equilibrium. Finally, Section 8.4 characterizes how staging in the financing process interacts with equilibrium risk-shifting in our setting.

8.1 Noisy information

In this extension, we consider a setting in which the entrepreneur's signal about θ is noisy. The precision of the entrepreneur's information now measures her information advantage relative to the VC. As this information advantage increases, the entrepreneur recommends the new project more, but, perhaps paradoxically, the VC intervenes less.

Specifically, suppose the entrepreneur observes a signal s about θ, where

$$\Pr(s=1|\theta=1)=\Pr(s=0|\theta=0)=\gamma>\frac{1}{2}, \tag{28}$$

so that the entrepreneur's posterior beliefs about θ are given by:

$$p_S(s)=\begin{cases}\frac{p_0\gamma}{p_0\gamma+(1-p_0)(1-\gamma)} & \text{if } s=1\\ \frac{p_0(1-\gamma)}{p_0(1-\gamma)+(1-p_0)\gamma} & \text{if } s=0\end{cases}. \tag{29}$$

We focus on the lying equilibrium as before. Specifically, suppose that the strategic entrepreneur recommends the new project (i.e., $m=1$) with probability l conditional on observing $s=0$, and reports truthfully otherwise, and that the VC follows the entrepreneur's recommendation.

Let the unconditional probability that the entrepreneur observes $s = 1$ be denoted by

$$\pi \equiv p_0\gamma + (1 - p_0)(1 - \gamma). \tag{30}$$

Then, conditional on observing a message m, the VC's beliefs are given by:

$$p(m) \equiv \Pr(\theta = 1|m) = \begin{cases} \frac{p_0(\gamma+(1-\gamma)(1-q_0)l)}{\pi+(1-\pi)(1-q_0)l} & \text{if } m = 1 \\ \frac{p_0(1-\gamma)}{1-\pi} & \text{if } m = 0 \end{cases}, \tag{31}$$

and

$$q(m) \equiv \Pr(E = H|m) = \begin{cases} \frac{\pi q_0}{\pi+(1-\pi)(1-q_0)l} & \text{if } m = 1 \\ \frac{q_0}{q_0+(1-q_0)(1-l)} & \text{if } m = 0 \end{cases}. \tag{32}$$

Given these beliefs, the intervention thresholds are given by $R_c(p, q)$ and $R_n(p, q)$ as before. Moreover, the strategic entrepreneur's indifference condition in equation (13) must hold. This implies the following result.

Proposition 6. *There exist $1 < \underline{z} < \bar{z}$ such that:*

(i) If $z < \underline{z}$, there does not exist an informative equilibrium.

(ii) If $z = \underline{z}$, there exists a unique equilibrium which features truth-telling.

(iii) If $z \in (\underline{z}, \bar{z})$, there exists a unique lying equilibrium. Moreover, if $p_0 > \frac{1}{2}$, a better informed entrepreneur over-recommends the new project more (i.e., $\partial l/\partial\gamma > 0$), but the VC intervenes less (i.e., $\partial R_n/\partial\gamma < 0$).

(iv) If $z \geq \bar{z}$, then the strategic entrepreneur always lies (i.e., $l = 1$) and recommends the new project.

Intuitively, when the entrepreneur is better informed (i.e., γ is higher), a recommendation for the new project is "better news" and leads to lower intervention by the VC. But this increases the incentives for the entrepreneur to recommend the new project.

In recent years, the relationship between VCs and entrepreneurs has undergone fundamental changes. As Kerr et al. (2014) document, many VCs have adopted a "spray-and-pray" approach and fund many startups with very limited oversight. Arguably, this has increased the information friction between entrepreneurs and investors. Proposition 6 shows that these two trends are related. Here, γ measures the information friction, i.e. the entrepreneur's

information advantage relative to the investor. As the entrepreneur's information advantage increases, the entrepreneur recommends the new project more frequently, but the VC intervenes less.

8.2 Control rights

The key underlying friction in our benchmark model is the misalignment between information and control. The strategic entrepreneur is informed about which project is better and is indifferent between which project is chosen, so long as it is guaranteed to continue. In particular, note that truth-telling can trivially be sustained if the VC commits to never intervene. However, the entrepreneur has no control rights in the benchmark model — the VC has complete discretion over whether to continue the project, or intervene and replace the entrepreneur.

In this section, we explore how robust our results are to partial delegation of control rights. Specifically, suppose that with probability β_t, the VC retains control after the project is chosen and with probability $1-\beta_t$, the entrepreneur receives control. Importantly, the likelihood of VC control β_t can depend on the project type $t \in \{c, n\}$.

Consider again a lying equilibrium in which the strategic entrepreneur always recommends the new project when $\theta = 1$, and recommends the new project with probability l when $\theta = 0$. Conditional on receiving control, the VC's intervention decision remains the same, and so the intervention thresholds R_n and R_c are still given by equations (6) and (7), respectively. Moreover, since the strategic entrepreneur always continues the project (and this happens with probability $1-\beta_t$), the indifference condition for $\theta = 0$ is now given by

$$\delta\left(1-\beta_n+\beta_n\left(1-F\left(R_n\right)\right)\right)=\delta\left(1-\beta_c+\beta_c\left(1-F\left(R_c\right)\right)\right). \tag{33}$$

The above condition simplifies to

$$\frac{F\left(R_n\left(l\right)\right)}{F\left(R_c\left(l\right)\right)}=\frac{\beta_c}{\beta_n}. \tag{34}$$

Equation (34) summarizes the equilibrium impact of project specific control rights. First, note that if the likelihood of the VC receiving control is the same across project types (i.e., $\beta_c = \beta_n$), then the indifference condition reverts to the benchmark condition in equation (13),

and the likelihood of lying in equilibrium is unaffected. This is true even if the entrepreneur receives control arbitrarily often (i.e., $\beta_c = \beta_n = \beta$ is small).

Next, recall that $R_n(l)$ is increasing in l while $R_c(l)$ is decreasing in l, which implies the LHS of equation (34) is increasing in the equilibrium likelihood of lying. This implies that if β_c/β_n increases, there is more lying in equilibrium. Intuitively, more VC control for the conventional project (or less VC control for the new project) makes lying more appealing to the entrepreneur. Similarly, if β_c/β_n decreases, there is less lying in equilibrium: if the VC has relatively more control for the new project, the relative benefit from recommending it is lower. In the following proposition, we summarize our results and provide a condition for truth-telling.

