Venture Deals: Sources of Leverage in Entrepreneur-Investor Bargaining

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To build a company, most entrepreneurs need outside investors. We ask *what* constitutes credible leverage when entrepreneurs negotiate with investors over the terms of the investment. Specifically, we examine how the allocation of startup equity between the entrepreneur and the investors is affected by the following: (1) the intrinsic value of the startup, (2) the number of investors, and (3) whether investors receive downside protection via "Preferred Stock," as is sometimes done in practice. We use game-theoretic models to show that the entrepreneur should retain a higher percentage of equity in a startup with a higher intrinsic value, with two investors relative to the single investor case and with a Preferred Stock contract relative to Common Stock. We test these predictions in behavioral experiments and find full support for the first but only partial support for the second and third predictions. To reconcile these differences, we examine the fairness norms invoked by the negotiators and revisit an important modeling assumption regarding the negotiators' off-equilibrium beliefs. We conclude by conducting a follow-up experiment that tests this assumption and use our results to propose a refinement for belief modeling in multi-party negotiations.

Key words: Innovation, Bargaining, Experiments

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1. Introduction

Early-stage startups often have limited access to capital and need to raise funds by soliciting investments from wealthy individuals and venture capital firms. The startup's choice of investors and the terms of the investment (the share allocation and the equity division rules) have attracted considerable interest in the entrepreneurial press (Wasserman 2012, Feld and Mendelson 2019, Graham 2021). At the same time, there is relatively little academic research to guide entrepreneurs as they navigate the fundraising process. In this study, we propose and experimentally test an entrepreneur-investor bargaining model that takes some initial steps towards closing this gap.

Bargaining and negotiations are a ubiquitous part of business and economic activity and, unsurprisingly, have been studied through various scholarly lenses. Management scholars typically focus on the interpersonal and group dynamics of bargaining (Thompson et al. 2010). Economists examine questions around efficiency and fairness of negotiations outcomes (Fehr et al. 1993, Gächter and Riedl 2005, Camerer et al. 2019, among others). Operations Management scholars examine similar questions, but often in a narrower context, almost exclusively within supply chain contracting (Leider and Lovejoy 2016, Davis and Hyndman 2019, and others). In this study we follow the Operations Management tradition, but instead of looking at supply chains we focus on the context of a business that can create value through technological innovation but lacks the resources to make it happen.

We study equity negotiations between an entrepreneur and one or more potential investors. As in any bargaining process, the outcome of the negotiations depends on the bargaining parties' outside options. To understand the bargaining outcomes, we need to understand how outside options are leveraged, both in theory and practice. We focus on three types of entrepreneurial leverage: the leverage of being able to generate revenues from the existing technology, the leverage of being able to walk away and negotiate with another investor, and the leverage of offering the investor a contract that reduces their risk exposure.

The first type of leverage entrepreneurs can use when negotiating with investors derives from the venture having some technological or market advantage, verifiable through standard performance metrics, patents, licensing deals, or proof of concept. It can also derive from being able to capture a large share of the market, verifiable by presenting contracts with large buyers (for B2B/B2G businesses) or engagement metrics (for B2C businesses) and other information that may help investors assess revenue-generating potential.[1]

The second type of leverage is based on the entrepreneur's ability to secure multiple interested investors. In theory, being able to negotiate with multiple parties opens room for more strategic negotiation behavior. However, empirical studies, both in the field and the lab, show that not all negotiators behave strategically and take full advantage of such outside options. For example, prior research has found that receivers demand (and receive) equal shares of the pie in a three-person ultimatum-game with two receivers (Ho and Su 2009), suggesting strong peer-induced fairness; similar deviations from standard theory were found in supply chains (Ho et al. 2014, Davis et al. 2022). In our model and experiments, we will examine negotiations, as well as fairness norms that are invoked when negotiating with a single investor and with two investors.

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[1] Here we focus on "hard" leverage whose value is observable and verifiable (at least approximately) by both sides. Other contexts, in which there is disagreement or large informational asymmetries about the value of the technology are outside the scope of our study.

The third type of leverage is based on the contractual provisions that insure investors (at least to a degree) against the risk of the startup being liquidated, or of its exit generating insufficient proceeds to repay the investors. Field surveys suggest that such provisions (usually termed "liquidation preferences" or "Preferred Stock") are used in about a third of startup term sheets. The rest use Common Stock with no investor protection (CB Insights 2021). Our model and experiments will examine the extent to which entrepreneurs can use the reduction in investor risk as a source of leverage for retaining a larger share of the startup.

In our model a single entrepreneur seeks to obtain a fixed amount of funding. To do so, the entrepreneur negotiates with one or two (depending on the scenario) investors about the allocation of startup equity. To model and solve this bargaining problem, we extend the classic Nash bargaining framework (Nash 1950), incorporating the multiple investor case, uncertainty about the true value of the venture and common equity investment contracts. Consistent with the Nash solution, the negotiating parties choose jointly the actions (in our case, investment amounts and equity allocation) that maximize the Nash product, which is the product of their expected profits, less the disagreement payoffs, weighted by their relative bargaining powers. If the negotiations are successful, a random draw from a commonly known distribution determines the value of the startup. The parties then divide that value according to the negotiated shares, with possible consideration of liquidation preferences. Our study is the first attempt that we are aware of to consider these features of entrepreneur-investor negotiations explicitly.

Within our modeling framework we examine the allocation of startup equity under a varying number of potential investors. When there is only a single investor, the problem reduces to the classic Nash bargaining solution (Nash 1950). However, when there are multiple investors, each bilateral negotiation cannot be treated independently, but rather is embedded within a larger game. This is because any agreement between any two negotiating parties affects the total size of the bargaining surplus for the remaining negotiations. In other words, each bilateral negotiation creates externalities for the other negotiations. To make predictions in this richer environment, we adopt the "Nash-in-Nash" framework. In this framework each bilateral negotiation has a solution given by the Nash bargaining solution, while at the same time, the outcome of the larger strategic game between the entrepreneur and all investors is itself a Nash equilibrium.

Our model provides several testable predictions. First, a negotiator's share should increase with the size of their outside option. This follows directly from the Nash logic of maximizing joint surplus. Second, holding the total investment amount constant, the entrepreneur is always better off negotiating with two smaller investors than with one large investor. This is because, with multiple investors, the entrepreneur has a stronger disagreement point versus each investor resulting from the threat to walk away from one investor and still secure at least a partial agreement with the

Table 1 Survey of Entrepreneurs

Entrepreneur does better …	Vignette 1: Startup has no intrinsic value	Vignette 2: Startup has some intrinsic value
...negotiating with single investor	18.5%	36.1%
...negotiating with two investors	42.9%	36.1%
...about the same	38.7%	27.7%

Note: Columns may not sum to 100% due to rounding. The order in which vignettes were displayed was randomized.

other. In contrast, with only one investor, walking away means that the investment opportunity is lost. Third, with Preferred Stock contracts entrepreneurs should be able to retain a larger share, given that investors are protected in the low state of the world.

To verify whether the theory is consistent with what real life entrepreneurs and investors might find plausible, we partnered with a network of entrepreneurs in the clean energy sector, as well as with a targeted recruitment platform and recruited 119 people with entrepreneurial experience. Their entrepreneurial experience ranged from 6 months to 30 years, and included a range of industrial sectors and different types of entrepreneurial involvement (survey details are in Appendix A.1 and demographic information is in Table A1). We created two short vignettes about an entrepreneur seeking to obtain a fixed amount of funding. We then asked whether the survey respondents thought that the entrepreneur would receive a larger share when negotiating with a single large investor, two smaller investors or that it would be "about the same". We asked this question for two scenarios: one in which the startup had no intrinsic value absent the investment and one in which the startup had some intrinsic value.

The results of the survey (Table 1) suggest that practitioner intuition only partially aligns with theoretical predictions: less than half of respondents hold beliefs that are consistent with theory. However, the respondents anticipate a reduction of the role of the number of investors for a more mature startup – an interaction effect that is also predicted by our theory.

The entrepreneurial survey provides some suggestive evidence that standard economic analysis may oversimplify negotiation behavior. To conduct a more comprehensive set of tests, in which we can explore not only what people believe to be fair, but also how they behave under real financial incentives, we conduct laboratory experiments with student participants. Our main experiment consists of four between-subject treatments which vary the intrinsic value of the startup (higher outside option for the entrepreneur), as well as whether the entrepreneur negotiates with one or with two investors. In each treatment we also look at behaviors under "Common Stock" and "Preferred Stock" contracts.

Similar to the entrepreneurial responses, our experimental results offer mixed support for the model predictions. The first prediction is fully supported; that is, a higher outside option is a credible source of leverage that increases the share retained by the entrepreneur. However, the remaining types of leverage are not always useful. In particular, we find that being able to negotiate with multiple investors may hurt rather than help the entrepreneur. That is, while the hard leverage of having a strong outside option is seen as credible and leads to higher payoffs, the softer leverage of walking away from the negotiations and bargaining with another investor is less credible and does not translate into higher payoffs.

One plausible explanation for the inability of entrepreneurs to leverage multiple investors is a countervailing source of leverage, not captured in the standard model. To realize the full potential of the startup when negotiating with two investors, the entrepreneur requires agreement from both investors. Investors recognize this mutual dependency and can make a plausible argument that the surplus should be divided equally amongst all three parties.

To further explore this conjecture, we conduct a follow-up experiment in which we endogenize the investment amount and allow the entrepreneur to receive the maximum investment amount even if an agreement is only reached with one investor. The results of this follow-up experiment validate our reasoning: when entrepreneurs negotiate with two investors *and* can exclude one investor but still realize the full potential, the entrepreneur's share increases both relative to the original single investor case and relative to the original two investor case.

To reconcile these experimental results with theory, we revisit a key modeling choice in multi-party negotiations – the negotiators' belief about the entrepreneur's disagreement point versus each investor. Existing research offers mixed guidance on how such beliefs should be modeled (see, e.g., Yürükoğlu 2022). Our results suggest that careful belief modeling that accounts for the details of the bargaining environment significantly improves the fit (and thus the realism) of the model. We, therefore, offer an important refinement of cooperative bargaining concepts used in technology development and investment models (Cassiman and Ueda 2006, De Bettignies 2008, Yoo and Sudhir 2022), and suggest a way for such models to accommodate the multiple investor case.

Finally, we show that the third type of leverage – the leverage from providing investors with downside protection via Preferred Stock contracts – does not always increase the entrepreneur's share. Our analysis suggests that with Preferred Stock investors are emboldened to adopt more aggressive bargaining positions, beyond even what they believe is fair, creating a noticeable disadvantage for entrepreneurs.

Taken together, our findings suggest that the fine details of the bargaining environment affect the credibility of various forms of leverage. To retain a large ownership stake in their venture, entrepreneurs can try to shape the environment and time their fundraising efforts in a way that will weaken investors' leverage and strengthen their own. When bargaining with multiple investors, the ability to credibly exclude investors from the final agreement appears to be key. Entrepreneurs should also be cognizant of liquidation preferences and similar financial instruments that limit the downside for the investors. While standard economic analysis suggests that such instruments allow the entrepreneur to retain a larger share (Metrick and Yasuda 2010), they may also affect the investors' bargaining tactics and negotiation outcomes.

2. Related Literature

Bargaining problems (both structured and unstructured) have attracted significant interest in the academic literature (Roth 1995). Most of these studies examine the problem of splitting a pie of a given size, and do not consider the relevant features of the entrepreneurial setting such as multiple investors, size of investment, uncertainty, or equity contract types. We provide a brief survey of the relevant bargaining literature in economics, its applications in operations management, as well as the entrepreneurship literature on equity contracting.

Cooperative Bargaining

The early experimental economics literature focused mainly on testing Nash solution predictions for bilateral negotiations with complete information (Nydegger and Owen 1974, Roth and Rothblum 1982, Murnighan et al. 1988). Two features of the entrepreneurial setting, that the entrepreneur may bargain with multiple investors, and that the size of the pie (value of startup equity) is both endogenous and uncertain, have attracted relatively little attention. The extant studies of multilateral bargaining in economics (see, e.g., Frechette et al. 2003, 2005a,b) are focused on legislative bargaining and have highly structured bargaining formats in order to test features of interest to these models. Embrey et al. (2021) is related in that, like us, they study bargaining over risky pies where risk exposure is asymmetric; but they do not consider multilateral bargaining or different contracts. The literature on splitting pies of endogenous size (Gantner et al. 2001, Bolton and Karagözoğlu 2016, Rodriguez-Lara 2016, Baranski 2019) is similarly small, with the main insight that players often take self-serving bargaining positions. No studies that we are aware of examine the types of equity division contracts that are prevalent in entrepreneurial practice (Common vs. Preferred Stock), or compare the outcomes of single vs. multiple investor bargaining.

Bargaining Applications in Operations Management

While there has been extensive research on bargaining in operations management – much of it has focused on the supply chain context Davis and Leider (2018), Davis and Hyndman (2019). Somewhat surprisingly, some of the results that hold in the (more abstract and sterile) economic setting do not carry over to the more contextualized supply chain setting. For example, Embrey et al. (2021) study bargaining over "risky pies", where one party is a residual claimant and the other receives a fixed payment. They find that residual claimants are able to negotiate a high premium compensating them for risk exposure. In contrast, Davis and Hyndman (2019) find that the party carrying inventory risk is not fully compensated for that risk. Together, these results suggest that the institutional context (i.e., operational environment) matters, even for problems that are mathematically equivalent, and that fairness norms may depend on the context.

Two of the scenarios examined in our study involve negotiations with *multiple* investors. This is an understudied problem in the literature, with the closest being Lovejoy (2010) and Leider and Lovejoy (2016) who study simultaneous bargaining with horizontal competition within a supply chain tier. Different from these studies, which assume single sourcing/contracting within a tier, entrepreneurs may contract with multiple investors. To analyze the multiple investor case we adopt the "Nash equilibrium in Nash bargains", or simply "Nash-in-Nash" framework, which takes a cooperative bargaining approach in the bilateral bargaining stage, and embeds it in a larger strategic game across all participants (Davidson 1988, Horn and Wolinsky 1988, Feng and Lu 2012, 2013, Chu et al. 2020, Mu et al. 2019). Different from this literature we focus on the entrepreneurial setting, and use both analytical and experimental tools to answer our research questions.

Firm Ownership, Entrepreneurship and Innovation

Although firm ownership and financing is one of the classic microeconomic questions (Grossman and Hart 1986, Hart and Moore 1990, Aghion and Tirole 1994), there is some renewed interest in this question with a focus on technology startups (De Bettignies 2008, Akerlof and Holden 2019, Halac et al. 2020, Cui et al. 2020). These studies focus on informational/incentive asymmetries between the players and assume take-it-or-leave-it behavior, bypassing any bargaining or negotiation dynamics. Studies that take a more cooperative approach to bargaining are Hellmann and Wasserman (2017), Hossain et al. (2019) and Kagan et al. (2020). Different from us they study ownership allocation *within* the entrepreneurial team and not *between* the entrepreneur and investors.

The entrepreneur-investor contracting problem has not been investigated in the innovation and product development literature (Krishnan and Ulrich 2001, Kavadias and Hutchison-Krupat 2020); indeed, a recent review of the innovation work in the OM community identifies both contract design and entrepreneurship as two areas that remain understudied from the operational perspective (Kavadias and Ulrich 2020). Lastly, we note that there is a sizable practitioner literature on equity agreements (Metrick and Yasuda 2010, Wasserman 2012, Feld and Mendelson 2019). Our study informs this literature by studying the bargaining dynamics and behaviors that affect the allocation of profits between entrepreneurs and their investors.

3. Model of Entrepreneur-Investor Bargaining

In this section we develop analytical benchmarks for two negotiation regimes: Single investor (SI) and Two investors (TI), and two contracts: Common and Preferred Stock. The end point of the theoretical analysis presented below are Corollaries 1-3, which present the comparative statics on the equilibrium shares and are used to formulate the experimental hypotheses. Extended analyses, which include detailed formulations of the equilibrium shares, investment amounts and profits comparisons across bargaining regimes are in Appendix A.2.

Bargaining with a Single Investor An entrepreneur seeks to obtain $2e$ units of funding from a single investor. We use "Investor 0" when referring to the investor in the single investor case to distinguish it from Investors 1 and 2 in the two investor case. If Investor 0 invests $I_0 \in [0, 2e]$, the value of the business becomes $V = \alpha I_0$, where α is the random multiplier on the investment and can be (H)igh or (L)ow with commonly known probabilities. Specifically, $\alpha = \alpha_H$ with probability p and $\alpha = \alpha_L$ with probability $1 - p$. The uncertainty in α (and hence in V which will be the basis for repaying the equity holders) comes from the technological and market unknowns typical for early-stage ventures.[2]

The entrepreneur and the investor bargain over the investment amount I_0 and the share μ_0 that the investor receives in exchange for the investment (the entrepreneur receives the share $\mu_e = 1 - \mu_0$). If the negotiations are successful, a random draw determines the value of α, and the parties split the realized value of V based on the negotiated shares (with possible consideration of liquidation preferences in the Preferred Stock contract case, defined below).[3] If the negotiations fail, the entrepreneur receives an outside option of $d_e \geq 0$, which represents the profit-generating potential of the current startup technology without the investment, and the investor keeps $2e$.[4]

Bargaining with Two Investors In the two investor case the entrepreneur bargains separately with Investor $i = 1, 2$, each of whom has an endowment of e units of capital, over investment $I_i \in [0, e]$ and Investor i's share μ_i. The value of the startup after the bargaining is $V = \alpha(I_1 + I_2)$. Note that the maximum total investment is equal to $2e$ in both the single investor and the two

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[2] The high and low states of the world represent the scenarios that a startup succeeds (α_H) or fails (α_L). While more complex valuation techniques with richer representations of uncertainty are sometimes used, the "Method of Multiples" with a fixed failure probability is one of the most common valuation methods used in practice (Metrick and Yasuda 2010). Further, we do not model potential information asymmetries between the entrepreneur and the investors, nor do we consider moral hazard. In other words, the return on investment, α is determined by a random draw whose distribution (and later, realization) are common knowledge among the negotiators.

[3] V need not represent the entire value of the startup. Rather, it represents the value of the shares that are *negotiable* in the current funding round, and may exclude equity that is already committed to other shareholders or reserved to incentivize future hires.

[4] The outside option $d_e \geq 0$ represents an alternative use of the entrepreneur's technology in the absence of the investment. For example, the entrepreneur may use the existing technology to generate revenues from a licensing deal, or deploy the technology in a smaller market.

investor cases. In the event of full (resp., partial) disagreement, each disagreeing Investor i keeps their endowment e and does not contribute to the value of the startup or receive any share; i.e., $I_i = 0$ and $\mu_i = 0$, and the entrepreneur receives the outside option of d_e (resp., the sum of the value of the startup from agreement with the other investor and the outside option of $\frac{d_e}{2}$).[5]

Common vs Preferred Stock contracts We investigate two types of contractual arrangements: Common Stock and Preferred Stock contracts. With Common Stock contracts, once the uncertainty about the value of the business is resolved, each party is rewarded according to the negotiated shares regardless of the state of the world. In the high state of the world ($\alpha = \alpha_H > 1$), investor(s) will generally earn a positive profit (or else they would have disagreed to the split). However, in the low state of the world ($\alpha = \alpha_L = 1$) investor(s) will generally suffer a loss since the total proceeds are just enough to cover the initial investment. Thus, under Common Stock contracts, investors put their investment at risk.