Proposition 7. *As β_c/β_n decreases, in the lying equilibrium, the likelihood that the entrepreneur recommends the new project decreases. For any (β_c, β_n) such that*

$$\beta_n F\left(\frac{R_0 + \delta(1-q_0)}{z}\right) = \beta_c F\left(R_0 + \delta(1-q_0)\right),$$

truth-telling can be implemented. The pair (β_c, β_n) which implements truth-telling and maximizes the entrepreneur's value is given by $\beta_c = \beta_n = 0$, while the pair which maximizes the VC's value is given by $\beta_n = 1$ and

$$\beta_c = \frac{F\left(\frac{R_0+\delta(1-q_0)}{z}\right)}{F\left(R_0 + \delta(1-q_0)\right)}.$$

Contingent control rights are common in VC investments. As Kaplan and Strömberg (2003) show, the majority of startups have contingent control rights, either in terms of board seats or votes. Commonly, control rights are interpreted as allowing the investor to monitor the entrepreneur and to punish misbehavior. Our results provide a different, but complementary, interpretation. Allocating more control to the investor over the new project improves communication between the VC and the entrepreneur, and improves ex-ante project choice.

From the (strategic) entrepreneur's perspective, allocating no control rights to the VC is optimal, since then the VC can never intervene. This trivially implements truth-telling. By contrast, the VC's value is maximized at $\beta_n = 1$, i.e. the VC always retains control over the

new project, while sometimes ceding control over the conventional project.

8.3 The value of outsiders

In our main model, the VC monitors too much compared to the commitment solution and project choice is distorted. We now show that adding a less informed outsider who has decision power adds value. This is consistent with Ewens and Malenko (2020), who document that independent directors join startups at later stages and often hold tie-breaking power between entrepreneurs and VCs. Perhaps surprisingly, such decision power by a relatively uninformed outside director can effectively implement the commitment solution in our framework.

We alter the model as follows. After the project is implemented, an outsider joins and receives the control rights over the intervention decision. This outsider is less informed than the entrepreneur and the investor.[27] Consequently, we assume that the outsider does not know the message m sent by the entrepreneur or which project has been implemented, which reflects his lack of knowledge.

The timing structure is now as follows:

1. The entrepreneur observes θ and sends a recommendation for the new ($m = 1$) or conventional ($m = 0$) project to the early VC.

2. The VC chooses whether to invest in the new project or the conventional project.

3. The outsider joins, observes R, and chooses whether to intervene.

4. The payoffs are realized.

For simplicity, we assume that the VC and outsider split the equity in the firm equally.[28] In the context of an independent director, this could represent the director's reputational payoff from proving to be effective or explicit equity compensation. Since the outsider does

[27] This is a common criticism of independent directors, see e.g. Ferris et al. (2003).

[28] Introducing more complicated splits of equity does not deliver any additional insights. In particular, the split of equity between investors does not affect their decisions. Unlike in Section 6, increasing the entrepreneur's share does not affect lying, since the entrepreneur tells the truth in equilibrium even if her share is zero.

not know which project has been implemented, he simply chooses an intervention threshold to maximize his value, taking into account how much the entrepreneur lies in equilibrium:

$$U_{VC}^{L} = \max_{\bar{R}^L} \begin{array}{c} \frac{1}{2}\left(p_0 z + (1-p_0)\left(1-(1-q_0)\,l\right)\right)\int_{\bar{R}^L}^{\infty} Rf\left(R\right)dR \\ -\frac{1}{2}\delta\left(1-q_0\right)\left(1-F\left(\bar{R}^L\right)\right)+\frac{1}{2}F\left(\bar{R}^L\right)R_0 \end{array}, \tag{35}$$

which yields

$$\bar{R}^L\left(l\right) = \frac{R_0 + \delta\left(1-q_0\right)}{p_0 z + \left(1-p_0\right)\left(1-\left(1-q_0\right)l\right)}. \tag{36}$$

Since the intervention threshold is the same for both projects, the entrepreneur is indifferent between any choice of l. Thus, $l = 0$ is an equilibrium, in which case we have

$$\bar{R}^L\left(0\right) = \frac{R_0 + \delta\left(1-q_0\right)}{p_0 z + \left(1-p_0\right)} = \bar{R}^*. \tag{37}$$

Here, recall that $\bar{R}^*$ is the intervention threshold with commitment (in equation (18)). Thus, we have established the following result.

Proposition 8. *With an uninformed outsider, truth-telling and efficient intervention constitute an equilibrium.*

This result provides a novel justification for the evolution of board structures in startups (Ewens and Malenko (2020)). In later stages, independent directors are often brought in and receive control rights. As the result above shows, this may improve communication between entrepreneur and investors.

8.4 Staging venture capital

We now introduce a staging structure into the model.[29] We show that staging can reduce the entrepreneur's incentive to recommend the new project, whenever the intervention is sufficiently likely to require outside financing. Specifically, the project requires additional outside funding $I > 0$ from a late VC with some probability. This likelihood depends on whether the early VC continues the originally chosen project or whether she intervenes. The original project requires additional funding with probability $\rho \in (0,1)$ and following

[29] We are very grateful to Doron Levit for suggesting this extension.

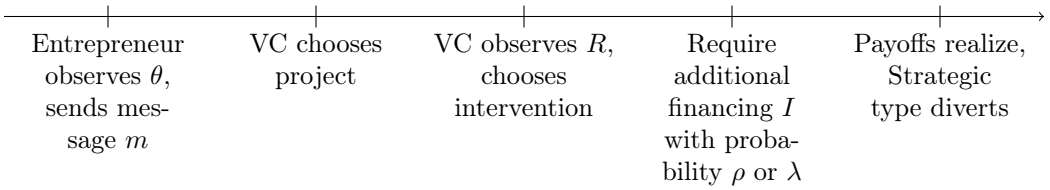


Figure 3: Timeline

intervention, the project requires funding with probability $\lambda \in (0,1)$. The early and the late VC bargain about the distribution of shares. We use Nash-Bargaining. If the early and late VC fail to agree, the project fails and everyone receives a payoff of zero. If the early and late VC agree, the strategic entrepreneur diverts funds and payoffs realize. The weight on the early VC is $\beta \in (0,1)$. The new timeline is in Figure 3.

The early VC now anticipates the bargaining outcome between herself and the late VC, which affects her intervention decision. If she intervenes, her expected payoff is

$$\lambda\beta\left(R_0 - I\right) + \left(1-\lambda\right)R_0, \tag{38}$$

which takes into account the likelihood that additional funding is required (λ) and the early VC's bargaining power (β). If she continues with the new project, her expected payoff is

$$\rho\beta\left(zpR - \delta\left(1-q\right) - I\right) + \left(1-\rho\right)\left(zpR - \delta\left(1-q\right)\right) \tag{39}$$

and if she continues with the conventional project, her expected payoff is

$$\rho\beta\left(R - \delta\left(1-q\right) - I\right) + \left(1-\rho\right)\left(R - \delta\left(1-q\right)\right). \tag{40}$$

This leads to the following optimal intervention thresholds

$$R_n\left(p,q\right) = \frac{1}{pz}\left(\frac{\left(\lambda\beta + \left(1-\lambda\right)\right)R_0 + \beta\left(\rho-\lambda\right)I}{\rho\beta + \left(1-\rho\right)} + \delta\left(1-q\right)\right) \tag{41}$$

and

$$R_c\left(q\right) = \frac{\left(\lambda\beta + \left(1-\lambda\right)\right)R_0 + \beta\left(\rho-\lambda\right)I}{\rho\beta + \left(1-\rho\right)} + \delta\left(1-q\right). \tag{42}$$

Given these thresholds, we show that staging can lead to more or less lying in equilibrium, as summarized by the following proposition.

Proposition 9. *If $\lambda > \rho$, then the entrepreneur recommends the new project less as the early VC's bargaining power decreases. With staging, she recommends the new project less than in the baseline model. If $\lambda < \rho$, the entrepreneur recommends the new project more as the early VC's bargaining power decreases. With staging, she recommends the new project more than the baseline model.*

The result implies that when the intervention is costly and requires outside financing with higher likelihood than the original project, then staging improves communication and improves project choice. On the other hand, staging can make communication worse when the original project requires outside financing with a higher likelihood.

To gain intuition for these results, suppose that $\lambda = 0$ and $\rho = 1$, i.e. additional funding is always required for the initial project but never after intervention. Then, the thresholds become

$$R_n(p,q) = \frac{\frac{R_0}{\beta} + \delta(1-q)}{pz} \text{ and } R_c(q) = \frac{R_0}{\beta} + \delta(1-q). \tag{43}$$

As the early VC's bargaining power (β) decreases, she intervenes more in both projects, since the value from continuing them is lower. But since the VC is more likely to intervene, the entrepreneur lies more. Formally, R_0/β increases, and Corollary 1 implies that the entrepreneur lies more in equilibrium. In particular, for any $\beta \in (0,1)$, the entrepreneur lies more compared to the baseline model.

Conversely, if $\lambda = 1$ and $\rho = 0$, then we have

$$R_n(p,q) = \frac{\beta(R_0 - I) + \delta(1-q)}{pz} \text{ and } R_c(q) = \beta(R_0 - I) + \delta(1-q). \tag{44}$$

Now, additional funding is only required after intervention, e.g. because intervention represents a costly reorganization or a pivot. As the early VC's bargaining power decreases, she intervenes less in both projects. By Corollary 1, she relatively less willing to intervene in the conventional project, which makes lying less appealing for the entrepreneur. Thus, the entrepreneur lies less. In particular, he lies less for any $\beta \in (0,1)$ compared to the baseline model.

9 Concluding remarks

We study monitoring and communication in VC financing. The VC is less willing to intervene in the new project, since it has a higher upside. The entrepreneur then distorts her recommendations towards the new project. This, however, leads the VC to intervene more frequently. As a result, the equilibrium features too much intervention. A "friendly" VC, who implicitly commits to intervene less, can improve both his and the entrepreneur's payoffs. As such, our model provides a rationale for the recent trend of "hands-off" VCs who limit their oversight of founders (Kerr et al. (2014)).

Our analysis highlights the importance of reputation in relationship finance. The strategic entrepreneur has an incentive to tell the truth, since doing so allows her to pool with the honest type. When the entrepreneur is perceived as being honest, the VC intervenes less once the project is implemented, which allows the strategic type to enjoy more private benefits of control. This reputation only provides partial incentives for truth-telling and in equilibrium, the strategic type still distorts her recommendations towards the new project. Thus, other mechanisms are needed to ensure truthful communication.

Our analysis suggests a number of novel empirical predictions. Most directly, our model predicts that VCs who intervene less often should have better performance, controlling for ex-ante project characteristics. Our model also predicts that, all else equal, a VC should intervene less often when the he believes that the entrepreneur is honest (which need not necessarily translate to past success) and when the project has more "upside," conditional on success.

In contrast to common wisdom, we find that that higher competition for deals among VCs need not always lead to more founder-friendly behavior. Moreover, even in settings where higher competition leads to less intervention, the impact of such behavior is nuanced: it can improve VC payoffs when less intervention leads to better communication between the entrepreneur and the VC, but can lower VC payoffs otherwise.

We show that contingent control rights, which are commonly used in VC financing, can reduce the entrepreneur's incentive to lie and lead to higher profits for the VC. Likewise, increasing the entrepreneur's stake in the firm leads to less distorted recommendations, since the entrepreneur also suffers when the new project fails. Finally, we show the advantage of having outside directors, which separates the decision of choosing the project and choosing

whether to intervene. If the intervention decision is given to a less informed outsider, the monitoring trap in our baseline model disappears. This is because the late VC's intervention decision no longer depends on the entrepreneur's recommendation, breaking the cycle of lying and intervention.

While our focus is on VC financing, our model applies more broadly. Instead of being an entrepreneur, the sender could be an employee or a mid-level manager inside a firm, who recommends projects to a superior. The superior decides which project to implement and whether to intervene in the interim. Alternatively, the sender could be a consultant who recommends strategies to a client or a lawyer advising on complex litigation. In all these settings, the main features of our model - communication and intervention - are likely to be key economic forces.

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A Proofs

A.1 Proof of Proposition 1

We first prove an intermediate result.