With Preferred Stock contracts investors receive downside protection in the form of liquidation preferences. Specifically, we set downside protection to be *exactly equal* to the investment amount. This means, in the high state of the world ($\alpha = \alpha_H > 1$), the value V is divided according to the negotiated shares as long as the investors' share is sufficient to cover their investment amount. If it is not, investor(s) receive their investment amount back. Further, in the low state of the world ($\alpha = \alpha_L = 1$) investor(s) receive their investment back. Thus, under Preferred Stock contracts investor(s) are insured against potential losses in both states of the world.[6]

To distinguish between contracts, we use μ_i^j and I_i^j (resp., $\tilde{\mu}_i^j$ and $\tilde{I}_i^j$) to denote the equilibrium share and investment amount for Common Stock (resp., Preferred Stock) contracts with $i \in \{e, 0, 1, 2\}$ and $j \in \{SI,\ TI\}$.

Equilibrium Characterization The characterization of equilibria for these bargaining problems depends on (p, α_H, α_L), the contract (Common or Preferred Stock), and on the relative bargaining power of the players, indexed by $\theta_i \in [0, 1]$ to denote the relative bargaining power of investor i when bargaining with the entrepreneur. Equal bargaining power is given by $\theta_i = 1/2$. In the single investor case, the equilibrium is always unique. In the two investor case multiple equilibria are possible. This typically happens when $\mathbb{E}[\alpha]$ is low, in which case there are equilibria where

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[5] We focus on the two investor case because it captures many of the first-order bargaining dynamics relative to the single investor case, for example the improved bargaining position of the entrepreneur with multiple investors. However, much of the theoretical analysis can be readily extended to an arbitrary number of investors.

[6] In practice, the extent to which the investor is protected from potential losses (sometimes referred to as "Liquidation Multiple") may be set endogenously by the negotiators. To simplify the analysis and the experiment, we assume an exogenous liquidation multiple of 1. We also note that Preferred stock contracts in practice often entail increased control and voting rights for the investors. We do not examine control issues and focus solely on the surplus allocation properties of contracts.

only one investor invests as well as an equilibrium where both investors invest. When $\mathbb{E}[\alpha]$ is high enough, as will be the case in our experiments, there is a unique equilibrium where both investors invest. The theoretical results below will focus on such parametrizations. Further, we will assume equal bargaining powers. A more complete characterization of the equilibria under general $\mathbb{E}[\alpha]$ and general bargaining powers is relegated to Appendix A.2. Lastly, we assume risk neutrality; however, we also provide some discussion on how risk aversion affects bargaining in Appendix A.2.3.

3.1. Common Stock Contracts

3.1.1. Single Investor In the single investor case, Investor 0 and the entrepreneur bargain over the size of the investment made by the investor, I_0, and the share of the startup, μ_0, that the investor will receive in exchange for making the investment. The entrepreneur's share is given by $\mu_e = 1-\mu_0$. Let d_e (d_0) denote the disagreement point of the entrepreneur (Investor 0); i.e., their respective profits if the negotiation breaks down. In the single investor scenario $d_0 = 2e$ since the investor has $2e$ units of capital as the endowment. Thus, the expected profit of the entrepreneur (resp., Investor 0) is $\pi_e(I_0,\mu_0) = \mathbb{E}[\alpha]I_0(1-\mu_0) + d_e\mathbf{1}_{\{I_0=0\}}$ (resp., $\pi_0(I_0,\mu_0) = \mathbb{E}[\alpha]I_0\mu_0 + 2e - I_0$). Here $\mathbf{1}_{\{C\}}$ is an indicator function which is 1 if condition C is satisfied and zero otherwise. If a deal is settled, the investment I_0 and the share μ_0 maximize the following Nash product:

$$\begin{aligned} \max_{I_0\in[0,2e],\ \mu_0\in[0,1]} \quad & [\pi_0(I_0,\mu_0)-d_0]\,[\pi_e(I_0,\mu_0)-d_e] \\ & \pi_0(I_0,\mu_0)\ge d_0,\ \pi_e(I_0,\mu_0)\ge d_e. \end{aligned} \tag{1}$$

Solving (1), we obtain the following bargaining outcome.

Proposition 1 **(Single investor bargaining)**. *The investor invests $I_0^{SI} = 2e$. The shares are as follows:*

$$\mu_0^{SI} = \frac{\mathbb{E}[\alpha]+1}{2\mathbb{E}[\alpha]} - \frac{d_e}{4e\mathbb{E}[\alpha]}, \quad \mu_e^{SI} = 1-\mu_0^{SI} = \frac{\mathbb{E}[\alpha]-1}{2\mathbb{E}[\alpha]} + \frac{d_e}{4e\mathbb{E}[\alpha]}.$$

Proposition 1 reproduces the standard result from the Nash Bargaining literature: converted to expected profits, the shares equalize the negotiators' gains from negotiating minus their disagreement payoffs.

3.1.2. Two Investors In the two investor scenario, Investors $i = 1,2$ engage separately in bilateral bargaining with the entrepreneur about the investment amounts I_i and the shares, μ_i, received in exchange for their investment. We adopt the Nash-in-Nash solution approach to determine the negotiation outcome; i.e., the negotiation outcomes are derived as a Nash equilibrium of two simultaneous Nash bargaining problems. We denote the outcome of each bargaining unit i (the bargaining between the entrepreneur and Investor i) by (I_i,μ_i) and the collective outcomes by $\boldsymbol{I} =$

(I_1, I_2) and $\boldsymbol{\mu} = (\mu_1, \mu_2)$. Then, the expected profit of the entrepreneur is $\pi_e(\boldsymbol{I}, \boldsymbol{\mu}) = \mathbb{E}[\alpha](I_1 + I_2)(1 - \mu_1 - \mu_2) + \frac{d_e}{2}\sum_{i=1}^{2} \mathbf{1}_{\{I_i=0\}}$ and the expected profit of Investor i is $\pi_i(\boldsymbol{I}, \boldsymbol{\mu}) = \mathbb{E}[\alpha](I_1 + I_2)\mu_i + e - I_i$.

With two investors, the disagreement point of the entrepreneur is not always d_e: when bargaining with one investor breaks down, the entrepreneur may still earn a profit from agreement with the other investor. Hence the entrepreneur will have a disagreement point *versus* each investor i – denoted by d_e^{-i}, which will depend on the shared *beliefs* about what would happen if the entrepreneur and that investor disagreed. We make the assumption common in the literature that the agreement with Investor j is the same, *whether or not the entrepreneur agreed with Investor i* (Yürükoğlu 2022).[7] Then $d_e^{-1} = \pi_e(0, I_2, 0, \mu_2)$ is the profit of the entrepreneur when Investor 2 is the only investor. Similarly $d_e^{-2} = \pi_e(I_1, 0, \mu_1, 0)$. Further, the disagreement point of Investor i is $d_i = e$ since each investor has e units of capital as the endowment. Then, the investments $\boldsymbol{I}$ and the shares $\boldsymbol{\mu}$ maximize the Nash products simultaneously for each $i = 1, 2$:

$$\begin{aligned} \max_{I_i \in [0,e],\ \mu_i \in [0,1]} \quad & [\pi_i(\boldsymbol{I}, \boldsymbol{\mu}) - d_i]\left[\pi_e(\boldsymbol{I}, \boldsymbol{\mu}) - d_e^{-i}\right] \\ & \pi_i(\boldsymbol{I}, \boldsymbol{\mu}) \geq d_i,\ \pi_e(\boldsymbol{I}, \boldsymbol{\mu}) \geq d_e^{-i},\ i \in \{1, 2\}. \end{aligned} \tag{2}$$

Solving (2), we obtain the following proposition:

Proposition 2 **(Two investor bargaining)**. *There exists an equilibrium bargaining outcome in which both investors invest; i.e.,* $I_i^{TI} = e$ *for* $i \in \{1, 2\}$*. The equilibrium shares are as follows:*

$$\mu_i^{TI} = \frac{\mathbb{E}[\alpha] + 1}{5\mathbb{E}[\alpha]} - \frac{d_e}{10e\mathbb{E}[\alpha]},\ i = 1, 2, \quad \mu_e^{TI} = 1 - \mu_1^{TI} - \mu_2^{TI} = \frac{3\mathbb{E}[\alpha] - 2}{5\mathbb{E}[\alpha]} + \frac{d_e}{5e\mathbb{E}[\alpha]}.$$

3.2. Preferred Stock Contracts

Much of the analysis is analogous to the Common Stock contracts. Therefore, we only present the main results below. Detailed formulation and analysis are in Appendix A.2.2.

Single Investor Under Preferred Stock contracts Investor 0 is paid up to I_0 before the entrepreneur receives any proceeds. This is true in both states of the world. Recall that the low state multiplier $\alpha_L = 1$ in our experimental implementation. Thus, in the low state of the world Investor 0 receives exactly I_0 while the entrepreneur receives nothing. The following proposition summarizes the bargaining outcome.

Proposition 3 **(Single investor bargaining)**. *The investor invests* $\tilde{I}_0^{SI} = 2e$*. The shares are as follows:*

$$\tilde{\mu}_0^{SI} = \frac{\alpha_H + 1}{2\alpha_H} - \frac{d_e}{4e\alpha_H p}, \quad \tilde{\mu}_e^{SI} = 1 - \tilde{\mu}_0^{SI} = \frac{\alpha_H - 1}{2\alpha_H} + \frac{d_e}{4e\alpha_H p}.$$

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[7] This assumption is plausible given that the process and the outcome of the negotiation between the entrepreneur and investor i are not observable to investor j. It is, however, an assumption, and one that we will revisit later, in Section 6.2.

Two Investors Under Preferred Stock contracts both investors, if they choose to invest, receive at least their endowments back in both states of the world.[8] The following proposition summarizes the equilibrium bargaining outcomes in these scenarios.

PROPOSITION 4 **(Two investor bargaining)**. *There exists an equilibrium bargaining outcome in which both investors invest; i.e.,* $\tilde{I}_i^{TI} = e$ *for* $i \in \{1,2\}$*. The equilibrium shares are as follows:*

$$\tilde{\mu}_i^{TI} = \frac{\alpha_H + 1}{5\alpha_H} - \frac{d_e}{10e\alpha_H p}, \; i = 1,2, \quad \tilde{\mu}_e^{TI} = 1 - \tilde{\mu}_1^{TI} - \tilde{\mu}_2^{TI} = \frac{3\alpha_H - 2}{5\alpha_H} + \frac{d_e}{5e\alpha_H p}.$$

Propositions 2 and 4 provide existence results for two investor scenarios. For the parameter values used in our experiments these equilibria are also *unique*. Details are provided in Appendix A.2.

3.3. Equilibrium Share Comparisons

We now present comparative statics and relative comparisons of equilibrium shares in each scenario in the following three corollaries. The corollaries follow immediately from examining the expressions in Propositions 1 - 4. Recall that we use μ_i^j (resp., $\tilde{\mu}_i^j$) to denote the equilibrium share for Common Stock (resp., Preferred Stock) contracts, with $i \in \{e, 0, 1, 2\}$ and $j \in \{SI,\ TI\}$.

COROLLARY 1 **(Entrepreneur's Outside Option)**. *The entrepreneur's share increases with the size of the entrepreneur's outside option. That is,* μ_e^j *and* $\tilde{\mu}_e^j$ *with* $j \in \{SI,\ TI\}$ *increase in* d_e*.*

Corollary 1 states that the entrepreneur is able to obtain a larger share when the size of their outside option is larger. Intuitively, the larger their outside option, the better the bargaining position of the entrepreneur, which in turn leads to a higher share.

COROLLARY 2 **(Single Investor vs Two Investors)**. *The entrepreneur obtains a larger share when bargaining with two investors than when bargaining with a single investor. That is,* $\mu_e^{TI} > \mu_e^{SI}$ *and* $\tilde{\mu}_e^{TI} > \tilde{\mu}_e^{SI}$*.*

Corollary 2 states that the entrepreneur prefers the two investor scenario to the single investor scenario. With two investors the entrepreneur has a larger disagreement outcome vis-à-vis each investor because partial agreements with one investor are theoretically possible (though may only occur off the equilibrium path). These partial agreements leave the entrepreneur with positive surplus, allowing the entrepreneur to extract more from each investor. Note also that the results in Corollary 2 hold under both Common and Preferred Stock contracts.

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[8] We assume that each investor is always first compensated out of the profit of the entrepreneur and then, if needed, is compensated out the profit of the other investor. In Appendix A.2.2 we show that the latter scenario cannot occur in equilibrium so that we can restrict attention to the case where the investor who is protected will be compensated out of the profit of the entrepreneur.

Corollary 3 **(Common Stock vs Preferred Stock Contracts)**. *The entrepreneur obtains a smaller share under Common Stock contracts than under Preferred Stock contacts. That is,* $\mu_e^j < \tilde{\mu}_e^j$ *,* $j \in \{SI,\ TI\}$*.*

Corollary 3 states that the entrepreneur receives a higher equilibrium share under Preferred Stock contracts relative to Common Stock contracts. This is because under Preferred Stock contracts, the investors' investments are fully protected when the startup fails, leaving the entrepreneur with nothing in this state. To compensate, the entrepreneur's share of the startup – which the entrepreneur receives only in the high state – must increase.

4. Experiment Design and Hypotheses

To examine whether the leverage that is available in theory is exploitable in practice, we conducted a laboratory experiment. Subjects were recruited at a large public US university. At the beginning of each session subjects were given the role of either an entrepreneur or an investor and kept that role for the duration of the experiment. For brevity, we will refer to subjects by their role: entrepreneur or investor. We follow the common approach in the behavioral operations literature, of "training" participants by presenting them with extensive examples in the instructions, as well as administering a comprehension quiz. In regressions, we also control for entrepreneurial experience (25% of our participants have entrepreneurial experience) and comprehension (quiz performance). Neither of these two measures interacts significantly with our treatment variables.[9] In addition to the experiments described here we also conducted a follow-up experiment whose details are postponed until Section 6.2.

4.1. Experiment Design

Our experiment consists of four between-subject treatments summarized in Table 2. In the first treatment (SI-PoorEnt), an entrepreneur who has no outside option negotiates with a single investor. The lack of an outside option for the entrepreneur means that the entrepreneur receives zero absent an agreement. In the second treatment (TI-PoorEnt), two investors negotiate with a single entrepreneur simultaneously. As before, the entrepreneur's outside option is zero. In the third treatment (SI-RichEnt), the entrepreneur negotiates with a single investor, but has a positive outside option. This is to reflect a business that has some outside value irrespective of any investment. Finally, in the fourth treatment (SI-RichEnt), the entrepreneur negotiates with two investors, and has a positive outside option.

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[9] We note that most cross-population comparisons in Operations Management find few differences in behavior between untrained and professional participants across a variety of operational contexts, including supply chain interactions (Bolton et al. 2012, Choi et al. 2020) and healthcare decisions (Kim et al. 2020). Relative to these contexts, the entrepreneurial context is arguably more accessible to student subjects given the more similar demographics and experiences of the entrepreneurial and the student populations.

Table 2 Summary of Treatments

	Treatment (varied between-subject)	Contracts (varied within-subject)	Sessions/ Subjects
Main Experiment:	Single Investor, entrepreneur has a zero outside option (SI-PoorEnt)	Common Stock, Preferred Stock	10/114
	Single Investor, entrepreneur has a positive outside option (SI-RichEnt)	Common Stock, Preferred Stock	4/50
	Two Investors, entrepreneur has a zero outside option (TI-PoorEnt)	Common Stock, Preferred Stock	6/72
	Two Investors, entrepreneur has a positive outside option (TI-RichEnt)	Common Stock, Preferred Stock	4/54
Follow-up Experiment:	Two Investors, entrepreneur has a zero outside option, investment amount is endogenous (TI-Alt)	Common Stock	4/45

Notes: Of the ten sessions of the SI-PoorEnt treatment, four sessions were conducted with a training phase. The remaining six sessions were conducted without the training phase, with half of the sessions having a reverse ordering of the contracts (Preferred ⟶ Common). This was done to check robustness to learning. In regressions, we include a dummy variable (SI-PoorEnt No Training) to control for these six sessions.

Within each treatment we examine negotiation behavior and outcomes under Common and Preferred Stock contracts. With Common Stock contracts the negotiated split applies to both the high and the low states of the world, while with Preferred Stock contracts the negotiated split applies only in the high state of the world, and the investor(s) receive(s) their investment amount back in the low state of the world. The contract (Common or Preferred) is imposed exogenously and cannot be changed by the negotiating parties. To avoid framing effects contracts were not labeled as "Common" or "Preferred" Stock to participants, but rather were described in neutral language. Our experimental instructions are reproduced in Appendix A.6.

Negotiation Format The negotiation format is semi-structured: players can make or accept offers specifying a share of the realized startup value (between 0 and 100%) that the investor will receive in exchange for their investment.[10] No structure is placed on who may propose first, or on the order or proposals. Players may not exchange verbal messages during the negotiations. All negotiations are bilateral, including the two investor case. That is, in the TI-PoorEnt and TI-RichEnt the entrepreneur negotiates separately (and privately) with each investor: Investor 1 cannot see the offers exchanged between the entrepreneur and Investor 2, and vice versa. At the end of each round the results of all negotiations are announced to all players in a dyad/triad.

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[10] In the main experiment we do not test our theoretical prediction (for our parameters) that all investors invest their full endowment in equilibrium. That is, players negotiate over a single parameter: the share(s) received by the investor(s). If players reach an agreement, the investment amount is equal to the endowment; if not, it is zero. In the follow-up experiment (Section 6.2) the parties also negotiate over the investment amount.

In the PoorEnt treatments, if the entrepreneur cannot secure an agreement with *any* investor within the specified time (90 seconds in the single investor treatments, or 180 seconds in the two investor treatments), then the entrepreneur receives nothing. In the RichEnt treatments, failure to reach an agreement would leave the entrepreneur with their outside option. In the two investor cases, if negotiations fail with one investor, the entrepreneur can try to secure a deal with the other investor. If negotiations succeed with only one investor, then the entrepreneur also receives half of their outside option, $^{d_e}/_2$. Any investor who is unable to reach an agreement with the entrepreneur receives their outside option (i.e., their initial endowment).

Additional measurements At the end of the experiment we elicited subjects' risk preferences, both in the gains-only and in the gains-and-losses domain (Eckel and Grossman 2002, 2008). Additionally, we administered a short survey, which included a non-incentivized measure of the subjects' fairness perceptions. The survey questions were based on Babcock et al. (1995) and asked subjects: "According to your opinion, from the vantage point of a non-involved neutral arbitrator, what would be a 'fair' share of the business that should go to the investor (to Investor 1/Investor 2 in TI)?" This question was asked separately for Common and Preferred Stock contracts. We will use the answers to these fairness questions to gain a better understanding into the division norms driving our results (Section 5.3).

Parameters and Hypotheses Consistent with our theoretical development in Section 3 we set $\alpha_L = 1$, such that the value of the firm in the low state of the world is exactly equal to the investment. We set $e = 100$, such that the total available investment is 200 in all treatments. Further, we set the probability of the high state of the world (i.e., that $\alpha = \alpha_H$) to be $p = 0.2$, and the multiplier $\alpha_H = 11$. A low value of p and a high value of α_H are reflective of the entrepreneurial context in which there is a small probability of large profits and a large probability of failure. Lastly, the expected return on investment is $\mathbb{E}[\alpha] = 0.2 \times 11 + 0.8 \times 1 = 3$; thus the expected size of the pie is also held constant at $200 \times 3 = 600$ in all treatments and under all contracts, provided that all agreements are secured. The equilibrium shares under this parametrization are in Table 3.

The above parameters were chosen to (a) produce noticeable differences in the anticipated effects (between 9.7 and 18.1 percentage points) and (b) facilitate calculations and intuition building for untrained participants in the lab. This allows us to make robust predictions about the direction of the hypothesized effects. We summarize these predictions in Table 4, where we also report the level of support in the data from the entrepreneurial survey (Section 1) and a preview of our experimental results (Section 5.2) and of the fairness survey (Section 5.3).[11]

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[11] Note that our hypotheses focus on the direction of the proposed effects and not on the point predictions. That is, we test which sources of theoretical leverage can be exploited in practice, but not necessarily the extent to which they are exploited (see List and Levitt 2005, for a discussion of valid tests of theoretical models in the lab).