Lemma 2. *The VC chooses the new project conditional on $m = 1$ if and only if $zp(1) \geq 1$.*

Proof. Defining

$$\begin{aligned} U_{VC,n}(p,q) &= F(R_n(p,q))R_0 \\ &\quad + (1 - F(R_n(p,q)))(pzE(R|R \geq R_n(p,q)) - \delta(1-q)) \end{aligned}$$

and

$$U_{VC,c}(q) = F(R_c(q))R_0 + (1 - F(R_c(q)))(E_c(R|R \geq R_c(q)) - \delta(1-q)),$$

choosing the new project is optimal conditional on $m = 1$ whenever

$$U_{VC,n}(p(1), q(1)) \geq U_{VC,c}(q(1)).$$

We now show that this condition is equivalent to $zp(1) \geq 1$. Let $U_{VC,n}\left(p, q, \bar{R}\right)$ be the VC's value from choosing the new project given some arbitrary intervention threshold $\bar{R}$ and let $U_{VC,c}\left(q, \bar{R}\right)$ be defined similarly. Clearly, $U_{VC,n}(p,q) \geq U_{VC,n}\left(p, q, \bar{R}\right)$ and $U_{VC,c}(q) \geq U_{VC,c}\left(q, \bar{R}\right)$ for all $\bar{R}$. First, suppose that $zp(1) < 1$. Then, we have for any given $\bar{R}$

$$U_{VC,n}\left(p, q, \bar{R}\right) < U_{VC,c}\left(q, \bar{R}\right)$$

and therefore

$$\begin{aligned} U_{VC,c}(q(1)) &\geq U_{VC,c}(q(1), R_n) \\ &> U_{VC,n}(p(1), q(1), R_n) \\ &= U_{VC,n}(p(1), q(1)). \end{aligned}$$

Thus, if $zp(1) < 1$, the VC does not invest in the new project conditional on $m = 1$. If $zp(1) \geq 1$, then a similar argument as above yields

$$U_{VC,n}\left(p, q, \bar{R}\right) \geq U_{VC,c}\left(q, \bar{R}\right)$$

for any fixed $\bar{R}$ and

$$\begin{aligned} U_{VC,n}(p(1), q(1), R_n) &\geq U_{VC,n}(p(1), q(1), R_c(q(1))) \\ &\geq U_{VC,c}(q(1), R_c(q(1))) \end{aligned}$$

$$= \quad U_{VC,c}\left(q\left(1\right)\right).$$

Thus, choosing the new project is optimal conditional on $m=1$ if and only if $zp\left(1\right)\geq 1$. $\square$

We now prove Proposition 1.

Proof of Proposition 1. Under truth-telling, we have

$$p=\begin{cases}1 & \text{if } m=1\\ 0 & \text{if } m=0\end{cases},\quad q=q_0. \tag{45}$$

This implies that it is optimal for VC to pick the conventional project, conditional on a message $m=0$ and the new project, conditional on $m=1$. To ensure truth telling is optimal, we need that conditional on $\theta=1$, S sends $m=1$ and conditional on $\theta=0$, S sends $m=0$. Note that since

$$R_n=\frac{R_0+\delta\left(1-q_0\right)}{z}, \tag{46}$$

and

$$R_c=R_0+\delta\left(1-q_0\right), \tag{47}$$

and since $z=1$, the entrepreneur is indifferent between which project is chosen and so truth-telling can be sustained.

Indeed, when $z=1$, truth-telling is the unique informative equilibrium. In any equilibrium, conditional on $m=1$, it must be optimal for the VC to choose the new project. By Lemma 2, this is the case whenever $zp\left(m=1\right)\geq 1$. Under truth-telling, we have $p\left(m=1\right)=1$, so that $zp\left(m=1\right)=1$. However, for any equilibrium other than truth-telling, we have $p\left(1\right)<1$ and thus $zp\left(1\right)<1$. Hence, no informative equilibrium other than truth-telling can exist.

Now consider a lying equilibrium, in which the probability of lying is l. Then,

$$p=\begin{cases}\frac{p_0}{p_0+(1-p_0)(1-q_0)l}\equiv p_1\left(l\right) & m=1\\ 0 & m=0\end{cases} \tag{48}$$

$$q=\begin{cases}\frac{p_0q_0}{p_0+(1-p_0)(1-q_0)l}\equiv q_0p_1\left(l\right) & m=1\\ \frac{q_0}{1-(1-q_0)l} & m=0\end{cases} \tag{49}$$

To sustain lying, we need $U_S\left(n\right)=U_S\left(c\right)$ when $\theta=0$, but this implies l satisfies the indifference condition $H\left(l\right)=0$, where

$$H\left(l\right)\equiv R_n\left(p_1,q_0p_1\right)-R_c\left(0,\frac{q_0}{1-\left(1-q_0\right)l}\right). \tag{50}$$

$$= \frac{R_0 + \delta\left(1 - q_0 p_1\left(l\right)\right)}{z p_1\left(l\right)} - \left(R_0 + \delta\left(1 - \frac{q_0}{1 - \left(1 - q_0\right) l}\right)\right) \tag{51}$$

Note that since $z > 1$, we have:

$$H\left(0\right) = \left(R_0 + \delta\left(1 - q_0\right)\right)\left(\frac{1}{z} - 1\right) < 0 \tag{52}$$

$$H\left(1\right) = R_0\left(\frac{1 - q_0\left(1 - p_0\right)}{p_0 z} - 1\right) + \frac{\delta\left(1 - q_0\right)}{p_0 z} \tag{53}$$

and

$$\frac{\partial H\left(l\right)}{\partial l} = \left(1 - q_0\right)\left(\frac{\left(1 - p_0\right)\left(\delta + R_0\right)}{p_0 z} + \frac{\delta q_0}{\left(l\left(q_0 - 1\right) + 1\right)^2}\right) > 0. \tag{54}$$

Additionally, it must be optimal for the VC to choose the new project when $m = 1$, which by Lemma 2 is equivalent to $z p_1\left(l\right) \geq 1$.[30] We next distinguish two parametric cases. First, suppose that

$$z \geq \underline{z} \equiv \frac{1 - q_0\left(1 - p_0\right)}{p_0}.$$

This ensures that $z p_1\left(l = 1\right) \geq 1$. Then, since

$$p_1\left(l\right) \in \left[\frac{p_0}{p_0 + \left(1 - p_0\right)\left(1 - q_0\right)}, 1\right],$$

choosing the new project is optimal conditional on $m = 1$ for any $l \in [0, 1]$. We thus only have to verify that there exists an $l \in (0, 1)$ such that $H\left(l\right) = 0$. Since $H\left(l\right)$ is increasing in l, this is true if and only if $H\left(1\right) > 0$. Using equation (53), we have $H\left(1\right) > 0$ whenever

$$z < \bar{z} \equiv \frac{R_0\left(p_0 + \left(1 - p_0\right)\left(1 - q_0\right)\right) + \delta\left(1 - q_0\right)}{R_0 p_0} = \underline{z} + \frac{\delta\left(1 - q_0\right)}{p_0 R_0}.$$

This is the condition in the statement of the Proposition.[31]

Note that $\underline{z} > 1$ and consider the case $z \in (1, \underline{z})$. Then, by construction of $\underline{z}$, we have $z p_1\left(l\right) < 1$ for l sufficiently close to 1. Denote with $\bar{l} \in (0, 1)$ the value at which $z p_1\left(l\right) = 1$. Since $p_1\left(l\right) = 1$ for $l = 0$ and $z > 1$, such an $\bar{l}$ exists. At $\bar{l}$, we have

$$R_n\left(p\left(1\right), q\left(1\right)\right) = R_0 + \delta\left(1 - q\left(1\right)\right)$$

[30] Since $p\left(0\right) = 0$ in any lying equilibrium, it is immediate that the VC chooses the conventional project conditional on $m = 0$, since she knows that the new project cannot succeed.

[31] Note that $\underline{z} < \bar{z}$, so the two conditions do not conflict with each other.

and

$$R_c\left(q\left(1\right)\right) = R_0 + \delta\left(1 - q\left(0\right)\right)$$

and since $q\left(1\right) < q\left(0\right)$ for any $l \in \left(0,1\right)$, this implies that $R_n > R_c$. Thus, $H\left(\bar{l}\right) > 0$. Since $H\left(0\right) < 0$ and since $H\left(l\right)$ is strictly increasing in l, there exists an $l \in \left(0, \bar{l}\right)$ such that $H\left(l\right) = 0$. For such an l, we have $zp_1\left(l\right) > 1$, since $l < \bar{l}$ by construction. Taken together, the two cases establish that a lying equilibrium exists whenever $z \in \left(1, \bar{z}\right)$. □

A.2 Proof of Proposition 3

Proof. We first show that for q_0 sufficiently small, the optimal thresholds satisfy $\bar{R}_n = \bar{R}_c$. Suppose by way of contradiction that $\bar{R}_n < \bar{R}_c$.[32] Then, $l = 1$ and the VC's expected value is given by

$$\begin{aligned} U_{VC} &= \left(p_0 + \left(1-p_0\right)\left(1-q_0\right)\right)\left(\int_{\bar{R}_n}^{\infty} zp\left(1\right)Rf\left(R\right)dR - \delta\left(1-q\left(1\right)\right)\left(1-F\left(\bar{R}_n\right)\right) + F\left(\bar{R}_n\right)R_0\right) \\ &\quad + \left(1-p_0\right)q_0\left(\int_{\bar{R}_c}^{\infty} Rf\left(R\right)dR + F\left(\bar{R}_c\right)R_0\right). \end{aligned}$$

By picking $\bar{R}_c' = \bar{R}_n$, the VC can induce truth-telling and receive payoff

$$U_{VC}' = \left(p_0 z + \left(1-p_0\right)\right)\int_{\bar{R}_n}^{\infty} Rf\left(R\right)dR - \delta\left(1-q_0\right)\left(1-F\left(\bar{R}_n\right)\right) + F\left(\bar{R}_n\right)R_0.$$

We have

$$\begin{aligned} U_{VC} - U_{VC}' &= \left(1-p_0\right)q_0\int_{\bar{R}_c}^{\infty} Rf\left(R\right)dR - \left(1-p_0\right)\left(1-q_0\right)\int_{\bar{R}_n}^{\infty} Rf\left(R\right)dR \\ &\quad + \left(1-p_0\right)q_0\left(F\left(\bar{R}_c\right) - F\left(\bar{R}_n\right)\right)R_0, \end{aligned}$$

which is negative whenever q_0 is sufficiently small. Thus, for q_0 small, it is optimal for the sender to choose $\bar{R}_n = \bar{R}_c$.

We now show the second part of the proposition, i.e. the VC monitors less with commitment. We have

$$\begin{aligned} \bar{R}^* - R_c &= \frac{R_0 + \delta\left(1-q_0\right)}{p_0 z + \left(1-p_0\right)} - \left(R_0 + \delta\left(1 - \frac{q_0}{1-\left(1-q_0\right)l}\right)\right) \\ &= R_0\left(\frac{1}{p_0 z + \left(1-p_0\right)} - 1\right) + \delta\left(1-q_0\right)\left(\frac{1}{p_0 z + \left(1-p_0\right)} - \frac{1-l}{1-\left(1-q_0\right)l}\right). \end{aligned}$$

[32] Note that setting $\bar{R}_n > \bar{R}_c$ is suboptimal, since the entrepreneur always recommends the safe project in this case. Then, the VC can trivially improve by setting $\bar{R}_n = \bar{R}_c = R_0 + \delta\left(1-q_0\right)$.

If z is close to 1, then the first term vanishes, and the second term approaches

$$\frac{1}{p_0 z + (1 - p_0)} - \frac{1 - l}{1 - (1 - q_0) l} \to 1 - \frac{1}{q_0} < 0.$$

Thus, $\bar{R}^* < R_c = R_n$ when z is small. Further, we have

$$\frac{d}{dz}\left(\bar{R}^* - R_c\right) = \frac{d}{dz}\bar{R}^* - \frac{dR_c}{dl}\frac{dl}{dz}.$$