Table 3 **Predicted Shares for $\theta = 0.5, e = 100, \alpha_H = 11, \alpha_L = 1, p = 0.2; d_e = 0$ in PoorEnt; $d_e = 160$ in RichEnt**

	Common Stock		Preferred Stock	
Treatment	Entrepreneur's Share (%)	Investors' Share (%)	Entrepreneur's Share (%)	Investors' Share (%)
SI-PoorEnt	33.3	66.7	45.5	54.5
SI-RichEnt	46.7	53.3	63.6	36.4
TI-PoorEnt	46.7	53.3	56.4	43.6
TI-RichEnt	57.3	42.7	70.9	29.1

Notes: Investor column refers to Investor 0 in SI treatments and to combined (Investor 1 + 2) share in TI treatments.

Table 4 **Summary of Hypotheses and Preview of Results**

Hypothesis		**Entrepreneurial survey (Section 1)**	**Experimental data (Section 5.2)**	**Fairness survey (Section 5.3)**
H1:	Entrepreneur's share increases with the size of the outside option	n.a.	S	n.a.
H2:	Entrepreneur's share is higher with two investors than with a single investor	PS	PS	n.a.
H3:	Entrepreneur's share is higher with Preferred Stock contract relative to Common Stock contract	n.a.	PS	S

Notes:"S" indicates that the hypothesis is fully supported with the comparison being significant at $p < 0.05$. "PS" indicates that the hypothesis is partially supported, i.e., at least one of the comparisons is significant at $p < 0.05$. "n.a." indicates that the question was not examined in the respective study.

Experimental procedures and protocols The experiment was programmed in oTree (Chen et al. 2016) and conducted virtually via Zoom, using a protocol that was adapted from Zhao et al. (2020) and Li et al. (2020). Further details are provided in Appendix A.6. For the main experiment we recruited a total of 290 participants. Each participant was limited to one session and, within a session, participated in several rounds of the same treatment. At the beginning of each round subjects were randomly matched into a dyad (SI treatments) or triad (TI treatments).[12] Subjects were paid for one randomly selected round and we did not reveal the realized startup value in any round until after all rounds were completed. This was to avoid wealth effects. Average earnings were $17.38 (min. $5; max. $48.40) including the show-up fee of $8.[13]

[12] The number of rounds played by each subject varied by treatment (between 6 and 10), so that the total time spent in the experiment did not exceed 80 minutes, and the average was approximately 60 minutes. In some early sessions we allowed participants to practice during training rounds, in which subjects begin by negotiating over a pie whose size is either $I \times \alpha_H$ or zero, which makes negotiations simpler relative to our base case. There were no notable effects of the training phase on subsequent behaviors. We do not report the results of the training phase in our analysis; however including these rounds does not change any of our findings (results available from the authors upon request).

[13] It was possible to earn less than the show-up fee because of the possibility of losses in the risk-elicitation task.

Table 5 **Agreement Rates**

Treatment	Disagreement (%)	Partial Agreement (%)	Full Agreement (%)
SI-PoorEnt	14.62	n/a	85.38
SI-RichEnt	23.20	n/a	76.80
TI-PoorEnt	1.04	19.79	79.17
TI-RichEnt	4.27	20.14	75.60

Notes: Percentage of all negotiations are reported. In the TI treatments, a "Partial Agreement" occurs when the entrepreneur agrees with one investor only, while a "Full Agreement" occurs when the entrepreneur agrees with both investors.

5. Results

We begin by reporting a brief summary of the data from our four main experimental treatments, before proceeding to formally test our hypotheses and providing a richer analysis. In our statistical analysis below, we report non-parametric tests based on subject averages as well as random effects regressions with standard errors corrected for clustering at the session level.

5.1. Summary Statistics

Table 5 provides summary statistics on agreement rates. Although theory predicts that disagreements of any kind should never occur, we see that they are fairly common, occurring between 14 and 25% of the time. Moreover, full agreements are less likely to be reached when the entrepreneur is rich, and the difference is significant ($p < 0.01$, rank sum test). While not predicted by the theory, this result is not surprising. When the entrepreneur has a significant outside option, there is less scope for a mutually beneficial agreement and, moreover, the entrepreneur is putting her endowment at risk by reaching an agreement with the investor(s). We also see that the frequency of full agreements is lower when negotiating with two investors than when negotiating with a single investor, but the difference is not significant ($p = 0.41$, rank sum test).

Turning now to negotiated shares reported in Table 6, we see that the negotiated share the entrepreneur receives is generally higher when the entrepreneur has a significant outside option. This provides some suggestive evidence for H1. However, support for H2 and H3 appears to be mixed. The entrepreneur's share ranges is between 43 and 52% when negotiating with a single investor and between 33 and 39% when negotiating with two investors. Further, Preferred Stock contracts appear to increase the entrepreneur's share only in the RichEnt scenarios.[14]

5.2. Hypothesis Tests

In Table 7 we formally test our hypotheses with a series of random effects regressions, where the dependent variable is the entrepreneur's negotiated share. The baseline in these regressions is the SI-PoorEnt treatment under a Common Stock contract. We include indicator variables for the

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[14] In addition to the average shares in Table 6, we also report average expected profits conditional on full agreement as well as the unconditional average expected profits in Table A3 in the Appendix.

Table 6 Summary Statistics on Negotiated Shares for Entrepreneurs, Conditional on Full Agreement

	Common Stock	Preferred Stock	Common Stock vs Preferred Stock
SI-PoorEnt	43.30	42.97	↗ →
SI-RichEnt	48.35	52.28	↗ ↗
SI: PoorEnt vs RichEnt	↗ ↗	↗ ↗	
TI-PoorEnt	34.81	34.52	↗ →
TI-RichEnt	32.72	38.56	↗ ↗
TI: PoorEnt vs RichEnt	↗ ↘	↗ ↗	
SI-PoorEnt vs TI-PoorEnt	↗ ↘	↗ ↘	**Legend:**
SI-RichEnt vs TI-RichEnt	↗ ↘	↗ ↘	↗ theory ↗ data

Notes: Dashed black arrows (↗) indicate theoretical predictions for the direction of the effect, based on risk neutrality and equal bargaining powers. Blue arrows (↗) indicate the direction of the effect in the experimental data. Any change under 1 percentage point is represented by a horizontal arrow.

Table 7 Marginal Effects for Entrepreneur's Share (Conditional on Full Agreement)

	(1)		(2)		Hypothesis Tests
Average Marginal Effects					
Rich Entrepreneur	8.405^{***}	(2.282)	10.384^{***}	(1.978)	H1: Supported
Two Investors	-9.206^{***}	(1.855)	-8.663^{***}	(1.850)	H2: Not Supported
Preferred Stock	0.821	(1.083)	1.011	(1.116)	H3: Partially Supported (see below)
Conditional Marginal Effects					
Preferred Stock (PoorEnt)	-0.925	(1.517)	-0.666	(1.556)	H3: Not Supported
Preferred Stock (RichEnt)	3.629^{***}	(0.877)	3.620^{***}	(0.954)	H3: Supported
Preferred Stock (SI)	0.525	(1.255)	0.633	(1.295)	H3: Not Supported
Preferred Stock (TI)	1.675	(1.157)	2.023^{*}	(1.200)	H3: Not Supported
Controls	No		Yes		

Notes: This table reports marginal effects based on random effects regressions where the dependent variable is the entrepreneur's share and the explanatory variables are indicators for the RichEnt treatments, the TI treatments and Preferred Stock contracts and a full set of interactions. Column (2) also contains control variables. Controls are age, gender, entrepreneurial experience, number of quiz errors, risk aversion (measured post-task using the Eckel and Grossman (2002) elicitation mechanism) and an indicator variable for a second wave of data collection for SI-PoorEnt. See Table A4 in the appendix for the underlying regression results. *, **, *** denotes significance at the 10, 5 an 1% level, respectively.

three experimental manipulations (Outside option, Two investors, Contract type) and the full set of interactions among them. Additionally, in column (2) we include several demographic controls (see table note). For ease of exposition, the table reports estimated marginal effects, with the full regression results contained in Table A4.

We find broad support for H1. That is, consistent with the theory predictions, a larger outside option significantly increases the entrepreneur's share. Further, H2 is rejected: rather than increasing the entrepreneur's share, negotiating with two investors actually harms the entrepreneur. Finally, the support for H3 is only partial. In particular, the share increases significantly only under Preferred Stock contracts when the entrepreneur has a positive outside option. There is also directional support for H3 in the TI treatments, although not at the 5% significance level. This suggests that entrepreneurs can more credibly deter the aggressive negotiating positions taken by the investors under Preferred Stock contracts when they have a significant outside option and, to a lesser extent, when there are two investors that can be played against each other.

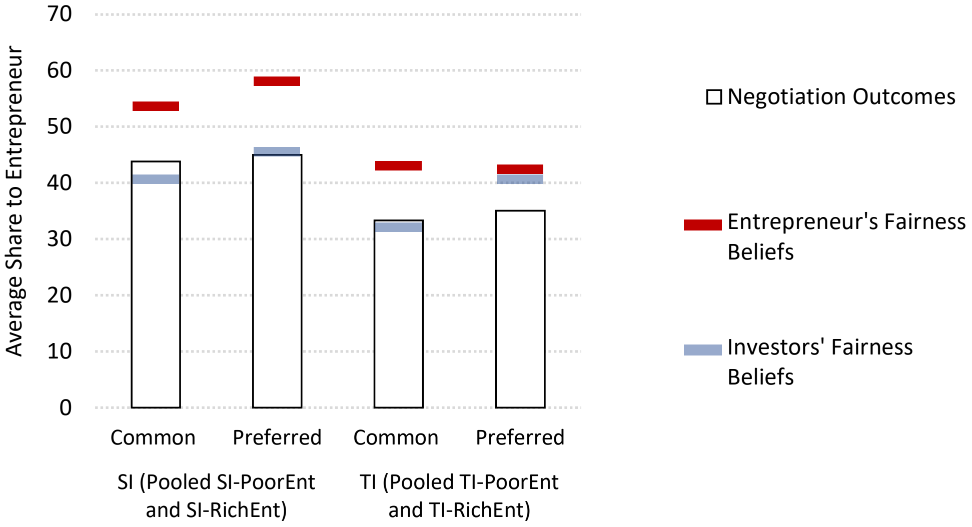
5.3. Fairness Beliefs

The failure to adjust the shares to the differences in contract types, and the resulting lack of support for Hypothesis 3 may indicate that our experimental participants failed to understand the differences between Common and Preferred Stock contracts. To better understand the participants' reasoning and behavior, we therefore examined their fairness beliefs; i.e., their responses to the (unincentivized) question of what a fair equity allocation would look like. Figure 1 summarizes the results, focusing on the fair share of the entrepreneur, and plotting the session averages by treatment and by contract.

First, unsurprisingly, in all four cases the investors' fairness beliefs are substantially below the entrepreneurs' fairness beliefs about the entrepreneur's share (average across all treatments and contracts, 39.04 vs 51.82, $p \ll 0.01$). Second, in all four cases the agreed share to the entrepreneur is always closer to the investors' fairness beliefs than to the entrepreneurs' fairness beliefs. This suggests that investors were better able to employ tactics to pull the outcome closer to their perceived fair outcome. In particular, for entrepreneurs, agreements are 9.88 points *below* their fairness beliefs, while for investors agreements are – surprisingly – 0.75 points below their fairness belief. That is, on average, investors were able to hold the entrepreneurs to *less* than even what they thought was fair. This difference between entrepreneurs and investors is significant at $p \ll 0.01$. Third, consider the comparison between Common and Preferred Stock contracts. As shown in the previous section, the negotiated outcomes are indistinguishable between Common and Preferred Stock contracts in the SI case, and are only slightly higher for the TI case. In contrast, if we consider the fairness beliefs, going from the Common to the Preferred Stock contract, they significantly increase for both the SI (46.74 vs 51.82, $p \ll 0.01$) and the TI case (35.62 vs 41.45, $p \ll 0.01$), which would fully support Hypothesis 3. The one exception appears to be for entrepreneurs in the TI treatments, where fairness beliefs are essentially equal for the two contract types.

One particularly striking result is that overall and, in particular, under Preferred Stock contracts, the negotiated share to the entrepreneur is actually *below* the investors' fairness beliefs for

Figure 1 **Fairness vs. Negotiation Outcomes**



both the single investor and two investor treatments. This suggests that investors know that it is fair to allocate more to entrepreneurs when they (the investors) have the downside protection afforded by the Preferred Stock contracts, but they, nevertheless, bargain aggressively to maximize their own share. Indeed, such behavior was even noted by investors in their comments after the experiment, with one investor reporting, “It was great as I can freely invest without fear of [losing] my investment. Can take a lot of risk in this scenario.” Another investor said, “I tried to be more aggressive. I would get back my money either way if it failed.” In Section 7 we will provide some discussion about how such behaviors can be incorporated into bargaining models.

6. Reconciling Theory and Behavior

Two results that are not consistent with our theory are the effects of increasing the number of investors (H2) and – at least partially – the effects of the contract type (H3). In Section 5, we saw that the contract effect was in the correct direction, but was not strong enough to support H3. The analysis of fairness beliefs (Section 5.3) rules out that this was due to comprehension issues or alternative fairness notions, and suggests instead that the parties understood the contracts yet interpreted the contract as a signal to bargain more/less aggressively. In this section we seek to understand the lack of support for H2; i.e., the inability of entrepreneurs to leverage multiple investors. To do so we will discuss what constitutes bargaining leverage, introduce and test a modified bargaining environment to give entrepreneurs more leverage and end with a discussion of how theory may be revised to better account for the patterns in the data.

6.1. What Is "Fair" and What Constitutes Leverage?

Consider the average shares of entrepreneurs (Table 6). Entrepreneurs earn more than predicted in SI (and closer to an an equal split of 50%), and less than predicted in TI (and closer to an equal split of 33.3%), strongly suggesting egalitarian fairness as a salient norm for splitting the surplus. In the SI treatments entrepreneurs can, implicitly, call on the fairness norm as a way to justify their claim for a larger share than suggested by theory. Similarly, in the TI treatments, investors can make implicit calls to fairness (towards the entrepreneur or towards the other investor) to justify giving entrepreneurs less than predicted by theory. Such behaviors have been observed in other bargaining contexts (Embrey et al. 2021) and are sometimes referred to as "superficial fairness", which describes division rules that seem fair but fail to account for complexity, exposure to risk, or contractual details (see Davis 2022, for a recent survey).

A plausible explanation for the attractiveness of the superficially fair, equal split norm in the TI treatments is the mutual dependence between all three negotiators. Indeed, to achieve the largest possible pie size, the entrepreneur needs both investors to agree to invest. Given that both investors are needed, it makes sense that both investors should be treated equally. It is only a small additional step for investors to think that they should get the same share as the entrepreneur, given that they have some control over the size of the business and given that they are putting money at risk.

One potential way to limit the salience of the equal split fairness norm is to reduce the dependence of the entrepreneur on both investors. Consider a startup seeking to raise 200 units, as in our original experiment. There are two investors, as in the TI treatments. However, rather than being limited to investing 100 units at most, each investor can now invest up to 200 units. That is, the maximum total investment is still 200, but this can now be achieved by any combination of $I_1, I_2 \in [0, 200]$ such that $I_1 + I_2 \leq 200$. Why should this bargaining scenario increase the entrepreneur's leverage? First, competition in bargaining has been shown to lead to very unequal outcomes even when players have strong fairness preferences (Fehr and Schmidt 1999). Second, unlike in the original experiment, entrepreneurs will now have much more flexibility to negotiate an agreement – up to and including full investment – with one investor. The ability to exclude the second investor should give the entrepreneur noticeable leverage in the negotiations.[15]

6.2. Alternative Bargaining Environment (TI-Alt)

6.2.1. Predictions The idea that competition among investors should increase the entrepreneur's share aligns with intuition but does not align with the Nash-in-Nash bargaining

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[15] This scenario is somewhat similar to legislative bargaining experiments with "minimum winning coalitions" (Baranski and Morton 2021, Agranov 2022). In these, only the minimal number of players needed to win are included so as to split the surplus over fewer players. To map our setting to legislative bargaining, the entrepreneur would represent a veto player (who must be included in the winning coalition) and the investors would be non-veto players, with only one investor needed to create a winning coalition.

logic. Indeed, in Appendix A.3 we show that, assuming equal bargaining powers, there is a continuum of equilibria, which give the entrepreneur a share that is bounded from below by the share predicted in the original SI-PoorEnt case (33.3%) and is bounded from above by the share predicted in the original TI-PoorEnt case (46.7%). This follows from the way Nash-in-Nash theory represents negotiators' beliefs about disagreement points. For example, in the equilibrium where $I_1 = 200$ and $I_2 = 0$, the standard assumption is that negotiators' off-equilibrium beliefs is that $I_2 = 0$ even if the entrepreneur cannot reach an agreement with Investor 1. Hence, the equilibrium share in this case is mathematically equivalent to the SI case and is equal to 33.3%.

To formulate predictions for this alternative environment we will revisit Hypothesis 2 from Section 4 (Table 4). To obtain a prediction we can either use standard theory as a theoretical benchmark, or we can use the results of our initial wave of experiments as an empirical benchmark. Theory suggests that the entrepreneur's share should be in between the SI-PoorEnt and the TI-PoorEnt cases. In contrast, our intuition in Section 6.1 suggests that the entrepreneur should be able to receive a larger share relative to TI-PoorEnt (34.81 % under Common Stock, see Table 6), given that the entrepreneur now has the additional leverage – not captured by standard theory – of being able to exclude one of the investors. We therefore formulate two competing hypotheses summarizing our predictions. Note that our hypotheses focus only on Common Stock contracts (we will not examine Preferred Stock contracts in this alternative scenario).

Hypothesis 2-Alt (H2-Alt):

(a) *The entrepreneur's share in TI-Alt is at least 33.3% and at most 46.7%.*

(b) *The entrepreneur's share in TI-Alt is higher than the average empirical share in TI-PoorEnt (34.81%).*

6.2.2. Follow-up Treatment To test H2-Alt we conducted a follow-up treatment with a new set of subjects drawn from the same student subject pool as the initial wave of experiments. The treatment was similar to the TI-PoorEnt treatment in that the startup had zero value if the entrepreneur could not agree with at least one investor, and the maximum total investment was 200. However, unlike the TI-PoorEnt treatment, each investor had 200 units of capital and could negotiate with the entrepreneur to invest 50, 100, 150 or 200 units of capital, subject to the constraint that the total investment of both investors be less than or equal to 200. This experiment was conducted with Common Stock contracts for 8 periods.[16]

Table 8 contains a summary of the results. In panel (a), we show the frequency of agreement types. The most common agreement is exclusionary and efficient ($I_i = 200, I_j = 0$). That is, the

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[16] There was no discernible time trend in the entrepreneur's share to indicate learning occurred.

Table 8 Summary Results on TI-Alt

(a) Breakdown of Agreement

	Freq.	Percent
Full Agreements ($I_1 + I_2 = 200$)		
$I_i = 200,\ I_j = 0$	50	42.37
$I_1 = I_2 = 100$	10	8.47
$I_1 \neq I_2,\ I_i > 0$	20	16.95
Partial Agreements ($I_1 + I_2 < 200$)	38	32.20
Overall	118	100.00

(b) Average Entrepreneurs' Share, Conditional on $I_1 + I_2 = 200$

Full Agreements ($I_1 + I_2 = 200$)	TI-Alt	Benchmark: SI-PoorEnt	Benchmark: TI-PoorEnt
$I_i = 200,\ I_j = 0$	59.71%	43.30%	
$I_1 = I_2 = 100$	42.50%		34.81%
$I_1 \neq I_2,\ I_i > 0$	32.10%		
Overall Average$^{\text{(see Note 1)}}$	48.25%	43.30%	34.81%**

For TI-Alt, the overall average reports the subject average, while for each subcase above (due to small sample sizes), overall averages are reported. ** indicates that the overage entrepreneur share in TI-PoorEnt is significantly different from that in TI-Alt at the 5% level, based on a rank-sum test on subject averages.

entrepreneur reaches an agreement with one of the investors to invest the full amount, excluding the second investor. Less than 10% of agreements are symmetric, with investors investing equal amounts. Panel (b) shows the entrepreneur's share for various agreement types, focusing on efficient investments ($I_1 + I_2 = 200$). In all cases, the share is greater than or equal to the entrepreneur's share in SI-PoorEnt. Indeed, when the agreement is exclusionary, which is the most common outcome, the entrepreneur receives a nearly 60% share, and this is significantly different from the SI-PoorEnt benchmark (rank-sum test, $p \ll 0.01$). Moreover, the overall average entrepreneur's share is significantly higher than the TI-PoorEnt benchmark (rank-sum test, $p < 0.05$). It is also significantly higher than the theoretical SI-PoorEnt benchmark of 33.3% (sign-rank test, $p < 0.05$), but it is not significantly different from the TI-PoorEnt benchmark of 46.7% (sign-rank test, $p \gg 0.1$).

In sum, the alternative bargaining environment with endogenous investments provides support for both H2-Alt (a) and H2-Alt (b): Entrepreneurs can leverage multiple investors to extract a larger share relative to the theoretical prediction for the SI case, with the share not being significantly different from the theoretical prediction for the TI case (supporting H2-Alt (a)). The new treatment also increases the entrepreneur's share relative to the empirical average in TI-PoorEnt (supporting H2-Alt (b)). However, the mechanism by which they do so differs somewhat from the Nash-in-Nash bargaining theory, which predicts that the entrepreneur would benefit only in the case of split

Table 9 **Model Fit (Common Stock Contracts and PoorEnt Treatments Only)**

		SI Treatments		TI Treatments		TI-Alt Treatment	
		MSE	$\hat{\theta}_i$	MSE	$\hat{\theta}_i$	MSE	$\hat{\theta}_i$
(i)	Equal Split	0.043	N/A	0.033	N/A	0.186	N/A
(ii)	Nash-in-Nash, Equal bargaining powers	0.055	0.500	0.102	0.500	0.169	0.500
(iii)	Nash-in-Nash, Best fitting bargaining powers	0.040	0.355	0.066	1.000	0.102	0.192
(iv)	Nash-in-Nash alternative beliefs, Best fitting bargaining powers	N/A		0.045	0.462	0.091	0.472

Notes: The investor's bargaining power $\hat{\theta}_i$ is either set to 0.5 (row (ii)) or set to the bargaining power with the best fit for a given treatment (rows (iii) and (iv)). In the SI treatments, $\hat{\theta}_i$ denotes the bargaining power of the single investor. In the TI treatments, $\hat{\theta}_i$ denotes the average bargaining power of the two investors. In row (iv) we make alternative assumptions about the negotiators' beliefs about disagreement points. In the TI treatments, we assume that the belief is that the entrepreneur will not be able to come to an agreement with the second investor. In the TI-Alt treatment, we assume that the entrepreneur will be able to obtain full investment from the second investor.

investments. In contrast, we find that in most cases, entrepreneurs set off a competition among investors to negotiate an exclusionary deal with a single investor only, yet this allows them to negotiate a significantly higher share than in both the SI-PoorEnt and TI-PoorEnt scenarios.

6.3. Model Fit

Our theoretical development in Section 3 and the resultant hypotheses in Section 4 assumed equal bargaining powers, i.e., $\theta_i = 0.5$ across all treatments. This default assumption is based on the idea that any individual differences in bargaining style should balance out as subjects in the experiment are randomly assigned to a role of an entrepreneur or an investor. Relaxing the equal bargaining power assumption and estimating $\hat{\theta}_i$ from the data may help improve model fit and correct for some of the power imbalance resulting from residual sources not captured by the model (for example, the contract type may affect bargaining power as discussed in Section 5.3). Perhaps more importantly, estimating $\hat{\theta}_i$ may expose potential model misspecification. For example, $\hat{\theta}_i$ close to 0 or to 1 would indicate that the model fails to capture some key aspect of behavior.

To examine model fit, we compute the mean squared error (MSE) between the predicted shares and the negotiated shares observed in the data. We begin by examining the fit for three theoretical benchmarks: (i) the "superficially fair" equal split norm discussed in Section 6.1 where the entrepreneur and investor(s) all receive an equal share ($^1/_2$ in SI and $^1/_3$ in TI and TI-Alt), (ii) the Nash-in-Nash model predictions under the assumption of equal bargaining power ($\theta_i = 0.5$ for all i) and (iii) the Nash-in-Nash model where we use the best-fitting θ_i for each treatment.

Our estimation results are in Table 9, which shows MSE for each model, given $\hat{\theta}_i$ (the investor's bargaining power). Consider first the SI and TI treatments. Model (ii), i.e., our normative theory with equal bargaining powers ($\theta = 0.5$) fits the data the worst. For the SI treatment, the best fit is obtained by model (iii) with $\hat{\theta}_i = 0.355$. This estimated θ_i is substantially below 0.5, implying that entrepreneurs have relatively more leverage. Moreover, the fit is only marginally better than simply assuming an equal split. In the TI treatments, model (i), i.e., equal split is the best-fitting model, with a mean squared error doubling even for the normative model with the best fitting $\hat{\theta}_i$. Indeed, for the TI treatments the corner case $\hat{\theta}_i = 1$ achieves the best fit, indicating full bargaining power for the investors. Both of these results suggest that the equal-split norm does a significantly better job at explaining behavior and point to fundamental flaws in the descriptive validity of Nash-in-Nash theory in the multiple investor case.[17] For the TI-Alt treatment, the Nash-in-Nash model with the best-fitting θ_i fits the data substantially better than the other two models. However, $\hat{\theta} = 0.192$, which appears implausibly low.

6.4. Refinement of the Nash-in-Nash Model

To understand the lack of fit of the model in the two-investor case (TI treatments) consider how standard theory models the negotiators' outside options. The common assumption in the Nash-in-Nash literature is that the agreement between the entrepreneur and investor i is the same whether or not the entrepreneur agreed with investor j (Yürükoğlu 2022), and this belief is what gives the entrepreneur leverage in the main TI treatments. Similarly, in the TI-Alt treatment, the underlying assumption is that, in the event of disagreement with one investor, the agreed share and investment amount with the other investor do not change. This limits the ability of the entrepreneur to make investors compete for being included in the deal. However, our results suggest that such competition is common, and this benefits entrepreneurs.

To accommodate observed behaviors, we consider alternative assumptions on the negotiators' beliefs about disagreement points. In the main TI treatments, we must remove the entrepreneur's theoretical leverage that investors found not credible. To this end, we assume that disagreement with one investor implies disagreement with the other investor (details are in Appendix A.4). The results are presented in row (iv) of Table 9. As can be seen, the fit improves substantially and the estimates of θ_i are closer to 0.5, which we deem to be more plausible. Note, however, that the fit is still worse than the equal split (0.045 vs. 0.033), which suggests that fairness still has a role to play in explaining behavior.

In the TI-Alt treatment, while the standard theory with θ_i estimated fits behavior well, the estimates of θ_i are significantly below 0.5 and close to 0.2. Again, this suggests that the original model fails to capture the entrepreneur's leverage. In Appendix A.5 we consider a modification of beliefs such that the entrepreneur's outside option is the maximum of the original outside option

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[17] While we do not report estimates for Preferred Stock contracts, the same general patterns emerge, but the estimates of θ_i are higher, indicating more investor bargaining power, consistent with our previous results.

and full investment with a single investor (i.e., the theoretical prediction from the SI-PoorEnt treatment). The estimation results are in the bottom-right cell of Table 9. Similar to the main TI treatments, the fit improves and the estimates of θ_i are somewhat closer to 0.5, which suggests that our alternative approach is a more accurate representation of observed behavior.

7. Conclusion

Equity negotiations are an essential part of entrepreneurial growth. This is the first study that we are aware of to explicitly model the key features of entrepreneur-investor bargaining, which includes the intrinsic value of the startup, uncertain valuation, multiple investors and the contracts common in the industry. We used the Nash-in-Nash framework to uncover the theoretical sources of leverage and to develop hypotheses regarding the split of shares between the entrepreneur and the investors. We then conducted lab experiments to test whether the leverage that is available in theory is exploitable in practice.

Insights and Practical Implications. Our investigation offers several novel insights into equity bargaining. Our theory predicts that entrepreneurs benefit from having a hard outside option and this result is strongly supported by the behavior of subjects in our experiments. Although this result is not surprising, it is still worth emphasizing. To the extent possible, entrepreneurs should work to develop the hard leverage of a valuable and objectively verifiable advantage before seeking a large outside investment. Such outside options can be in the form of existing contractual relationships with customers, licensing deals, and other sources of recurrent revenues.

Going beyond this simple insight, our theory also predicts that entrepreneurs should be able to benefit from negotiating with multiple investors and that they should receive a higher share when offering investors downside protection via Preferred Stock contracts. Neither of these predictions was fully supported by our data. In our main experiments, entrepreneurs actually received lower shares when negotiating with two investors, and their shares were only higher under Preferred Stock contracts when they had a substantial outside option.

To understand the low sensitivity to contract type we examined the negotiators' fairness beliefs and found them to be quite close to the theory predictions, and – in the investors' case – strikingly different from actual behavior. That is, investors understand that it is fair to give the entrepreneur a higher share under Preferred Stock contracts. Nevertheless, their behavior tells another story. The downside protection afforded by Preferred Stock contracts actually emboldens them to bargain more aggressively, increasing their share at the expense of the entrepreneur. Investors' comments in the exit questionnaire provide some suggestive evidence that this is because downside protection increases their reference points, something that is not captured by standard bargaining models.[18]

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[18] This echoes a result found by Davis and Hyndman (2019) in a supply chain bargaining context where inventory risk holders were not adequately compensated. However, the mechanisms in our study appear to be different.

The implication of this result in practice is that caution is warranted when offering investors downside protection. Entrepreneurs should make clear that the downside protection offered by Preferred Stock contracts is valuable and should be compensated via a lower share to the investor.

The result that entrepreneurs do not benefit from negotiating with multiple investors is surprising given the theoretical advantage suggested by Nash-in-Nash theory. In theory, multiple investors give the entrepreneur leverage because disagreement with one investor does not leave the entrepreneur empty-handed. However, our experiments strongly suggest that this is not necessarily viewed as credible leverage; rather, the equal-split norm emerges as both fair and compelling. Our follow-up experiment puts this logic to a more rigorous test: when the environment is changed so that the entrepreneur and one investor only are sufficient to realize the full potential of the start-up, investors compete with each other and the equal-split norm is no longer salient, to the entrepreneur's benefit. The lesson for entrepreneurs is to delay large-scale fundraising campaigns until their technology and business model are sufficiently mature and investors are more institutionalized and substitutable.

Implications for Theory Development. Our results also provide meaningful takeaways for theory development. First, the more aggressive investor behavior under Preferred Stock contracts and the implied shift in reference points is not part of standard models of bargaining under uncertainty. Future research could study and model such shifts in reference points.[19]

Second, theorists need to be careful when modeling the negotiators' beliefs about disagreement points. In multi-party negotiations, beliefs are a key driver of the entrepreneur's theoretical leverage. Most bargaining models simply pick beliefs that are consistent with the equilibrium outcome (Yürükoğlu 2022). Being more careful in modeling these beliefs can significantly improve predictive accuracy. The full circle approach of analyzing a standard model, testing it in the lab and then revising its key assumptions, as we have done in this paper, can serve a template for future research. Experiments can identify which sources of leverage are credible, point to appropriate modeling choices, which can, in turn, generate new predictions.

Limitations and Future Research. Our investigation does not consider several bargaining features that may play a role in negotiations. In our experiment, bargaining outcomes are public once bargaining is completed, but the bilateral offer exchange is private. It may be interesting to explore behavior in a setting where the offer exchanges with the other investor can be observed. This may also be more reflective of entrepreneurial pitch competitions and other large events where offers to invest can be made publicly and observed by everyone. Other interesting extensions include

[19] Keskin (2022) and Isoni et al. (2022) provide surveys of reference points and focal points in bargaining. Although many things can serve as focal points (e.g., equality, efficiency, player labels, or strategy labels), there is little to suggest in the literature that downside protection would serve as a cue for more aggressive bargaining tactics.

richer negotiation settings where investors receive some control rights in addition to equity, as well as settings with informational asymmetries, and where investors may find it optimal to offer entrepreneurs a larger share to incentivize future effort.

An equally interesting direction is to examine bargaining behaviors across multiple operational contexts. Leider and Lovejoy (2016) and Davis et al. (2022) show that, in supply chain bargaining the theoretically advantaged party is unable to fully exploit their leverage and the outcomes are much more equal. This is broadly consistent with our findings. In Leider and Lovejoy (2016) the necessity of exclusion drives leverage and, hence, profits. As the cost differential between the low-cost and high-cost party increases, the threat of exclusion decreases and, consequently, profits increase, but the surplus is split more equally than predicted by theory. In Davis et al. (2022), the manufacturer must reach an agreement with both suppliers to realize any surplus, making the equal-split norm more salient. Understanding the commonalities and the differences in behavior between technology investment and supply chain contexts can help further understand the sources of credible leverage and how small changes in the negotiation environment can drive behavior.

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Supplementary Materials (Electronic Companion)

A.1. Survey of Entrepreneurs

A.1.1. The Vignettes

The survey contained the following vignette for the case in which the start-up had no intrinsic value without investment.[20]

> An entrepreneur has a business that she/he would like to launch. However, to launch the business, the entrepreneur needs capital from investor(s). In exchange for the investment the entrepreneur must offer the investor(s) some ownership in the business.
>
> The entrepreneur is currently negotiating with investors about how much ownership in the business the investor(s) will receive in exchange for their investment. In particular, imagine the following two scenarios:
>
> - **Scenario A**. An investor is offering 200 units of capital. If the entrepreneur is not able to agree with the investor, then the entrepreneur cannot launch the company and gets 0 profit.
> - **Scenario B**. Two investors are offering 100 units of capital each. If the entrepreneur is not able to agree with any investor, then the entrepreneur cannot launch the company and gets 0 profit. If the entrepreneur can agree with only one investor, then the size of the investment is 100. in this case, the entrepreneur can launch the business at a smaller scale.
>
> The business is in its early stages, so even if the entrepreneur can obtain capital, there is only a small chance that the business succeeds. However, if the business succeeds, its value will grow substantially.
>
> In which scenario, **A** or **B** do you expect the entrepreneur to keep a **larger share** of the business?

We also asked respondents a variation on this vignette where the start-up was valuable even without investment. The text read:

> Imagine a similar scenario as before. However, rather than receiving 0 profit if the negotiations with the investors break down, the entrepreneur **may now be able to make a profit even if the negotiations break down**. This is because the venture is now valued at 160

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[20] Note also that we randomized the order. The example here assumes that the “PoorEnt” case was seen first followed by the “RichEnt”.

units, and can be sold to another company, generating a profit for the entrepreneur.

As before, consider the following two scenarios:

- **Scenario A**. An investor is offering 200 units of capital. If the entrepreneur is not able to agree with the investor, then the entrepreneur can sell the company for 160 units.
- **Scenario B**. Two investors are offering 100 units of capital each. If the entrepreneur is not able to agree with either investor, then the entrepreneur can sell the company for 160 units. If the entrepreneur can agree with only one investor, then the business will be launched at a smaller scale. In that case the entrepreneur can sell the other half of the business and earn 80 units from that transaction.

As in the previous question, the business is in its early stages, so even if the entrepreneur can obtain capital, there is only a small chance that the business succeeds. However, if the business succeeds its value will grow substantially higher than its current valuation of 160 units.

In which scenario, **A** or **B** do you expect the entrepreneur to keep a **larger share** of the business?

A.1.2. Respondent Characteristics

Table A1 Characteristics of Survey Respondents

Gender		Age		Experience		Years Exp.	
Male	46.2%	Average	41.6	Founder	76.5%	4 +	37.0%
Female	51.3%	Max	89	Investor	21.0%	3	16.0%
Other	2.5%	Min	17	Employee	30.3%	2	21.0%
						1 −	26.1%

Notes: 1. Numbers in the “Experience” column do not sum to 100% because respondents could select all options for which they had experience, and many respondents had experience in more than one category.
2. Numbers in the “Years Exp.” column do not sum to 100% due to rounding.

A.2. Proofs and Additional Analysis of Normative Theory (SI & TI in Section 3)

We present the results and the proofs with the general bargaining powers of the investor(s) relative to the entrepreneur. Specifically, let $\theta_0 \in (0,1)$ denote the bargaining power of the single investor relative to the entrepreneur (i.e., the entrepreneur's bargaining power is $1-\theta_0$) in the SI setting. Let $\theta_i \in (0,1)$, $i \in \{1,2\}$, denote the bargaining power of Investor i relative to the entrepreneur (i.e., the entrepreneur's bargaining power is $1-\theta_i$) in the TI setting. To obtain the results when the investor(s) have equal bargaining power relative to the entrepreneur, we set $\theta_i = {}^1\!/_2$, $i \in \{s,1,2\}$.

Recall that the return of the investment α follows a two-point distribution: $\alpha_H > 1$ w.p. $p \in (0,1)$ and $\alpha_L \leq 1$ w.p. $1-p$.

Assumption EC.1. *Assume that the expected return* $\mathbb{E}[\alpha] = \alpha_H p + \alpha_L(1-p) \geq 2$.

In the analysis, if the bargaining unit between the entrepreneur and Investor i is indifferent among multiple investment levels in equilibrium, we assume that the largest investment level is made. In Section A.2.1, we consider the scenario of the common stock contracts. In Section A.2.2, we consider the scenario of the preferred stock contracts with $\alpha_L = 1$.

A.2.1. Common Stock Contracts

We consider the setting of Common Stock contracts in this section.

A.2.1.1. The Single Investor Model The investment I_0 and the share μ_0 maximize the following Nash product:

$$\max_{I_0 \in [0,2e],\ \mu_0 \in [0,1]} \ [\pi_0(I_0,\mu_0) - d_0]^{\theta_0} \, [\pi_e(I_0,\mu_0) - d_e]^{1-\theta_0} \tag{A-1}$$
$$\pi_0(I_0,\mu_0) \geq d_0,\ \pi_e(I_0,\mu_0) \geq d_e.$$

The following proposition is Proposition 1 under general bargaining powers.