By the implicit function theorem and the relation $R_n - R_c = 0$, we have

$$\frac{dl}{dz} = \frac{\frac{dR_n}{dz}}{\frac{dR_c}{dl}}$$

and thus

$$\begin{aligned} \frac{d}{dz}\left(\bar{R}^* - R_c\right) &= \frac{d}{dz}\bar{R}^* - \frac{d}{dz}R_n \\ &= \frac{p_0 \bar{R}^*}{p_0 z + (1 - p_0)} - \frac{R_n}{z}, \end{aligned}$$

which has the same sign as

$$p_0 z\left(\bar{R}^* - R_n\right) - (1 - p_0) R_n.$$

Thus, whenever $\bar{R}^* < R_n$ (or equivalently, $\bar{R}^* < R_c$), then

$$\frac{d}{dz}\left(\bar{R}^* - R_c\right) < 0.$$

This establishes that $\bar{R}^* < R_n$ for all z. □

A.3 Proof of Proposition 4

Proof. We have $dR_n/dl > 0$ and $dR_c/dl < 0$ as in the baseline model, which follows from differentiating equations (23) and (24). Thus,

$$\begin{aligned} \frac{\partial H}{\partial l} &= \left(-(1 - \alpha)\delta + \alpha R_0 - \alpha R_c\right) f(R_c) \frac{dR_c}{dl} \\ &\quad + (1 - \alpha)\delta f(R_n) \frac{dR_n}{dl}. \end{aligned}$$

We have, using the definition of R_c in equation (24),

$$\begin{aligned} -(1-\alpha)\delta + \alpha R_0 - \alpha R_c &= -\alpha(R_c - R_0 - \delta) - \delta \\ &= \alpha q(0)\delta - \delta < 0, \end{aligned}$$

which implies that $\partial H/\partial l > 0$. Further, we have

$$\frac{\partial H}{\partial \alpha} = -(1 - F(R_c))\delta + R_0 F(R_c) + \int_{R_c}^{\infty} Rf(R)\, d + (1 - F(R_n))\delta.$$

In equilibrium, we have $H(l) = 0$ and thus

$$(1 - F(R_n))\delta - (1 - F(R_c))\delta = \frac{\alpha}{1-\alpha}\left(R_0 F(R_c) + \int_{R_c}^{\infty} Rf(R)\, dR\right),$$

so that

$$\frac{\partial H}{\partial \alpha} = \frac{1}{1-\alpha}\left(R_0 F(R_c) + \int_{R_c}^{\infty} Rf(R)\, dR\right) > 0$$

whenever $H(l) = 0$. The implicit function theorem now implies that

$$\frac{dl}{d\alpha} = -\frac{\frac{\partial H}{\partial \alpha}}{\frac{\partial H}{\partial l}} < 0. \tag{55}$$

This establishes the result. □

A.4 Proof of Proposition 5

We first establish a preliminary result.

Lemma 3. *For δ sufficiently large, $dU_{VC}/d\alpha < 0$.*

Proof. Let R_n and R_c denote the equilibrium intervention thresholds. Using Equations (20) and (21), we can write the VC's value as

$$\begin{aligned} U_{VC} = (1-\alpha)\Bigg(&\Pr(m=1)\left(p(1)\left(F(R_n)R_0 + z\int_{R_n}^{\infty} Rf(R)\, dR\right) - \delta(1-q(1))(1-F(R_n))\right) \\ &+ \Pr(m=0)\left(R_0 F(R_c) + \int_{R_c}^{\infty} Rf(R)\, dR - \delta(1-q(0))(1-F(R_c))\right)\Bigg) \end{aligned}$$

and we have

$$\frac{dU_{VC}}{d\alpha} = -\frac{U_{VC}}{1-\alpha} + \frac{dU_{VC}}{dl}\frac{dl}{d\alpha}.$$

Here, note that R_n and R_c only depend on α through the likelihood of lying l, and are thus subsumed in the derivative dU_{VC}/dl. Equation (55) implies that

$$\frac{dl}{d\alpha} = -\frac{1}{1-\alpha}\frac{1}{\delta}\frac{R_0 F(R_c) + \int_{R_c}^{\infty} R f(R)\, dR}{(1-\alpha)\frac{dR_n}{dl} - (1-\alpha q(0))\, f(R_c)\frac{dR_c}{dl}},$$

which vanishes as $\delta \to \infty$, since dR_n/dl, dR_c/dl and R_c are bounded. Moreover, Equations (23) and (24), together with the updating rule in Equation (12) imply that dU_{VC}/dl is bounded. Then, it holds that $dU_{VC}/d\alpha < 0$ for δ sufficiently large. □

This result implies that in a competitive equilibrium, there exists a unique equity share α so that investors break even. For I sufficiently large, the share α is small, so that Proposition 4 implies that $l \in (0,1)$. Then, a similar argument as in Proposition 3 implies that R_n exceeds the commitment benchmark.

We now show that the equilibrium features truth-telling for I sufficiently small. Since α is decreasing in I, it is sufficient to establish that the strategic entrepreneur tells the truth for α sufficiently large. Conditional on $\theta = 0$, the entrepreneur's payoff from recommending the new project is given in Equation (27) and the payoff from recommending the conventional project is given in Equation (5). As α becomes large, $U_S(m=1,\theta=0)$ vanishes while $U_S(m=0,\theta=0)$ is strictly positive. Thus, for α sufficiently large, the strategic entrepreneur tells the truth.

A.5 Proof of Corollary 3

The VC's value from implementing the conventional project given equity share α is given by

$$U_{VC}(c,\alpha) = \max_{R_c}\left((1-\alpha)R_0 - \kappa\right)F(R_c) + (1-\alpha)\int_{R_c}^{\infty}\left(R - \delta(1-q_0)\right)dF(R)$$

and we have

$$\frac{dR_c}{d\alpha} < 0,$$

since

$$\frac{\partial^2 U_{VC}}{\partial R_c \partial \alpha} = -\frac{\kappa}{1-\alpha} < 0,$$

using monotone comparative statics. Similarly, the VC's value from implementing the new project is

$$U_{VC}(n,\alpha) = \max_{R_n}\left((1-\alpha)p_0 R_0 - \kappa\right)F(R_n) + (1-\alpha)\int_{R_n}^{\infty}\left(p_0 zR - \delta(1-q_0)\right)dF(R)$$

and by the same argument as above,

$$\frac{dR_n}{d\alpha} < 0.$$

Since the entrepreneur cannot communicate with the VC, the VC chooses either the new or the conventional project. In either case, the intervention threshold locally decreases in α.