Proposition A1 **(Single investor bargaining under general bargaining powers)**. *The investor invests* $I_0^{SI} = 2e$. *The share of the investor is*

$$\mu_0^{SI} = \frac{(\mathbb{E}[\alpha]-1)\theta_0 + 1}{\mathbb{E}[\alpha]} - \frac{\theta_0 d_e}{2e\mathbb{E}[\alpha]}.$$

The corresponding entrepreneur's share is

$$\mu_e^{SI} = 1 - \mu_0^{SI} = \frac{(\mathbb{E}[\alpha]-1)(1-\theta_0)}{\mathbb{E}[\alpha]} + \frac{\theta_0 d_e}{2e\mathbb{E}[\alpha]}.$$

Proof of Proposition A1. Recall that $d_0 = 2e$. We also have that the expected profit of the entrepreneur is

$$\pi_e(I_0,\mu_0) = \mathbb{E}[\alpha] I_0 (1-\mu_0);$$

the expected profit of investor s is

$$\pi_0(I_0,\mu_0) = \mathbb{E}[\alpha] I_0 \mu_0 + 2e - I_0.$$

Solving the problem (A-1) above, we have that,

$$\pi_0(I_0,\mu_0) - d_0 = \theta_0 \left(\pi_e(I_0,\mu_0) + \pi_0(I_0,\mu_0) - d_e - d_0\right); \tag{A-2}$$
$$\pi_e(I_0,\mu_0) - d_e = (1-\theta_0) \left(\pi_e(I_0,\mu_0) + \pi_0(I_0,\mu_0) - d_e - d_0\right).$$

Recall that $\mathbb{E}[\alpha] > 2$, and we have that

$$I_0^{SI} = \arg \max_{I_0 \in [0,2e]} \{\pi_e(I_0, \mu_0) + \pi_0(I_0, \mu_0) - d_e - d_0\} = 2e.$$

By Eq. (A-2), we have that

$$\mu_0^{SI} = \frac{(\mathbb{E}[\alpha]-1)\theta_0 + 1}{\mathbb{E}[\alpha]} - \frac{\theta_0 d_e}{2e\mathbb{E}[\alpha]}.$$

■

A.2.1.2. The Two Investor Model The investments I_i and the share μ_i maximize the following Nash product simultaneously:

$$\max_{I_i \in [0,e],\ \mu_i \in [0,1]} \ [\pi_i(\boldsymbol{I}, \boldsymbol{\mu}) - d_i]^{\theta_i} \left[\pi_e(\boldsymbol{I}, \boldsymbol{\mu}) - d_e^{-i}\right]^{1-\theta_i} \tag{A-3}$$
$$\pi_i(\boldsymbol{I}, \boldsymbol{\mu}) \geq d_i, \ \pi_e(\boldsymbol{I}, \boldsymbol{\mu}) \geq d_e^{-i}.$$

The following proposition is Proposition 2 under general bargaining powers.

Proposition A2 **(Two investor bargaining under general bargaining powers).**

- *There exists an equilibrium bargaining outcome in which both investors invest with* $I_i^{TI} = e$ *for* $i \in \{1,2\}$, *and the equilibrium share of investor* i *is*

$$\mu_i^{TI} = \frac{(3 - 2\mathbb{E}[\alpha])(2-\theta_i)}{\mathbb{E}[\alpha](4 - \theta_1\theta_2)} + \frac{\mathbb{E}[\alpha]-1}{\mathbb{E}[\alpha]} - \frac{d_e(2\theta_i - \theta_1\theta_2)}{2e\mathbb{E}[\alpha](4-\theta_1\theta_2)}. \tag{A-4}$$

- *There exists an equilibrium bargaining outcome in which only Investor* i *invests when* $\mathbb{E}[\alpha] < \frac{2-\theta_i}{1-\theta_i} - \frac{d_e\theta_i}{2e(1-\theta_i)}$. *The equilibrium investment level* $I_i^{TI} = e$ *and* $I_j^{TI} = 0$ *for* $i, j \in \{1,2\}$ *and* $i \neq j$, *and the equilibrium share of Investor* i *is*

$$\mu_i^{TI} = \frac{(\mathbb{E}[\alpha]-1)\theta_i + 1}{\mathbb{E}[\alpha]} - \frac{d_e\theta_i}{2e\mathbb{E}[\alpha]}.$$

Proof of Proposition A2. Recall that the expected profit of the entrepreneur is

$$\pi_e(\boldsymbol{I}, \boldsymbol{\mu}) = \mathbb{E}[\alpha](I_1 + I_2)(1 - \mu_1 - \mu_2), \tag{A-5}$$

and the expected profit of Investor i is

$$\pi_i(\boldsymbol{I}, \boldsymbol{\mu}) = \mathbb{E}[\alpha](I_1 + I_2)\mu_i + e - I_i. \tag{A-6}$$

The disagreement point of the entrepreneur when negotiating with Investor 1 is

$$d_e^{-1} = \pi_e(0, I_2, 0, \mu_2) = \frac{d_e}{2} + \mathbb{E}[\alpha]I_2(1-\mu_2),$$

which is the sum of half of the outside option and the profit of the entrepreneur when Investor 2 is the only investor. Similarly, the disagreement point of the entrepreneur when negotiating with Investor 2 is

$$d_e^{-2} = \pi_e(I_1, 0, \mu_1, 0) = \frac{d_e}{2} + \mathbb{E}[\alpha] I_1 (1 - \mu_1).$$

The disagreement point of Investor i is $d_i = e$ since the investor has e units of capital as the endowment.

We first solve the bargaining problem between the entrepreneur and Investor 1 as specified in (A-3). Following the similar analysis as in the proof of Proposition A1, we have that

$$\begin{aligned} \pi_1(\boldsymbol{I}, \boldsymbol{\mu}) - d_1 &= \theta_1 \left(\pi_1(\boldsymbol{I}, \boldsymbol{\mu}) + \pi_e(\boldsymbol{I}, \boldsymbol{\mu}) - d_1 - d_e^{-1} \right); \\ \pi_e(\boldsymbol{I}, \boldsymbol{\mu}) - d_e^{-1} &= (1 - \theta_1) \left(\pi_1(\boldsymbol{I}, \boldsymbol{\mu}) + \pi_e(\boldsymbol{I}, \boldsymbol{\mu}) - d_1 - d_e^{-1} \right). \end{aligned} \tag{A-7}$$

Note that the best-response investment level

$$I_1(I_2, \mu_2) = \arg \max_{I_1 \in [0, e]} \left\{ \pi_1(\boldsymbol{I}, \boldsymbol{\mu}) + \pi_e(\boldsymbol{I}, \boldsymbol{\mu}) - d_1 - d_e^{-1} \right\} = \begin{cases} e & \text{if } \mathbb{E}[\alpha](1 - \mu_2) \geq 1; \\ 0 & \text{otherwise.} \end{cases} \tag{A-8}$$

By Eq. (A-7), the best-response share for Investor 1 is

$$\mu_1(I_2, \mu_2) = \begin{cases} \frac{\theta_1 \left[\mathbb{E}[\alpha] e (1 - \mu_2) - e - \frac{d_e}{2} \right] + e}{\mathbb{E}[\alpha](e + I_2)}. & \text{if } \mathbb{E}[\alpha](1 - \mu_2) \geq 1; \\ 0 & \text{otherwise.} \end{cases} \tag{A-9}$$

Similarly, we have that the best-response investment level and share for Investor 2 are

$$I_2(I_1, \mu_1) = \begin{cases} e & \text{if } \mathbb{E}[\alpha](1 - \mu_1) \geq 1; \\ 0 & \text{otherwise;} \end{cases} \tag{A-10}$$

$$\mu_2(I_1, \mu_1) = \begin{cases} \frac{\theta_2 \left[\mathbb{E}[\alpha] e (1 - \mu_1) - e - \frac{d_e}{2} \right] + e}{\mathbb{E}[\alpha](e + I_1)} & \text{if } \mathbb{E}[\alpha](1 - \mu_1) \geq 1; \\ 0 & \text{otherwise.} \end{cases} \tag{A-11}$$

Solving the system of the best-response functions Eqs. (A-8) through (A-11), we have that if $\mathbb{E}[\alpha] \geq \max \left\{ \frac{3}{2} - \frac{d_e(2\theta_1 - \theta_1\theta_2)}{4e(2 - \theta_1)}, \, \frac{3}{2} - \frac{d_e(2\theta_2 - \theta_1\theta_2)}{4e(2 - \theta_2)} \right\}$, there exists an equilibrium in which both investors invest $I_i^{TI} = e$ with the share for Investor i as

$$\mu_i^{TI} = \frac{(3 - 2\mathbb{E}[\alpha])(2 - \theta_i)}{\mathbb{E}[\alpha](4 - \theta_1\theta_2)} + \frac{\mathbb{E}[\alpha] - 1}{\mathbb{E}[\alpha]} - \frac{d_e(2\theta_i - \theta_1\theta_2)}{2e\mathbb{E}[\alpha](4 - \theta_1\theta_2)}.$$

Similarly, we have that, if $\mathbb{E}[\alpha] < \frac{2 - \theta_i}{1 - \theta_i} - \frac{d_e\theta_i}{2e(1 - \theta_i)}$, there exists an equilibrium in which Investor i is the only investor with the investment level $I_i^{TI} = e$ in equilibrium and the share for Investor i is

$$\mu_i^{TI} = \frac{(\mathbb{E}[\alpha] - 1)\,\theta_i + 1}{\mathbb{E}[\alpha]} - \frac{d_e\theta_i}{2e\mathbb{E}[\alpha]}.$$

■

A.2.2. Preferred Stock Contracts

We consider the setting with Preferred Stock contracts and $\alpha_L = 1$. In this case, Assumption EC.1 reduces to $\alpha_H p + (1-p) \geq 2$. It follows that $\alpha_H \geq 1 + \frac{1}{p} > 2$.

A.2.2.1. The Single Investor Model The investment I_0 and the share μ_0 maximize the following Nash product with $\pi_e(I_0, \mu_0) = E\left[\min\{\alpha(1-\mu_0), \alpha - 1\}\right] I_0$ and $\pi_0(I_0, \mu_0) = E\left[\max\{\alpha\mu_0, 1\}\right] I_0 + 2e - I_0$:

$$\max_{I_0 \in [0,2e],\ \mu_0 \in [0,1]} \quad [\pi_0(I_0,\mu_0) - d_0]^{\theta_0} [\pi_e(I_0,\mu_0) - d_e]^{1-\theta_0} \tag{A-12}$$

$$\pi_0(I_0,\mu_0) \geq d_0,\ \ \pi_e(I_0,\mu_0) \geq d_e.$$

The following proposition is Proposition 3 under general bargaining powers.

PROPOSITION A3 **(Single investor bargaining under general bargaining powers)**. *The investor invests* $\tilde{I}_0^{SI} = 2e$. *The share of the investor is*

$$\tilde{\mu}_0^{SI} = \frac{\theta_0(\alpha_H - 1) + 1}{\alpha_H} - \frac{\theta_0 d_e}{2e\alpha_H p}.$$

The corresponding entrepreneur's share is

$$\tilde{\mu}_e^{SI} = 1 - \tilde{\mu}_0^{SI} = \frac{(\alpha_H - 1)(1-\theta_0)}{\alpha_H} + \frac{\theta_0 d_e}{2e\alpha_H p}.$$

Proof of Proposition A3. Recall that $d_0 = 2e$. Also we have that $\alpha_H > 2$. We focus on the scenario where $\mu_0 \geq 1/\alpha_H$. Otherwise the investor does not have incentives to invest. Thus, the expected profit of the entrepreneur should be

$$\pi_e(I_0,\mu_0) = E\left[\min\{\alpha(1-\mu_0), \alpha - 1\}\right] I_0 = \alpha_H(1-\mu_0) I_0 p,$$

and the expected profit of investor s should be

$$\pi_0(I_0,\mu_0) = E\left[\max\{\alpha\mu_0, 1\}\right] I_0 + 2e - I_0 = \alpha_H \mu_0 I_0 p + 2e - I_0 p.$$

Solving the problem (A-12) above, we have that,

$$\pi_0(I_0,\mu_0) - d_0 = \theta_0\left(\pi_e(I_0,\mu_0) + \pi_0(I_0,\mu_0) - d_e - d_0\right); \tag{A-13}$$

$$\pi_e(I_0,\mu_0) - d_e = (1-\theta_0)\left(\pi_e(I_0,\mu_0) + \pi_0(I_0,\mu_0) - d_e - d_0\right).$$

Recall that $\alpha_H > 2$, and we have that

$$\tilde{I}_0^{SI} = \arg\max_{I_0 \in [0,2e]} \{\pi_e(I_0,\mu_0) + \pi_0(I_0,\mu_0) - d_e - d_0\} = 2e.$$

By Eq. (A-13), we have that

$$\tilde{\mu}_0^{SI} = \frac{\theta_0(\alpha_H - 1) + 1}{\alpha_H} - \frac{\theta_0 d_e}{2e\alpha_H p}.$$

■

A.2.2.2. The Two Investor Model In this case, both investors simultaneously negotiate with the entrepreneur. The bargaining outcome is a pair of the share μ_i for Investor i in return for the investment I_i. With the downside protection for the investors, when the return of the startup is realized as $\alpha_L = 1$, the investors are able to recover their investment. That is, in addition to the negotiated $\alpha_L\mu_i$, Investor i is able to recover his potential loss $\alpha_L(1-\mu_i)$ from the entrepreneur. Thus, both investors obtain their investment back and the entrepreneur earns zero. When the return of the startup is realized as α_H, the protection for the investors is invoked only if one investor negotiated for a share that is significantly low. In such an event, the investor who invoked the protection will first be compensated by the profit of the entrepreneur, and then by the profit of the other investor (if the other investor invests as well).

Therefore, the expected profit of the entrepreneur is

$$\pi_e(\boldsymbol{I},\boldsymbol{\mu}) = \alpha_H(I_1+I_2)p - \sum_{i=1}^{2} \max\left\{\alpha_H(I_1+I_2)\mu_i - \left(I_{3-i} - \alpha_H(I_1+I_2)(1-\mu_i)\right)^+, I_i\right\}p, \quad \text{(A-14)}$$

and the expected profit of Investor i is

$$\begin{aligned}\pi_i(\boldsymbol{I},\boldsymbol{\mu}) &= \max\left\{\alpha_H(I_1+I_2)\mu_i - \left(I_{3-i} - \alpha_H(I_1+I_2)(1-\mu_i)\right)^+, I_i\right\}p + I_i(1-p) + e - I_i \\ &= \max\left\{\alpha_H(I_1+I_2)\mu_i - \left(I_{3-i} - \alpha_H(I_1+I_2)(1-\mu_i)\right)^+, I_i\right\}p + e - I_i p. \qquad \text{(A-15)}\end{aligned}$$

The disagreement point of the entrepreneur when negotiating with Investor 1 is

$$d_e^{-1} = \pi_e(0, I_2, 0, \mu_2) = \frac{d_e}{2} + \alpha_H I_2 p - \max\left\{\alpha_H I_2 \mu_2, I_2\right\}p,$$

which is the sum of half of the outside option and the profit of the entrepreneur when Investor 2 is the only investor. Similarly, the disagreement point of the entrepreneur when negotiating with Investor 2 is

$$d_e^{-2} = \pi_e(I_1, 0, \mu_1, 0) = \frac{d_e}{2} + \alpha_H I_1 p - \max\left\{\alpha_H I_1 \mu_1, I_1\right\}p.$$

The disagreement point of Investor i is $d_i = e$ since the investor has e units of capital as the endowment.

Then, the investments $\boldsymbol{I}$ and the shares $\boldsymbol{\mu}$ maximize the following Nash product simultaneously:

$$\begin{gathered}\max_{I_i\in[0,e],\ \mu_i\in[0,1]} \left[\pi_i(\boldsymbol{I},\boldsymbol{\mu}) - d_i\right]^{\theta_i}\left[\pi_e(\boldsymbol{I},\boldsymbol{\mu}) - d_e^{-i}\right]^{1-\theta_i} \qquad \text{(A-16)} \\ \pi_i(\boldsymbol{I},\boldsymbol{\mu}) \geq d_i,\ \pi_e(\boldsymbol{I},\boldsymbol{\mu}) \geq d_e^{-i}.\end{gathered}$$

We first establish a lemma, which helps us simplify the profits in Eqs. (A-14) and (A-15).

Lemma A1. *In any equilibrium bargaining outcome* $(\boldsymbol{I},\boldsymbol{\mu})$, *the following conditions are satisfied:*

$$\alpha_H(I_1+I_2)(1-\mu_i)\geq I_{3-i},\ \ i=1,2.$$

Proof of Lemma A1. It is easy to observe that the result holds if only one investor invests in equilibrium. The following proof focuses on the case where both investors invest in equilibrium.

We first observe that $\alpha_H(I_1+I_2)(1-\mu_i)<I_{3-i}$ when the entrepreneur's profit is not enough to cover the compensation to protect investor $(3-i)$. Since $\alpha_H>1$ and $\mu_1+\mu_2<1$, we note that $\alpha_H(I_1+I_2)(1-\mu_i)<I_{3-i}$ can hold for at most one bargaining unit. We next prove the lemma by showing that in any bargaining outcome $(\boldsymbol{I},\boldsymbol{\mu})=(I_1,I_2,\mu_1,\mu_2)$, if $\alpha_H(I_1+I_2)(1-\mu_1)<I_2$ and $\alpha_H(I_1+I_2)(1-\mu_2)\geq I_1$, then $(\boldsymbol{I},\boldsymbol{\mu})$ is not feasible for the bargaining problem between the entrepreneur and Investor 1.

Since $\alpha_H(I_1+I_2)(1-\mu_1)<I_2$ and $\alpha_H(I_1+I_2)(1-\mu_2)\geq I_1$, by Eqs. (A-14), we have

$$\begin{aligned}\pi_e(\boldsymbol{I},\boldsymbol{\mu})=&\alpha_H(I_1+I_2)p-\max\left\{\alpha_H(I_1+I_2)-I_2,I_1\right\}p-\max\left\{\alpha_H(I_1+I_2)\mu_2,I_2\right\}p\\=&\alpha_H(I_1+I_2)p-\left(\alpha_H(I_1+I_2)-I_2\right)p-I_2p\\=&0,\end{aligned}$$

Note that the disagreement point of the entrepreneur is that

$$d_e^{-1}=\pi_e(0,I_2,0,\mu_2)=\frac{d_e}{2}+\alpha_H I_2p-\max\left\{\alpha_H I_2\mu_2,I_2\right\}p=\frac{d_e}{2}+(\alpha_H-1)I_2p>0.$$

It follows that $\pi_e(\boldsymbol{I},\boldsymbol{\mu})<d_e^{-1}$ and therefore, $(\boldsymbol{I},\boldsymbol{\mu})$ is not feasible for the bargaining problem between the entrepreneur and Investor 1. ■

By Lemma A1, we can further simplify the expected profit of the entrepreneur as

$$\pi_e(\boldsymbol{I},\boldsymbol{\mu})=\alpha_H(I_1+I_2)p-\sum_{i=1}^{2}\max\left\{\alpha_H(I_1+I_2)\mu_i,I_i\right\}p,\tag{A-17}$$

and the expected profit of Investor i as

$$\pi_i(\boldsymbol{I},\boldsymbol{\mu})=\max\left\{\alpha_H(I_1+I_2)\mu_i,I_i\right\}p+e-I_ip.\tag{A-18}$$

The following proposition is Proposition 4 under general bargaining powers.

Proposition A4 **(Two investor bargaining under general bargaining powers)**.

- *There exists an equilibrium bargaining outcome in which both investors invest; i.e.,* $\tilde{I}_i^{TI}=e$ *for* $i\in\{1,2\}$, *and the equilibrium share of investor* i *is as follows.*

— *If* $\alpha_H \leq \min\left\{\frac{1-2\theta_1\theta_2+\theta_1}{\theta_1-\theta_1\theta_2}+\frac{d_e}{2ep}, \frac{1-2\theta_1\theta_2+\theta_2}{\theta_2-\theta_1\theta_2}+\frac{d_e}{2ep}\right\}$,

$$\tilde{\mu}_1^{TI} = \frac{1-\alpha_H\theta_1\theta_2+\alpha_H\theta_1-\theta_1}{2\alpha_H(1-\theta_1\theta_2)} - \frac{d_e(\theta_1-\theta_1\theta_2)}{4\alpha_H pe(1-\theta_1\theta_2)}, \tag{A-19}$$

$$\tilde{\mu}_2^{TI} = \frac{1-\alpha_H\theta_1\theta_2+\alpha_H\theta_2-\theta_2}{2\alpha_H(1-\theta_1\theta_2)} - \frac{d_e(\theta_2-\theta_1\theta_2)}{4\alpha_H pe(1-\theta_1\theta_2)} \tag{A-20}$$

— *If* $\frac{1-2\theta_1\theta_2+\theta_1}{\theta_1-\theta_1\theta_2}+\frac{d_e}{2ep} < \alpha_H \leq \frac{2+3\theta_2-2\theta_1\theta_2}{2\theta_2-\theta_1\theta_2}+\frac{d_e}{2ep}$

$$\tilde{\mu}_1^{TI} = \frac{1-\alpha_H\theta_1\theta_2+\alpha_H\theta_1+\theta_1\theta_2-\theta_1}{\alpha_H(2-\theta_1\theta_2)} - \frac{d_e(\theta_1-\theta_1\theta_2)}{2\alpha_H pe(2-\theta_1\theta_2)}, \tag{A-21}$$

$$\tilde{\mu}_2^{TI} = \frac{2-\alpha_H\theta_1\theta_2+2\alpha_H\theta_2-3\theta_2}{2\alpha_H(2-\theta_1\theta_2)} - \frac{d_e(2\theta_2-\theta_1\theta_2)}{4\alpha_H pe(2-\theta_1\theta_2)} \tag{A-22}$$

— *If* $\frac{1-2\theta_1\theta_2+\theta_2}{\theta_2-\theta_1\theta_2}+\frac{d_e}{2ep} < \alpha_H \leq \frac{2+3\theta_1-2\theta_1\theta_2}{2\theta_1-\theta_1\theta_2}+\frac{d_e}{2ep}$

$$\tilde{\mu}_1^{TI} = \frac{2-\alpha_H\theta_1\theta_2+2\alpha_H\theta_1-3\theta_1}{2\alpha_H(2-\theta_1\theta_2)} - \frac{d_e(2\theta_1-\theta_1\theta_2)}{4\alpha_H pe(2-\theta_1\theta_2)}, \tag{A-23}$$

$$\tilde{\mu}_2^{TI} = \frac{1-\alpha_H\theta_1\theta_2+\alpha_H\theta_2+\theta_1\theta_2-\theta_2}{\alpha_H(2-\theta_1\theta_2)} - \frac{d_e(\theta_2-\theta_1\theta_2)}{2\alpha_H pe(2-\theta_1\theta_2)} \tag{A-24}$$

— *If* $\alpha_H > \max\left\{\frac{2+3\theta_1-2\theta_1\theta_2}{2\theta_1-\theta_1\theta_2}+\frac{d_e}{2ep}, \frac{2+3\theta_2-2\theta_1\theta_2}{2\theta_2-\theta_1\theta_2}+\frac{d_e}{2ep}\right\}$

$$\tilde{\mu}_1^{TI} = \frac{2-\alpha_H\theta_1\theta_2+2\alpha_H\theta_1+\theta_1\theta_2-3\theta_1}{\alpha_H(4-\theta_1\theta_2)} - \frac{d_e(2\theta_1-\theta_1\theta_2)}{2\alpha_H pe(4-\theta_1\theta_2)}, \tag{A-25}$$

$$\tilde{\mu}_2^{TI} = \frac{2-\alpha_H\theta_1\theta_2+2\alpha_H\theta_2+\theta_1\theta_2-3\theta_2}{\alpha_H(4-\theta_1\theta_2)} - \frac{d_e(2\theta_2-\theta_1\theta_2)}{2\alpha_H pe(4-\theta_1\theta_2)} \tag{A-26}$$

- *If* $\alpha_H < \frac{2-\theta_i}{1-\theta_i} - \frac{d_e\theta_i}{2ep(1-\theta_i)}$, *an equilibrium bargaining outcome in which only Investor* i *invests exists; i.e.,* $\tilde{I}_i^{TI} = e$ *and* $\tilde{I}_j^{TI} = 0$ *for* $i, j \in \{1,2\}$ *and* $i \neq j$, *and the equilibrium share of Investor* i *is*

$$\tilde{\mu}_i^{TI} = \frac{(\alpha_H-1)\,\theta_i+1}{\alpha_H} - \frac{\theta_i d_e}{2e\alpha_H p}.$$

Proof of Proposition A4. We solve the bargaining problem between the entrepreneur and Investor 1 as specified in (A-16) for the best-response investment level and the share of the investor. We first note that if $\mu_1 < \frac{I_1}{\alpha_H(I_1+I_2)}$, it follows that $\pi_1(\boldsymbol{I},\boldsymbol{\mu}) = e$ and the Nash product for the bargaining between the entrepreneur and Investor 1 in problem (A-16) is zero. In the following analysis, we restrict attention to the case where Investor 1's share $\mu_1 \geq \frac{I_1}{\alpha_H(I_1+I_2)}$ and later verify that the equilibrium bargaining outcome leads to a strictly positive Nash product. In this case, by the first order condition, we have that

$$\pi_1(\boldsymbol{I},\boldsymbol{\mu}) - d_1 = \theta_1\left(\pi_1(\boldsymbol{I},\boldsymbol{\mu}) + \pi_e(\boldsymbol{I},\boldsymbol{\mu}) - d_1 - d_e^{-1}\right); \tag{A-27}$$

$$\pi_e(\boldsymbol{I},\boldsymbol{\mu}) - d_e^{-1} = (1-\theta_1)\left(\pi_1(\boldsymbol{I},\boldsymbol{\mu}) + \pi_e(\boldsymbol{I},\boldsymbol{\mu}) - d_1 - d_e^{-1}\right).$$

Note that the best-response investment level

$$\tilde{I}_1(I_2,\mu_2) = \arg\max_{I_1\in[0,e]}\left\{\pi_1(\boldsymbol{I},\boldsymbol{\mu}) + \pi_e(\boldsymbol{I},\boldsymbol{\mu}) - d_1 - d_e^{-1}\right\} = \begin{cases} e & \text{if } \mu_2 \le \frac{\alpha_H-1}{\alpha_H}; \\ 0 & \text{if } \mu_2 > \frac{\alpha_H-1}{\alpha_H}. \end{cases} \tag{A-28}$$

By Eq. (A-27), the best-response share for Investor 1 is

$$\tilde{\mu}_1(I_2,\mu_2) = \begin{cases} \frac{\theta_1[\alpha_H(e+I_2)(1-\mu_2)-e-\alpha_H I_2+I_2]+e}{\alpha_H(e+I_2)} - \frac{d_e\theta_1}{2\alpha_H p(e+I_2)} & \text{if } \mu_2 \le \frac{1}{\alpha_H}; \\ \frac{\theta_1[\alpha_H e(1-\mu_2)-e]+e}{\alpha_H(e+I_2)} - \frac{d_e\theta_1}{2\alpha_H p(e+I_2)} & \text{if } \frac{1}{\alpha_H} < \mu_2 \le \frac{\alpha_H-1}{\alpha_H}; \\ 0 & \text{if } \mu_2 > \frac{\alpha_H-1}{\alpha_H}. \end{cases} \tag{A-29}$$

Similarly, we have that the best-response investment level and share for Investor 2 are

$$\tilde{I}_2(I_1,\mu_1) = \begin{cases} e & \text{if } \mu_1 \le \frac{\alpha_H-1}{\alpha_H}; \\ 0 & \text{if } \mu_1 > \frac{\alpha_H-1}{\alpha_H}. \end{cases} \tag{A-30}$$

$$\tilde{\mu}_2(I_1,\mu_1) = \begin{cases} \frac{\theta_2[\alpha_H(I_1+e)(1-\mu_1)-e-\alpha_H I_1+I_1]+e}{\alpha_H(I_1+e)} - \frac{d_e\theta_2}{2\alpha_H p(e+I_1)} & \text{if } \mu_1 \le \frac{1}{\alpha_H}; \\ \frac{\theta_2[\alpha_H e(1-\mu_1)-e]+e}{\alpha_H(I_1+e)} - \frac{d_e\theta_2}{2\alpha_H p(e+I_1)} & \text{if } \frac{1}{\alpha_H} < \mu_1 \le \frac{\alpha_H-1}{\alpha_H}; \\ 0 & \text{if } \mu_1 > \frac{\alpha_H-1}{\alpha_H}. \end{cases} \tag{A-31}$$

Solving the system of the best-response functions Eqs. (A-28) through (A-31), we have that there exists an equilibrium in which both investors invest $\tilde{I}_i^{TI} = e$ with the share for Investor i as follows.

- If $\alpha_H \le \min\left\{\frac{1-2\theta_1\theta_2+\theta_1}{\theta_1-\theta_1\theta_2} + \frac{d_e}{2ep}, \frac{1-2\theta_1\theta_2+\theta_2}{\theta_2-\theta_1\theta_2} + \frac{d_e}{2ep}\right\}$,

$$\tilde{\mu}_1^{TI} = \frac{1-\alpha_H\theta_1\theta_2+\alpha_H\theta_1-\theta_1}{2\alpha_H(1-\theta_1\theta_2)} - \frac{d_e(\theta_1-\theta_1\theta_2)}{4\alpha_H pe(1-\theta_1\theta_2)},$$
$$\tilde{\mu}_2^{TI} = \frac{1-\alpha_H\theta_1\theta_2+\alpha_H\theta_2-\theta_2}{2\alpha_H(1-\theta_1\theta_2)} - \frac{d_e(\theta_2-\theta_1\theta_2)}{4\alpha_H pe(1-\theta_1\theta_2)}$$

- If $\frac{1-2\theta_1\theta_2+\theta_1}{\theta_1-\theta_1\theta_2} + \frac{d_e}{2ep} < \alpha_H \le \frac{2+3\theta_2-2\theta_1\theta_2}{2\theta_2-\theta_1\theta_2} + \frac{d_e}{2ep}$

$$\tilde{\mu}_1^{TI} = \frac{1-\alpha_H\theta_1\theta_2+\alpha_H\theta_1+\theta_1\theta_2-\theta_1}{\alpha_H(2-\theta_1\theta_2)} - \frac{d_e(\theta_1-\theta_1\theta_2)}{2\alpha_H pe(2-\theta_1\theta_2)},$$
$$\tilde{\mu}_2^{TI} = \frac{2-\alpha_H\theta_1\theta_2+2\alpha_H\theta_2-3\theta_2}{2\alpha_H(2-\theta_1\theta_2)} - \frac{d_e(2\theta_2-\theta_1\theta_2)}{4\alpha_H pe(2-\theta_1\theta_2)}$$

- If $\frac{1-2\theta_1\theta_2+\theta_2}{\theta_2-\theta_1\theta_2} + \frac{d_e}{2ep} < \alpha_H \le \frac{2+3\theta_1-2\theta_1\theta_2}{2\theta_1-\theta_1\theta_2} + \frac{d_e}{2ep}$

$$\tilde{\mu}_1^{TI} = \frac{2-\alpha_H\theta_1\theta_2+2\alpha_H\theta_1-3\theta_1}{2\alpha_H(2-\theta_1\theta_2)} - \frac{d_e(2\theta_1-\theta_1\theta_2)}{4\alpha_H pe(2-\theta_1\theta_2)},$$
$$\tilde{\mu}_2^{TI} = \frac{1-\alpha_H\theta_1\theta_2+\alpha_H\theta_2+\theta_1\theta_2-\theta_2}{\alpha_H(2-\theta_1\theta_2)} - \frac{d_e(\theta_2-\theta_1\theta_2)}{2\alpha_H pe(2-\theta_1\theta_2)}$$

- If $\alpha_H > \max\left\{\frac{2+3\theta_1-2\theta_1\theta_2}{2\theta_1-\theta_1\theta_2}+\frac{d_e}{2ep}, \frac{2+3\theta_2-2\theta_1\theta_2}{2\theta_2-\theta_1\theta_2}+\frac{d_e}{2ep}\right\}$

$$\tilde{\mu}_1^{TI} = \frac{2-\alpha_H\theta_1\theta_2+2\alpha_H\theta_1+\theta_1\theta_2-3\theta_1}{\alpha_H(4-\theta_1\theta_2)} - \frac{d_e(2\theta_1-\theta_1\theta_2)}{2\alpha_H pe(4-\theta_1\theta_2)},$$
$$\tilde{\mu}_2^{TI} = \frac{2-\alpha_H\theta_1\theta_2+2\alpha_H\theta_2+\theta_1\theta_2-3\theta_2}{\alpha_H(4-\theta_1\theta_2)} - \frac{d_e(2\theta_2-\theta_1\theta_2)}{2\alpha_H pe(4-\theta_1\theta_2)}$$

It is easy to verify that the equilibrium shares satisfies that $\tilde{\mu}_i^{TI} \geq \frac{I_i^{TI}}{\alpha_H(I_1^{TI}+I_2^{TI})} = \frac{1}{2\alpha_H}$.

Similarly, we have that if $\alpha_H < \frac{2-\theta_i}{1-\theta_i} - \frac{d_e\theta_i}{2ep(1-\theta_i)}$, there exists an equilibrium in which Investor i is the only investor with the investment level $\tilde{I}_i^{TI} = e$ in equilibrium and the share for Investor i is

$$\tilde{\mu}_i^{TI} = \frac{(\alpha_H-1)\,\theta_i+1}{\alpha_H} - \frac{\theta_i d_e}{2e\alpha_H p}.$$

■

A.2.3. Model Robustness: Risk Aversion

For analytical tractability, the models above were solved under the assumption that all parties were risk neutral. However, it is natural to wonder how the results hold up, especially Corollary 2, if the parties involved are risk averse. Unfortunately, the model becomes analytically intractable to solve. We are able to show that, for the parameters that we implement in the experiment, so long as risk aversion is not too great, there will still be equilibria in which both investors choose to invest and that the entrepreneur's ranking from Corollary 2 still holds. The following illustrates an example when $d_e = 0$. Specifically, let $u_i = x^{1-\rho_i}$ denote player i's utility function, where $\rho_i = 0$ indicates risk neutrality and $\rho_i > 0$ indicates risk aversion. In the experiment, as we outlined in Section 4, we assume that $e = 100$ and $(\alpha_H, \alpha_L, p) = (11, 1, 0.2)$. Table A2 gives the entrepreneur's share under various assumptions on risk preferences, assuming equal bargaining powers of the investor(s) relative to the entrepreneur.

As can be seen, in all cases, the entrepreneur earns the least when bargaining against a single investor and the most when bargaining with two investors simultaneously. Note that entrepreneur risk aversion is detrimental to his share, but the effects are largest in the single investor case where the entrepreneur's bargaining power is weakest. It is also interesting to note that investor risk aversion is also detrimental to the entrepreneur under the Common Stock contracts but beneficial to the entrepreneur under the Preferred Stock contract. Under the Common Stock contracts, by investing in the business, the investor is putting money at risk and, therefore, requires compensation for that risk. Moreover, disagreement would also be a better outcome compared to successfully negotiating and having the business be a failure. Roth and Rothblum (1982) showed that increased risk aversion could, counterintuitively increase a player's share when disagreement is not the worst outcome. It

Table A2 The Entrepreneur's Share Under Risk Aversion

(a) Common Stock contracts

Risk Parameters	SI-PoorEnt (%)	TI-PoorEnt (%)
$\rho_e = \rho_s = \rho_1 = \rho_2 = 0$	33.33	46.67
$\rho_e = 0$; $\rho_s = \rho_1 = \rho_2 = 0.25$	31.23	44.48
$\rho_e = 0.25$; $\rho_s = \rho_1 = \rho_2 = 0$	28.57	46.44
$\rho_e = 0.25$; $\rho_s = \rho_1 = \rho_2 = 0.25$	26.98	44.32

(b) Preferred Stock contracts

Risk Parameters	SI-PoorEnt (%)	TI-PoorEnt (%)
$\rho_e = \rho_s = \rho_1 = \rho_2 = 0$	45.46	56.36
$\rho_e = 0$; $\rho_s = \rho_1 = \rho_2 = 0.25$	49.15	58.45
$\rho_e = 0.25$; $\rho_s = \rho_1 = \rho_2 = 0$	38.96	55.78
$\rho_e = 0.25$; $\rho_s = \rho_1 = \rho_2 = 0.25$	42.80	57.83

seems that a similar result holds here. Under the Preferred Stock contracts, the investor's downside is protected and effectively the bargaining is regarding the state when the startup value is realizes as α_H. In this case, the entrepreneur is able to take advantage of the risk aversion of the investors and gain a higher share when bargaining a more risk-averse investor.

A.3. Proofs and Additional Analysis of Normative Theory (TI-Alt in Section 6.1)

In this section, we analyze the scenario where a poor entrepreneur (the disagreement point $d_e = 0$ if neither investor invests) bargains with two investors, each with an endowment of $e = 200$ units of capital and the maximum investment the startup can receive is 200 units of capital. Similar to the previous section, we present the results and the proofs with the general bargaining powers of the investor(s) relative to the entrepreneur. All other model settings are the same as in Section 3.1. We analyze the bargaining with two investors under the common stock contract. We first formulate the problem as follows, with slight repetition in describing the problem setting as the one in Section 3.1.

In the two investor scenarios, investors $i = 1, 2$ engage separately in bilateral bargaining with the entrepreneur about the investment amounts I_i and the shares, μ_i, received in exchange for their investment. We denote the outcome of each bargaining unit i (the bargaining between the entrepreneur and Investor i) by (I_i, μ_i) and the collective outcomes by $\boldsymbol{I} = (I_1, I_2)$ and $\boldsymbol{\mu} = (\mu_1, \mu_2)$. Then, the expected profit of the entrepreneur is $\pi_e(\boldsymbol{I}, \boldsymbol{\mu}) = \mathbb{E}[\alpha](I_1 + I_2)(1 - \mu_1 - \mu_2)$ and the expected profit of Investor i is $\pi_i(\boldsymbol{I}, \boldsymbol{\mu}) = \mathbb{E}[\alpha](I_1 + I_2)\mu_i + e - I_i$.

Denote by d_e^{-i} the disagreement point of the entrepreneur when bargaining with Investor i. Then $d_e^{-1} = \pi_e(0, I_2, 0, \mu_2)$ is the profit of the entrepreneur when Investor 2 is the only investor (with simultaneous bargaining Investor 2 would not be aware of a potential disagreement with Investor 1; thus, neither the negotiated outcome nor the disagreement payoff can condition on the possibility that a disagreement has occurred). Similarly $d_e^{-2} = \pi_e(I_1, 0, \mu_1, 0)$. Further, the disagreement point of Investor i is $d_i = e$ since each investor has e units of capital as the endowment.

Note that not all the endowments of both investors can be invested, since the startup only needs e units of capital at this stage. That is, at most one investor can invest all the endowment. Therefore, there is an additional constraint that $I_1 + I_2 \leq e$. Then, the investments $\boldsymbol{I}$ and the shares $\boldsymbol{\mu}$ maximize the following Nash product simultaneously:

$$\begin{aligned} \max_{I_i \in [0,e],\ \mu_i \in [0,1]} \quad & \left[\pi_i(\boldsymbol{I}, \boldsymbol{\mu}) - d_i\right]\left[\pi_e(\boldsymbol{I}, \boldsymbol{\mu}) - d_e^{-i}\right] \\ & \pi_i(\boldsymbol{I}, \boldsymbol{\mu}) \geq d_i,\ \pi_e(\boldsymbol{I}, \boldsymbol{\mu}) \geq d_e^{-i},\ i \in \{1, 2\}, \\ & I_1 + I_2 \leq e. \end{aligned} \tag{A-32}$$

Solving the problem, we have the following proposition.

Proposition A5 **(Two investor bargaining with rich investors)**.