We now characterize when the VC chooses the new or conventional project. We have $U_{VC}(n,1) = U_{VC}(c,1) = 0$. First, consider the case $p_0 z > 1$. Then, we have

$$R_n = \frac{R_c - (1-p_0) R_0}{p_0 z} < R_c$$

and $R_n, R_c \to 0$ as $\alpha \to 1$, so that

$$\left.\frac{\partial U_{VC}(n,\alpha)}{\partial \alpha}\right|_{\alpha=1} = -\int_0^\infty (p_0 z R - \delta(1-q_0))\, dF(R)$$

and

$$\left.\frac{\partial U_{VC}(c,\alpha)}{\partial \alpha}\right|_{\alpha=1} = -\int_0^\infty (R - \delta(1-q_0))\, dF(R).$$

This implies that

$$\left.\frac{\partial U_{VC}(n,\alpha)}{\partial \alpha}\right|_{\alpha=1} < \left.\frac{\partial U_{VC}(c,\alpha)}{\partial \alpha}\right|_{\alpha=1}$$

so that $U_{VC}(n,\alpha) > U_{VC}(c,\alpha)$ for $\alpha \in (1-\varepsilon, 1)$. Moreover, we have

$$\frac{\partial U_{VC}(n,\alpha)}{\partial \alpha} - \frac{\partial U_{VC}(c,\alpha)}{\partial \alpha} = -\frac{1}{1-\alpha}\left(U_{VC}(n,\alpha) - U_{VC}(c,\alpha)\right) - \frac{\kappa}{1-\alpha}\left(F(R_n) - F(R_c)\right).$$

Since $R_n < R_c$, this implies that

$$\frac{\partial U_{VC}(n,\alpha)}{\partial \alpha} > \frac{\partial U_{VC}(c,\alpha)}{\partial \alpha}$$

whenever $U_{VC}(n,\alpha) \leq U_{VC}(c,\alpha)$. In particular, $U_{VC}(n,\alpha)$ can cross $U_{VC}(c,\alpha)$ at most once from below for $\alpha \in (0,1)$. Therefore, either (1) there exists an $\bar{\alpha} \in (0,1)$ such that the VC chooses the conventional project for $\alpha < \bar{\alpha}$ and the new project for $\alpha \geq \bar{\alpha}$ or (2) the VC chooses the new project for all α. Since $R_n < R_c$, in either case, the intervention threshold is decreasing in α, with a downward jump at $\bar{\alpha}$.

Suppose instead that $p_0 z < 1$. Then, the VC always chooses the conventional project, and R_c is decreasing in α.

Finally, as ψ decreases α decreases, which leads the likelihood of intervention to decrease

as well.

A.6 Proof of Proposition 6

Proof. The proof is similar to the proof of Proposition 1. Note that

$$\frac{\partial p(1)}{\partial \gamma} = \frac{(1-p_0)\,p_0\,(1-l^2\,(1-q_0)^{\,2})}{((2\gamma-1)p_0\,(l\,(1-q_0)+1)+\gamma\,(l\,(1-q_0)-1)+1)^{\,2}} > 0 \tag{56}$$

$$\frac{\partial p(1)}{\partial l} = -\frac{(2\gamma-1)\,(1-p_0)\,p_0\,(1-q_0)}{((2\gamma-1)p_0\,(l\,(q_0-1)+1)+\gamma\,(l\,(-q_0)+l-1)+1)^{\,2}} < 0 \tag{57}$$

$$\frac{\partial p(0)}{\partial \gamma} = -\frac{(1-p_0)\,p_0}{(\gamma+p_0-2\gamma p_0)^2} < 0 \tag{58}$$

$$\frac{\partial q(1)}{\partial \gamma} = \frac{l\,(2p_0-1)\,(1-q_0)\,q_0}{((2\gamma-1)p_0\,(l\,(q_0-1)+1)+\gamma\,(l\,(1-q_0)-1)+1)^{\,2}} \tag{59}$$

$$\frac{\partial q(1)}{\partial l} = \frac{(1-q_0)\,q_0\,((2\gamma-1)p_0-\gamma)\,((2\gamma-1)p_0+1-\gamma)}{((2\gamma-1)p_0\,(l\,(q_0-1)+1)+\gamma\,(l\,(-q_0)+l-1)+1)^{\,2}} < 0 \tag{60}$$

$$\frac{\partial q(0)}{\partial l} = \frac{(1-q_0)\,q_0}{(1-l\,(1-q_0))^2} > 0. \tag{61}$$

Note that $\frac{\partial q(1)}{\partial \gamma} > 0 \Leftrightarrow p_0 > \frac{1}{2}$. The indifference condition is $H(l) = 0$, where

$$H(l) \equiv R_n\,(p(1), q(1)) - R_c\,(p(0), q(0)). \tag{62}$$

Specifically, we have

$$R_n\,(p(1), q(1)) \;=\; \frac{(R_0+\delta)\,(\pi+(1-\pi)\,(1-q_0)\,l)-\delta\pi q_0}{zp_0\,(\gamma+(1-\gamma)\,(1-q_0)\,l)}$$

and

$$R_c\,(q(0)) = R_0 + \delta\frac{(1-q_0)\,(1-l)}{q_0+(1-q_0)\,(1-l)},$$

and R_n is strictly increasing while R_c is strictly decreasing in l. Thus, $H(l)$ is increasing in l, just as in the baseline model. Further,

$$H(0) = (R_0+\delta\,(1-q_0))\left(\frac{\pi}{\gamma p_0 z}-1\right).$$

Truth-telling is an equilibrium whenever

$$z = \underline{z} \equiv \frac{\pi}{\gamma p_0},$$

in which case $H(0) = 0$. Note that this is equivalent to $zp_1(l) = 1$ at $l = 0$. Thus, for $z < \underline{z}$, no informative equilibrium exists, since we have $zp_1(l) < 1$ for any l.

Suppose in the following that $z > \underline{z}$. Then, we have $H(0) < 0$. In equilibrium, we must have $zp_1(l) \geq 1$. At $l = 1$, this is true whenever

$$z \geq \hat{z} \equiv \frac{\pi + (1-\pi)(1-q_0)}{(\gamma + (1-\gamma)(1-q_0))\, p_0},$$

which follows from the definition of $p_1(l)$. As in the baseline model, we have $\underline{z} < \hat{z}$. Consider again two cases. For $z > \hat{z}$, we need to ensure that $H(1) > 0$. This is true whenever

$$z \leq \bar{z} \equiv \frac{R_0 + \delta(1 - q_1(1))}{R_0 p_1(1)},$$

which is the analog of the condition in Proposition 1. As before, we have $\bar{z} > \hat{z}$, which follows after some algebra. Thus, for $z \in [\hat{z}, \bar{z})$, there exists a lying equilibrium.