- *Consider* $(I_1^{ALT}, I_2^{ALT}, \mu_1^{ALT}, \mu_2^{ALT})$ *such that* $I_1^{ALT} + I_2^{ALT} = e$, $I_i^{ALT} \geq 0$, $i = 1, 2$, *and*

$$\begin{aligned} \mu_1^{ALT} &= \frac{I_1^{ALT}\left(I_1^{ALT}\theta_1(1-\theta_2+\mathbb{E}[\alpha]\theta_2) - e\Big(\theta_1\big(2-\mathbb{E}[\alpha](1-\theta_2)-\theta_2\big)-1\Big)\right)}{\mathbb{E}[\alpha](e^2 - I_1^{ALT} I_2^{ALT}\theta_1\theta_2)}, \\ \mu_2^{ALT} &= \frac{I_2^{ALT}\left(I_2^{ALT}\theta_2(1-\theta_1+\mathbb{E}[\alpha]\theta_1) - e\Big(\theta_2\big(2-\mathbb{E}[\alpha](1-\theta_1)-\theta_1\big)-1\Big)\right)}{\mathbb{E}[\alpha](e^2 - I_1^{ALT} I_2^{ALT}\theta_1\theta_2)}. \end{aligned} \tag{A-33}$$

  If $\mathbb{E}[\alpha] \geq \max\left\{\frac{e^2+eI_1^{ALT}-2eI_1^{ALT}\theta_1+(I_1^{ALT})^2\theta_1}{e^2-eI_1^{ALT}\theta_1}, \frac{e^2+eI_2^{ALT}-2eI_2^{ALT}\theta_2+(I_2^{ALT})^2\theta_2}{e^2-eI_2^{ALT}\theta_2}\right\}$, *then* $(I_1^{ALT}, I_2^{ALT}, \mu_1^{ALT}, \mu_2^{ALT})$ *is an equilibrium bargaining outcome with Investor i investing* I_i^{ALT} *for the share of* μ_i^{ALT}.
- *If* $\mathbb{E}[\alpha] < 1 + \frac{1}{1-\theta_1}$, *there exists an equilibrium with the equilibrium investment as* $I_1^{ALT} = e$ *and* $I_2^{ALT} = 0$, *and the equilibrium share of investor i as* $\mu_1^{ALT} = \frac{1-\theta_1+\mathbb{E}[\alpha]\theta_1}{\mathbb{E}[\alpha]}$ *and* $\mu_2^{ALT} = 0$;
- *If* $\mathbb{E}[\alpha] < 1 + \frac{1}{1-\theta_2}$, *there exists an equilibrium with the equilibrium investment as* $I_1^{ALT} = 0$ *and* $I_2^{ALT} = e$, *and the equilibrium share of investor i as* $\mu_1^{ALT} = 0$ *and* $\mu_2^{ALT} = \frac{1-\theta_2+\mathbb{E}[\alpha]\theta_2}{\mathbb{E}[\alpha]}$.

Proof of Proposition A5. We first solve the bargaining problem between the entrepreneur and Investor 1. Following the similar analysis as in the proof of Proposition A1, we have that

$$\begin{aligned} \pi_1(\boldsymbol{I}, \boldsymbol{\mu}) - d_1 &= \theta_1\left(\pi_1(\boldsymbol{I}, \boldsymbol{\mu}) + \pi_e(\boldsymbol{I}, \boldsymbol{\mu}) - d_1 - d_e^{-1}\right); \\ \pi_e(\boldsymbol{I}, \boldsymbol{\mu}) - d_e^{-1} &= (1-\theta_1)\left(\pi_1(\boldsymbol{I}, \boldsymbol{\mu}) + \pi_e(\boldsymbol{I}, \boldsymbol{\mu}) - d_1 - d_e^{-1}\right). \end{aligned} \tag{A-34}$$

Note that the best-response investment level

$$I_1(I_2, \mu_2) = \arg\max_{I_1 \in [0,e], I_1 + I_2 \leq e}\left\{\pi_1(\boldsymbol{I}, \boldsymbol{\mu}) + \pi_e(\boldsymbol{I}, \boldsymbol{\mu}) - d_1 - d_e^{-1}\right\} = \begin{cases} e - I_2 & \text{if } \mathbb{E}[\alpha](1-\mu_2) \geq 1; \\ 0 & \text{otherwise.} \end{cases} \tag{A-35}$$

By Eq. (A-34), the best-response share for Investor 1 is

$$\mu_1(I_2,\mu_2)=\begin{cases}\frac{\theta_1[\mathbb{E}[\alpha](e-I_2)(1-\mu_2)-e+I_2]+e-I_2}{\mathbb{E}[\alpha]e}. & \text{if } \mathbb{E}[\alpha](1-\mu_2)\geq 1;\\ 0 & \text{otherwise.}\end{cases} \tag{A-36}$$

Similarly, we have that the best-response investment level and share for Investor 2 are

$$I_2(I_1,\mu_1)=\begin{cases}e-I_1 & \text{if } \mathbb{E}[\alpha](1-\mu_1)\geq 1;\\ 0 & \text{otherwise;}\end{cases} \tag{A-37}$$

$$\mu_2(I_1,\mu_1)=\begin{cases}\frac{\theta_2[\mathbb{E}[\alpha](e-I_1)(1-\mu_1)-e+I_1]+e-I_1}{\mathbb{E}[\alpha]e} & \text{if } \mathbb{E}[\alpha](1-\mu_1)\geq 1;\\ 0 & \text{otherwise.}\end{cases} \tag{A-38}$$

Solving the system of the best-response functions Eqs. (A-35) through (A-38), we have that for $(I_1^{ALT},I_2^{ALT},\mu_1^{ALT},\mu_2^{ALT})$ such that $I_1^{ALT}+I_2^{ALT}=e$, $I_i^{ALT}\geq 0$, $i=1,2$, and

$$\mu_1^{ALT}=\frac{I_1^{ALT}\left(I_1^{ALT}\theta_1(1-\theta_2+\mathbb{E}[\alpha]\theta_2)-e\Big(\theta_1\big(2-\mathbb{E}[\alpha](1-\theta_2)-\theta_2\big)-1\Big)\right)}{\mathbb{E}[\alpha](e^2-I_1^{ALT}I_2^{ALT}\theta_1\theta_2)},$$

$$\mu_2^{ALT}=\frac{I_2^{ALT}\left(I_2^{ALT}\theta_2(1-\theta_1+\mathbb{E}[\alpha]\theta_1)-e\Big(\theta_2\big(2-\mathbb{E}[\alpha](1-\theta_1)-\theta_1\big)-1\Big)\right)}{\mathbb{E}[\alpha](e^2-I_1^{ALT}I_2^{ALT}\theta_1\theta_2)}; \tag{A-39}$$

if $\mathbb{E}[\alpha]\geq\max\left\{\frac{e^2+eI_1^{ALT}-2eI_1^{ALT}\theta_1+(I_1^{ALT})^2\theta_1}{e^2-eI_1^{ALT}\theta_1},\ \frac{e^2+eI_2^{ALT}-2eI_2^{ALT}\theta_2+(I_2^{ALT})^2\theta_2}{e^2-eI_2^{ALT}\theta_2}\right\}$, then $(I_1^{ALT},I_2^{ALT},\mu_1^{ALT},\mu_2^{ALT})$ is an equilibrium bargaining outcome with Investor i investing I_i^{ALT} for the share of μ_i^{ALT}.

If $\mathbb{E}[\alpha]<1+\frac{1}{1-\theta_1}$, there exists an equilibrium with the equilibrium investment as $I_1^{ALT}=e$ and $I_2^{ALT}=0$, and the equilibrium share of investor i as $\mu_1^{ALT}=\frac{1-\theta_1+\mathbb{E}[\alpha]\theta_1}{\mathbb{E}[\alpha]}$ and $\mu_2^{ALT}=0$;

If $\mathbb{E}[\alpha]<1+\frac{1}{1-\theta_2}$, there exists an equilibrium with the equilibrium investment as $I_1^{ALT}=0$ and $I_2^{ALT}=e$, and the equilibrium share of investor i as $\mu_1^{ALT}=0$ and $\mu_2^{ALT}=\frac{1-\theta_2+\mathbb{E}[\alpha]\theta_2}{\mathbb{E}[\alpha]}$. ■

A.4. Proofs and Additional Analysis of Theory with Alternative Beliefs (TI in Section 6.1)

In this section, we present the results and the proofs with the general bargaining powers of the investor(s) relative to the entrepreneur under the alternative disagreement point of the entrepreneur set as $d_e^{-i}=d_e$. All other model settings are the same as in Section 3. We note that the alternative specification of the entrepreneur's disagreement point does not affect the result in the single investor bargaining problem. It only affects the two investor bargaining problem.

A.4.1. Two Investor Bargaining Under Common Stock Contract

The investments I_i and the share μ_i maximize the following Nash product simultaneously:

$$\max_{I_i\in[0,e],\ \mu_i\in[0,1]}\ [\pi_i(\boldsymbol{I},\boldsymbol{\mu})-d_i]^{\theta_i}\left[\pi_e(\boldsymbol{I},\boldsymbol{\mu})-d_e^{-i}\right]^{1-\theta_i} \tag{A-40}$$

$$\pi_i(\boldsymbol{I},\boldsymbol{\mu})\geq d_i,\ \pi_e(\boldsymbol{I},\boldsymbol{\mu})\geq d_e^{-i}.$$

Proposition A6 **(Two investor bargaining under alternative disagreement point)**.

- *When* $\mathbb{E}[\alpha] \geq \max\left\{\frac{3-2\theta_1-\theta_1\theta_2}{2(1-\theta_1)} - \frac{d_e(\theta_1-\theta_1\theta_2)}{2e(1-\theta_1)}, \frac{3-2\theta_2-\theta_1\theta_2}{2(1-\theta_2)} - \frac{d_e(\theta_2-\theta_1\theta_2)}{2e(1-\theta_2)}\right\}$, *there exists an equilibrium bargaining outcome in which both investors invest with* $I_i^{TI} = e$ *for* $i \in \{1,2\}$, *and the equilibrium share of investor* i *is*

$$\mu_i^{TI} = \frac{1-2\theta_i+2\mathbb{E}[\alpha]\theta_i+(1-2\mathbb{E}[\alpha])\theta_1\theta_2}{2\mathbb{E}[\alpha](1-\theta_1\theta_2)} - \frac{d_e(\theta_i-\theta_1\theta_2)}{2e\mathbb{E}[\alpha](1-\theta_1\theta_2)}. \tag{A-41}$$

- *There exists an equilibrium bargaining outcome in which only Investor* i *invests when* $\mathbb{E}[\alpha] < \frac{2-\theta_i}{1-\theta_i} - \frac{d_e\theta_i}{e(1-\theta_i)}$. *The equilibrium investment level* $I_i^{TI} = e$ *and* $I_j^{TI} = 0$ *for* $i, j \in \{1,2\}$ *and* $i \neq j$, *and the equilibrium share of Investor* i *is*

$$\mu_i^{TI} = \frac{(\mathbb{E}[\alpha]-1)\theta_i+1}{\mathbb{E}[\alpha]} - \frac{d_e\theta_i}{e\mathbb{E}[\alpha]}.$$

Proof of Proposition A6. Recall that the expected profit of the entrepreneur is

$$\pi_e(\boldsymbol{I},\boldsymbol{\mu}) = \mathbb{E}[\alpha](I_1+I_2)(1-\mu_1-\mu_2), \tag{A-42}$$

and the expected profit of Investor i is

$$\pi_i(\boldsymbol{I},\boldsymbol{\mu}) = \mathbb{E}[\alpha](I_1+I_2)\mu_i + e - I_i. \tag{A-43}$$

The disagreement point of the entrepreneur when negotiating with Investor i is $d_e^{-i} = d_e$, which the value of the outside option when the entrepreneur does not reach agreement with either investor. The disagreement point of Investor i is $d_i = e$ since the investor has e units of capital as the endowment.

We first solve the bargaining problem between the entrepreneur and Investor 1 as specified in (A-40). Following the similar analysis as in the proof of Proposition A1, we have that

$$\begin{aligned} \pi_1(\boldsymbol{I},\boldsymbol{\mu}) - d_1 &= \theta_1\left(\pi_1(\boldsymbol{I},\boldsymbol{\mu}) + \pi_e(\boldsymbol{I},\boldsymbol{\mu}) - d_1 - d_e^{-1}\right); \\ \pi_e(\boldsymbol{I},\boldsymbol{\mu}) - d_e^{-1} &= (1-\theta_1)\left(\pi_1(\boldsymbol{I},\boldsymbol{\mu}) + \pi_e(\boldsymbol{I},\boldsymbol{\mu}) - d_1 - d_e^{-1}\right). \end{aligned} \tag{A-44}$$

Note that the best-response investment level

$$I_1(I_2,\mu_2) = \arg\max_{I_1\in[0,e]}\left\{\pi_1(\boldsymbol{I},\boldsymbol{\mu}) + \pi_e(\boldsymbol{I},\boldsymbol{\mu}) - d_1 - d_e^{-1}\right\} = \begin{cases} e & \text{if } \mathbb{E}[\alpha](1-\mu_2) \geq 1; \\ 0 & \text{otherwise.} \end{cases} \tag{A-45}$$

By Eq. (A-44), the best-response share for Investor 1 is

$$\mu_1(I_2,\mu_2) = \begin{cases} \frac{\theta_1[\mathbb{E}[\alpha](e+I_2)(1-\mu_2)-e-d_e]+e}{\mathbb{E}[\alpha](e+I_2)} & \text{if } \mathbb{E}[\alpha](1-\mu_2) \geq 1; \\ 0 & \text{otherwise.} \end{cases} \tag{A-46}$$

Similarly, we have that the best-response investment level and share for Investor 2 are

$$I_2(I_1,\mu_1)=\begin{cases} e & \text{if } \mathbb{E}[\alpha](1-\mu_1)\geq 1;\\ 0 & \text{otherwise;}\end{cases} \tag{A-47}$$

$$\mu_2(I_1,\mu_1)=\begin{cases} \frac{\theta_2[\mathbb{E}[\alpha](I_1+e)(1-\mu_1)-e-d_e]+e}{\mathbb{E}[\alpha](I_1+e)} & \text{if } \mathbb{E}[\alpha](1-\mu_1)\geq 1;\\ 0 & \text{otherwise.}\end{cases} \tag{A-48}$$

Solving the system of the best-response functions Eqs. (A-45) through (A-48), we have that if $\mathbb{E}[\alpha]\geq\max\left\{\frac{3-2\theta_1-\theta_1\theta_2}{2(1-\theta_1)}-\frac{d_e(\theta_1-\theta_1\theta_2)}{2e(1-\theta_1)},\ \frac{3-2\theta_2-\theta_1\theta_2}{2(1-\theta_2)}-\frac{d_e(\theta_2-\theta_1\theta_2)}{2e(1-\theta_2)}\right\}$, there exists an equilibrium in which both investors invest $I_i^{TI}=e$ with the share for Investor i as

$$\mu_i^{TI}=\frac{1-2\theta_i+2\mathbb{E}[\alpha]\theta_i+(1-2\mathbb{E}[\alpha])\theta_1\theta_2}{2\mathbb{E}[\alpha](1-\theta_1\theta_2)}-\frac{d_e(\theta_i-\theta_1\theta_2)}{2e\mathbb{E}[\alpha](1-\theta_1\theta_2)}.$$

Similarly, we have that, if $\mathbb{E}[\alpha]<\frac{2-\theta_i}{1-\theta_i}-\frac{d_e\theta_i}{e(1-\theta_i)}$, there exists an equilibrium in which Investor i is the only investor with the investment level $I_i^{TI}=e$ in equilibrium and the share for Investor i is

$$\mu_i^{TI}=\frac{(\mathbb{E}[\alpha]-1)\,\theta_i+1}{\mathbb{E}[\alpha]}-\frac{d_e\theta_i}{e\mathbb{E}[\alpha]}.$$

■

A.4.2. Two Investor Bargaining Under Preferred Stock Contract

Similar to the analysis before, we can show that the equilibrium bargaining share will not be too extreme such that in any equilibrium bargaining outcome $(\boldsymbol{I},\boldsymbol{\mu})$, the following conditions are satisfied: $\alpha_H(I_1+I_2)(1-\mu_i)\geq I_{3-i},\ i=1,2$. Therefore, the expected profit of the entrepreneur is

$$\pi_e(\boldsymbol{I},\boldsymbol{\mu})=\alpha_H(I_1+I_2)p-\sum_{i=1}^{2}\max\left\{\alpha_H(I_1+I_2)\mu_i,I_i\right\}p, \tag{A-49}$$

and the expected profit of Investor i as

$$\pi_i(\boldsymbol{I},\boldsymbol{\mu})=\max\left\{\alpha_H(I_1+I_2)\mu_i,I_i\right\}p+e-I_ip. \tag{A-50}$$

The (alternative) disagreement point of the entrepreneur when negotiating with Investor i is $d_e^{-i}=d_e$, and the disagreement point of Investor i is $d_i=e$ since the investor has e units of capital as the endowment.

Then, the investments $\boldsymbol{I}$ and the shares $\boldsymbol{\mu}$ maximize the following Nash product simultaneously:

$$\max_{I_i\in[0,e],\ \mu_i\in[0,1]}\ [\pi_i(\boldsymbol{I},\boldsymbol{\mu})-d_i]^{\theta_i}\left[\pi_e(\boldsymbol{I},\boldsymbol{\mu})-d_e^{-i}\right]^{1-\theta_i} \tag{A-51}$$
$$\pi_i(\boldsymbol{I},\boldsymbol{\mu})\geq d_i,\ \pi_e(\boldsymbol{I},\boldsymbol{\mu})\geq d_e^{-i}.$$

Proposition A7 **(Two investor bargaining under alternative disagreement point)**.