Now, suppose that $z \in (\underline{z}, \hat{z})$. We have $zp_1(l) < 1$ if $l = 1$. Since $p_1(l)$ is decreasing in l and $p_1(0) = \frac{p_0\gamma}{\pi}$, there exits a $\bar{l} \in (0,1)$ such that $zp_1(l) = 1$ if $l = \bar{l}$. As in the baseline model, we have $q(1) < q(0)$ for any $l > 0$, which implies that $H\left(\bar{l}\right) > 0$. Thus, there exists an $l \in \left(0, \bar{l}\right)$ such that $H(l) = 0$ and $zp_1(l) \geq 1$. Overall, a lying equilibrium exists whenever $z \in (\underline{z}, \bar{z})$. Since $H(l)$ is strictly increasing in l, the lying equilibrium is unique.

We next consider a change in γ. As γ increases, $q(0)$ is unchanged, so $R_c(q(0))$ is unchanged as well. Since $R_n(p,q)$ is decreasing in both p and q, as γ increases, R_n decreases. Then, l must increase to restore indifference. Thus, the entrepreneur lies more as γ increases. Finally, note that as γ increases, l must increase until the indifference condition holds. As l increases, $R_c(q(0))$ decreases. Thus, at a higher γ, R_n must be smaller than before for the indifference condition to hold. □

A.7 Proof of Proposition 7

Proof. The result that l decreases as β_c/β_n decreases is proven in the text. The condition for truth-telling follows by setting $l = 0$ and using the indifference condition 34, which becomes

$$\frac{F\left(\frac{R_0 + \delta(1-q_0)}{z}\right)}{F(R_0 + \delta(1-q_0))} = \frac{\beta_c}{\beta_n}.$$

Since

$$\frac{F\left(\frac{R_0+\delta(1-q_0)}{z}\right)}{F\left(R_0+\delta\left(1-q_0\right)\right)} \in (0,1)$$

whenever $z > 1$, a pair (β_c, β_n) which implements truth-telling always exists. □

A.8 Proof of Proposition 9

The derivative

$$\frac{d}{d\beta}\left(\frac{\left(\lambda\beta+(1-\lambda)\right)R_0+\beta\left(\rho-\lambda\right)I}{\rho\beta+(1-\rho)}\right)$$

has the same sign as

$$\left(R_0-I\left(1-\rho\right)\right)\left(\lambda-\rho\right).$$

Thus, if $\lambda > \rho$, the term is increasing in β and otherwise it is decreasing. Then, 1 implies the result.

B Additional Results

B.1 Mixed Equilibria

If $z > 1$, there generally exists a continuum of mixed equilibria. Any such equilibrium can be characterized as follows. Conditional on $\theta = 1$, the strategic type lies and sends $m = 0$ with probability l_1 and conditional on $\theta = 0$, she lies and sends $m = 1$ with probability l_0. Then the VC's beliefs satisfy

$$\begin{aligned}
p\left(1\right) &= \frac{p_0\left(q_0+\left(1-q_0\right)\left(1-l_1\right)\right)}{q_0p_0+\left(1-q_0\right)\left(p_0\left(1-l_1\right)+\left(1-p_0\right)l_0\right)} \\
p\left(0\right) &= \frac{p_0\left(1-q_0\right)l_1}{q_0\left(1-p_0\right)+\left(1-q_0\right)\left(p_0l_1+\left(1-p_0\right)\left(1-l_0\right)\right)} \\
q\left(1\right) &= \frac{q_0p_0}{q_0p_0+\left(1-q_0\right)\left(p_0\left(1-l_1\right)+\left(1-p_0\right)l_0\right)} \\
q\left(0\right) &= \frac{q_0\left(1-p_0\right)}{q_0\left(1-p_0\right)+\left(1-q_0\right)\left(p_0l_1+\left(1-p_0\right)\left(1-l_0\right)\right)}
\end{aligned}$$

and the thresholds $R_n\left(p,q\right)$ and $R_c\left(q\right)$ are defined as before. In any equilibrium, the thresholds are equal, i.e. $R_n\left(p\left(1\right),q\left(1\right)\right) = R_c\left(q\left(0\right)\right)$ and the VC chooses the new project conditional on $m = 1$, i.e. $zp\left(1\right) \geq 1$ by Lemma 2.

We now provide a sufficient condition so that the lying equilibrium Pareto-dominates any equilibrium with $l_1 > 0$. Intuitively, announcing $m = 0$ when $\theta = 1$ decreases welfare

because it distorts project choice. Conditional on $\theta = 1$, the new project is more valuable and the entrepreneur does not gain from reporting $m = 0$.

Proposition 10. *Suppose that*

$$\frac{\delta}{R_0 + \delta} \frac{p_0}{1 - p_0} \frac{q_0}{1 - q_0} \geq 1$$

and that $z \in (1, \bar{z})$. Then, the lying equilibrium Pareto-dominates any other equilibrium.

Proof. Take any equilibrium with values $l_0 \in (0, 1]$ and $l_1 \in (0, 1]$ and $R_n = R_c$. Using the definitions of R_n and R_c and the construction of $p(m)$ and $q(m)$ above, we have

$$\frac{dR_n}{dl_1} \leq 0, \ \frac{dR_c}{dl_1} > 0, \ \frac{dR_n}{dl_0} > 0, \text{ and } \frac{dR_c}{dl_0} < 0$$

under the condition

$$\frac{\delta}{R_0 + \delta} \frac{p_0}{1 - p_0} \frac{q_0}{1 - q_0} \geq 1.$$

Decreasing l_1 increases $R_n - R_c$ and decreasing l_0 decreases $R_n - R_c$. Thus, since $l_0, l_1 > 0$, we can decrease both l_1 and l_0 by a small amount such that $R_n - R_c$ remains unchanged. We have now increased the ex-ante likelihood that the new project is chosen conditional on $\theta = 1$ and that the conventional project is chosen conditional on $\theta = 0$. The entrepreneur's value is unchanged while the VC's value increases. Thus, any equilibrium with $l_0, l_1 > 0$ is Pareto-dominated. The only undominated equilibrium features $l_1 = 0$.[33] □

[33] There can be no equilibrium with $l_0 = 0$, since then $R_n < R_c$.