- *There exists an equilibrium bargaining outcome in which both investors invest; i.e.,* $\tilde{I}_i^{TI} = e$ *for* $i \in \{1,2\}$*, and the equilibrium share of investor* i *is as follows.*
  — *If* $\alpha_H \geq \max\left\{\frac{3}{2} + \frac{(1-\theta_1)\theta_2}{2(1-\theta_2)} - \frac{d_e(1-\theta_1)\theta_2}{2ep(1-\theta_2)}, \frac{3}{2} + \frac{(1-\theta_2)\theta_1}{2(1-\theta_1)} - \frac{d_e(1-\theta_2)\theta_1}{2ep(1-\theta_1)}\right\}$,

$$\tilde{\mu}_1^{TI} = \frac{\theta_1(2\alpha_H(1-\theta_2)+\theta_2-2)+1}{2\alpha_H(1-\theta_1\theta_2)} - \frac{d_e\theta_1(1-\theta_2)}{2\alpha_H ep(1-\theta_1\theta_2)}, \tag{A-52}$$

$$\tilde{\mu}_2^{TI} = \frac{\theta_2(2\alpha_H(1-\theta_1)+\theta_1-2)+1}{2\alpha_H(1-\theta_1\theta_2)} - \frac{d_e(1-\theta_1)\theta_2}{2\alpha_H ep(1-\theta_1\theta_2)} \tag{A-53}$$

- *If* $\alpha_H < \frac{2-\theta_i}{1-\theta_i} - \frac{d_e\theta_i}{ep(1-\theta_i)}$*, an equilibrium bargaining outcome in which only Investor* i *invests exists; i.e.,* $\tilde{I}_i^{TI} = e$ *and* $\tilde{I}_j^{TI} = 0$ *for* $i,j \in \{1,2\}$ *and* $i \neq j$*, and the equilibrium share of Investor* i *is*

$$\tilde{\mu}_i^{TI} = \frac{(\alpha_H - 1)\theta_i + 1}{\alpha_H} - \frac{\theta_i d_e}{e\alpha_H p}.$$

Proof of Proposition A7. We solve the bargaining problem between the entrepreneur and Investor 1 as specified in (A-51) for the best-response investment level and the share of the investor. We first note that if $\mu_1 < \frac{I_1}{\alpha_H(I_1+I_2)}$, it follows that $\pi_1(\boldsymbol{I},\boldsymbol{\mu}) = e$ and the Nash product for the bargaining between the entrepreneur and Investor 1 in problem (A-51) is zero. In the following analysis, we restrict attention to the case where Investor 1's share $\mu_1 \geq \frac{I_1}{\alpha_H(I_1+I_2)}$ and later verify that the equilibrium bargaining outcome leads to a strictly positive Nash product. In this case, by the first order condition, we have that

$$\begin{aligned} \pi_1(\boldsymbol{I},\boldsymbol{\mu}) - d_1 &= \theta_1\left(\pi_1(\boldsymbol{I},\boldsymbol{\mu}) + \pi_e(\boldsymbol{I},\boldsymbol{\mu}) - d_1 - d_e^{-1}\right); \\ \pi_e(\boldsymbol{I},\boldsymbol{\mu}) - d_e^{-1} &= (1-\theta_1)\left(\pi_1(\boldsymbol{I},\boldsymbol{\mu}) + \pi_e(\boldsymbol{I},\boldsymbol{\mu}) - d_1 - d_e^{-1}\right). \end{aligned} \tag{A-54}$$

Note that the best-response investment level

$$\tilde{I}_1(I_2,\mu_2) = \arg\max_{I_1\in[0,e]}\left\{\pi_1(\boldsymbol{I},\boldsymbol{\mu}) + \pi_e(\boldsymbol{I},\boldsymbol{\mu}) - d_1 - d_e^{-1}\right\} = \begin{cases} e & \text{if } \mu_2 \leq \frac{\alpha_H-1}{\alpha_H}; \\ 0 & \text{if } \mu_2 > \frac{\alpha_H-1}{\alpha_H}. \end{cases} \tag{A-55}$$

By Eq. (A-54), the best-response share for Investor 1 is

$$\tilde{\mu}_1(I_2,\mu_2) = \begin{cases} \frac{\theta_1[\alpha_H(e+I_2)(1-\mu_2)-e]+e}{\alpha_H(e+I_2)} - \frac{d_e\theta_1}{\alpha_H p(e+I_2)} & \text{if } \mu_2 \leq \frac{\alpha_H-1}{\alpha_H}; \\ 0 & \text{if } \mu_2 > \frac{\alpha_H-1}{\alpha_H}. \end{cases} \tag{A-56}$$

Similarly, we have that the best-response investment level and share for Investor 2 are

$$\tilde{I}_2(I_1,\mu_1) = \begin{cases} e & \text{if } \mu_1 \leq \frac{\alpha_H-1}{\alpha_H}; \\ 0 & \text{if } \mu_1 > \frac{\alpha_H-1}{\alpha_H}. \end{cases} \tag{A-57}$$

$$\tilde{\mu}_2(I_1,\mu_1) = \begin{cases} \frac{\theta_2[\alpha_H(I_1+e)(1-\mu_1)-e]+e}{\alpha_H(I_1+e)} - \frac{d_e\theta_2}{\alpha_H p(e+I_1)} & \text{if } \mu_1 \leq \frac{\alpha_H-1}{\alpha_H}; \\ 0 & \text{if } \mu_1 > \frac{\alpha_H-1}{\alpha_H}. \end{cases} \tag{A-58}$$

Solving the system of the best-response functions Eqs. (A-55) through (A-58), we have that there exists an equilibrium in which both investors invest $\tilde{I}_i^{TI} = e$ with the share for Investor i as follows.

- If $\alpha_H \geq \max\left\{\frac{3}{2}+\frac{(1-\theta_1)\theta_2}{2(1-\theta_2)}-\frac{d_e(1-\theta_1)\theta_2}{2ep(1-\theta_2)}, \frac{3}{2}+\frac{(1-\theta_2)\theta_1}{2(1-\theta_1)}-\frac{d_e(1-\theta_2)\theta_1}{2ep(1-\theta_1)}\right\}$,

$$\tilde{\mu}_1^{TI} = \frac{\theta_1(2\alpha_H(1-\theta_2)+\theta_2-2)+1}{2\alpha_H(1-\theta_1\theta_2)} - \frac{d_e\theta_1(1-\theta_2)}{2\alpha_H ep(1-\theta_1\theta_2)},$$
$$\tilde{\mu}_2^{TI} = \frac{\theta_2(2\alpha_H(1-\theta_1)+\theta_1-2)+1}{2\alpha_H(1-\theta_1\theta_2)} - \frac{d_e(1-\theta_1)\theta_2}{2\alpha_H ep(1-\theta_1\theta_2)}$$

It is easy to verify that the equilibrium shares satisfies that $\tilde{\mu}_i^{TI} \geq \frac{I_i^{TI}}{\alpha_H(I_1^{TI}+I_2^{TI})} = \frac{1}{2\alpha_H}$.

Similarly, we have that if $\alpha_H < \frac{2-\theta_i}{1-\theta_i} - \frac{d_e\theta_i}{ep(1-\theta_i)}$, there exists an equilibrium in which Investor i is the only investor with the investment level $\tilde{I}_i^{TI} = e$ in equilibrium and the share for Investor i is

$$\tilde{\mu}_i^{TI} = \frac{(\alpha_H-1)\,\theta_i+1}{\alpha_H} - \frac{\theta_i d_e}{e\alpha_H p}.$$

■

A.5. Proofs and Additional Analysis of Theory with Alternative Beliefs (TI-Alt in Section 6.1)

In this section, we analyze the scenario where a poor entrepreneur (the disagreement point $d_e = 0$ if neither investor invests) bargains with two investors, each with an endowment of $e = 200$ units of capital and the maximum investment the startup can receive is 200 units of capital. Similar to the previous section, we present the results and the proofs with the general bargaining powers of the investor(s) relative to the entrepreneur. All other model settings are the same as in Section 3.1. We analyze the bargaining with two investors under the common stock contract. We first formulate the problem as follows, with slight repetition in describing the problem setting as the one in Section 3.1.

In the two investor scenarios, investors $i = 1, 2$ engage separately in bilateral bargaining with the entrepreneur about the investment amounts I_i and the shares, μ_i, received in exchange for their investment. We denote the outcome of each bargaining unit i (the bargaining between the entrepreneur and Investor i) by (I_i, μ_i) and the collective outcomes by $\boldsymbol{I} = (I_1, I_2)$ and $\boldsymbol{\mu} = (\mu_1, \mu_2)$. Then, the expected profit of the entrepreneur is $\pi_e(\boldsymbol{I}, \boldsymbol{\mu}) = \mathbb{E}[\alpha](I_1 + I_2)(1 - \mu_1 - \mu_2)$ and the expected profit of Investor i is $\pi_i(\boldsymbol{I}, \boldsymbol{\mu}) = \mathbb{E}[\alpha](I_1 + I_2)\mu_i + e - I_i$.

Denote by d_e^{-i} the disagreement point of the entrepreneur when bargaining with Investor i. Then $d_e^{-1} = \max\{\pi_e(0, I_2, 0, \mu_2), \pi_e(0, e, 0, \frac{(\mathbb{E}[\alpha]-1)\theta_0+1}{\mathbb{E}[\alpha]})\}$ is maximum of the profit of the entrepreneur when Investor 2 is the only known investor and the profit of the entrepreneur when Investor 2 is the only unknown investor (due to the simultaneous bargaining). Similarly $d_e^{-2} = \max\{\pi_e(I_1, 0, \mu_1, 0), \pi_e(e, 0, \frac{(\mathbb{E}[\alpha]-1)\theta_0+1}{\mathbb{E}[\alpha]}, 0)\}$. Further, the disagreement point of Investor i is $d_i = e$ since each investor has e units of capital as the endowment.

Note that not all the endowments of both investors can be invested, since the startup only needs e units of capital at this stage. That is, at most one investor can invest all the endowment.

Therefore, there is an additional constraint that $I_1+I_2 \leq e$. Then, the investments $\boldsymbol{I}$ and the shares $\boldsymbol{\mu}$ maximize the following Nash product simultaneously:

$$\begin{aligned} \max_{I_i\in[0,e],\ \mu_i\in[0,1]} \quad & [\pi_i(\boldsymbol{I},\boldsymbol{\mu})-d_i]\left[\pi_e(\boldsymbol{I},\boldsymbol{\mu})-d_e^{-i}\right] \\ & \pi_i(\boldsymbol{I},\boldsymbol{\mu})\geq d_i,\ \pi_e(\boldsymbol{I},\boldsymbol{\mu})\geq d_e^{-i},\ i\in\{1,2\}, \\ & I_1+I_2\leq e. \end{aligned} \tag{A-59}$$

Solving the problem, we have the following proposition.

Proposition A8 **(Bargaining with rich investors under alternative disagreement points)**.

- *Consider* (I_1,I_2,μ_1,μ_2) *such that* $I_1+I_2=e,\ I_i\geq 0,\ i=1,2,$ *and*

  ☐ *Case 1. When* $\frac{I_2(I_2\theta_2(1-\theta_1+\mathbb{E}[\alpha]\theta_1)-e(\theta_2(2-\mathbb{E}[\alpha](1-\theta_1)-\theta_1)-1))}{e^2-I_1I_2\theta_1\theta_2}\leq\min\{E[\alpha]-1,\frac{E[\alpha]I_2-e(E[\alpha]-1)(1-\theta_2)}{I_2}\}$ *and* $\frac{I_1(I_1\theta_1(1-\theta_2+\mathbb{E}[\alpha]\theta_2)-e(\theta_1(2-\mathbb{E}[\alpha](1-\theta_2)-\theta_2)-1))}{e^2-I_1I_2\theta_1\theta_2}\leq\min\{E[\alpha]-1,\frac{E[\alpha]I_1-e(E[\alpha]-1)(1-\theta_1)}{I_1}\}$, *we have that*

$$\mu_1=\frac{I_1\Big(I_1\theta_1(1-\theta_2+\mathbb{E}[\alpha]\theta_2)-e\Big(\theta_1\big(2-\mathbb{E}[\alpha](1-\theta_2)-\theta_2\big)-1\Big)\Big)}{\mathbb{E}[\alpha](e^2-I_1I_2\theta_1\theta_2)},$$

$$\mu_2=\frac{I_2\Big(I_2\theta_2(1-\theta_1+\mathbb{E}[\alpha]\theta_1)-e\Big(\theta_2\big(2-\mathbb{E}[\alpha](1-\theta_1)-\theta_1\big)-1\Big)\Big)}{\mathbb{E}[\alpha](e^2-I_1I_2\theta_1\theta_2)}; \tag{A-60}$$

  ☐ *Case 2. When* $\frac{I_2\theta_2(E[\alpha]\theta_1-\theta_1+1)+I_2(1-\theta_2)}{e-I_1\theta_1\theta_2}\leq\min\{E[\alpha]-1,\frac{E[\alpha]I_2-e(E[\alpha]-1)(1-\theta_2)}{I_2}\}$ *and* $\frac{E[\alpha]I_1-e(E[\alpha]-1)(1-\theta_1)}{I_1}<\frac{I_1(I_1\theta_1(1-\theta_2)-e((E[\alpha]-1)\theta_1^2\theta_2-(E[\alpha]-2)\theta_1-1))}{e(e-I_1\theta_1\theta_2)}\leq E[\alpha]-1$, *we have that*

$$\mu_1=\frac{I_1\Big(I_1\theta_1(1-\theta_2)-e\Big((E[\alpha]-1)\theta_1^2\theta_2-(E[\alpha]-2)\theta_1-1\Big)\Big)}{E[\alpha]e(e-I_1\theta_1\theta_2)};$$

$$\mu_2=\frac{I_2\theta_2(E[\alpha]\theta_1-\theta_1+1)+I_2(1-\theta_2)}{E[\alpha](e-I_1\theta_1\theta_2)}. \tag{A-61}$$

  ☐ *Case 3. When* $\frac{E[\alpha]I_2-e(E[\alpha]-1)(1-\theta_2)}{I_2}<\frac{I_2(I_2(1-\theta_1)\theta_2-e((E[\alpha]-1)\theta_1\theta_2^2-(E[\alpha]-2)\theta_2-1))}{e(e-I_2\theta_1\theta_2)}\leq E[\alpha]-1$ *and* $\frac{I_1\theta_1(E[\alpha]\theta_2-\theta_2+1)+I_1(1-\theta_1)}{e-I_2\theta_1\theta_2}\leq\min\{E[\alpha]-1,\frac{E[\alpha]I_1-e(E[\alpha]-1)(1-\theta_1)}{I_1}\}$, *we have that*

$$\mu_1=\frac{I_1\theta_1(E[\alpha]\theta_2-\theta_2+1)+I_1(1-\theta_1)}{E[\alpha](e-I_2\theta_1\theta_2)};$$

$$\mu_2=\frac{I_2\Big(I_2(1-\theta_1)\theta_2-e\Big((E[\alpha]-1)\theta_1\theta_2^2-(E[\alpha]-2)\theta_2-1\Big)\Big)}{E[\alpha]e(e-I_2\theta_1\theta_2)}. \tag{A-62}$$

  ☐ *Case 4. When* $\frac{E[\alpha]I_2-e(E[\alpha]-1)(1-\theta_2)}{I_2}<\frac{I_2(1-\theta_1\theta_2)+e(1-\theta_2)(E[\alpha]-1)\theta_1\theta_2}{e(1-\theta_1\theta_2)}\leq E[\alpha]-1$ *and* $\frac{E[\alpha]I_1-e(E[\alpha]-1)(1-\theta_1)}{I_1}<\frac{I_1(1-\theta_1\theta_2)+e(1-\theta_1)(E[\alpha]-1)\theta_1\theta_2}{e(1-\theta_1\theta_2)}\leq E[\alpha]-1$, *we have that*

$$\mu_1=\frac{I_1(1-\theta_1\theta_2)+e(1-\theta_1)(E[\alpha]-1)\theta_1\theta_2}{E[\alpha]e(1-\theta_1\theta_2)};$$

$$\mu_2 = \frac{I_2(1-\theta_1\theta_2) + e(1-\theta_2)(E[\alpha]-1)\theta_1\theta_2}{E[\alpha]e(1-\theta_1\theta_2)}. \tag{A-63}$$

In each of the four cases, (I_1, I_2, μ_1, μ_2) is an equilibrium bargaining outcome with Investor i investing I_i for the share of μ_i.

- *If $\mathbb{E}[\alpha] < 1 + \frac{1}{1-\theta_1\theta_2}$, there exists an equilibrium with the equilibrium investment as $I_1 = e$ and $I_2 = 0$, and the equilibrium share of investor i as $\mu_1 = \frac{1-\theta_1\theta_2+\mathbb{E}[\alpha]\theta_1\theta_2}{\mathbb{E}[\alpha]}$ and $\mu_2 = 0$;*
- *If $\mathbb{E}[\alpha] < 1 + \frac{1}{1-\theta_1\theta_2}$, there exists an equilibrium with the equilibrium investment as $I_1 = 0$ and $I_2 = e$, and the equilibrium share of investor i as $\mu_1 = 0$ and $\mu_2 = \frac{1-\theta_1\theta_2+\mathbb{E}[\alpha]\theta_1\theta_2}{\mathbb{E}[\alpha]}$.*

Proof of Proposition A8. We first solve the bargaining problem between the entrepreneur and Investor 1. Following the similar analysis as in the proof of Proposition A1, we have that

$$\begin{aligned} \pi_1(\boldsymbol{I},\boldsymbol{\mu}) - d_1 &= \theta_1\left(\pi_1(\boldsymbol{I},\boldsymbol{\mu}) + \pi_e(\boldsymbol{I},\boldsymbol{\mu}) - d_1 - d_e^{-1}\right); \\ \pi_e(\boldsymbol{I},\boldsymbol{\mu}) - d_e^{-1} &= (1-\theta_1)\left(\pi_1(\boldsymbol{I},\boldsymbol{\mu}) + \pi_e(\boldsymbol{I},\boldsymbol{\mu}) - d_1 - d_e^{-1}\right). \end{aligned} \tag{A-64}$$

Note that the best-response investment level

$$I_1(I_2,\mu_2) = \arg\max_{I_1\in[0,e], I_1+I_2\le e}\left\{\pi_1(\boldsymbol{I},\boldsymbol{\mu}) + \pi_e(\boldsymbol{I},\boldsymbol{\mu}) - d_1 - d_e^{-1}\right\} = \begin{cases} e - I_2 & \text{if } \mathbb{E}[\alpha](1-\mu_2)\ge 1; \\ 0 & \text{otherwise.}\end{cases} \tag{A-65}$$

By Eq. (A-64), the best-response share for Investor 1 is

$$\mu_1(I_2,\mu_2) = \begin{cases} \frac{\theta_1[\mathbb{E}[\alpha](e-I_2)(1-\mu_2)-e+I_2]+e-I_2}{\mathbb{E}[\alpha]e}. & \text{if } \mathbb{E}[\alpha](1-\mu_2)\ge 1 \text{ and } \frac{E[\alpha]I_2-e(E[\alpha]-1)(1-\theta_2)}{E[\alpha]I_2} \ge \mu_2; \\ \frac{\theta_1[\mathbb{E}[\alpha]e(1-\mu_2)-e+I_2-e(E[\alpha]-1)(1-\theta_2)]+e-I_2}{\mathbb{E}[\alpha]e}. & \text{if } \mathbb{E}[\alpha](1-\mu_2)\ge 1 \text{ and } \frac{E[\alpha]I_2-e(E[\alpha]-1)(1-\theta_2)}{E[\alpha]I_2} < \mu_2; \\ 0 & \text{otherwise.} \end{cases} \tag{A-66}$$

Similarly, we have that the best-response investment level and share for Investor 2 are

$$I_2(I_1,\mu_1) = \begin{cases} e - I_1 & \text{if } \mathbb{E}[\alpha](1-\mu_1)\ge 1; \\ 0 & \text{otherwise;}\end{cases} \tag{A-67}$$

$$\mu_2(I_1,\mu_1) = \begin{cases} \frac{\theta_2[\mathbb{E}[\alpha](e-I_1)(1-\mu_1)-e+I_1]+e-I_1}{\mathbb{E}[\alpha]e}. & \text{if } \mathbb{E}[\alpha](1-\mu_1)\ge 1 \text{ and } \frac{E[\alpha]I_1-e(E[\alpha]-1)(1-\theta_1)}{E[\alpha]I_1} \ge \mu_1; \\ \frac{\theta_2[\mathbb{E}[\alpha]e(1-\mu_1)-e+I_1-e(E[\alpha]-1)(1-\theta_1)]+e-I_1}{\mathbb{E}[\alpha]e}. & \text{if } \mathbb{E}[\alpha](1-\mu_1)\ge 1 \text{ and } \frac{E[\alpha]I_1-e(E[\alpha]-1)(1-\theta_1)}{E[\alpha]I_1} < \mu_1; \\ 0 & \text{otherwise.} \end{cases} \tag{A-68}$$

Solving the system of equations, we have that

- Case 1. When $\frac{I_2(I_2\theta_2(1-\theta_1+\mathbb{E}[\alpha]\theta_1)-e(\theta_2(2-\mathbb{E}[\alpha](1-\theta_1)-\theta_1)-1))}{e^2-I_1I_2\theta_1\theta_2} \le \min\{E[\alpha]-1, \frac{E[\alpha]I_2-e(E[\alpha]-1)(1-\theta_2)}{I_2}\}$ and $\frac{I_1(I_1\theta_1(1-\theta_2+\mathbb{E}[\alpha]\theta_2)-e(\theta_1(2-\mathbb{E}[\alpha](1-\theta_2)-\theta_2)-1))}{e^2-I_1I_2\theta_1\theta_2} \le \min\{E[\alpha]-1, \frac{E[\alpha]I_1-e(E[\alpha]-1)(1-\theta_1)}{I_1}\}$, we have that

$$\mu_1 = \frac{I_1\Big(I_1\theta_1(1-\theta_2+\mathbb{E}[\alpha]\theta_2) - e\Big(\theta_1\big(2-\mathbb{E}[\alpha](1-\theta_2)-\theta_2\big)-1\Big)\Big)}{\mathbb{E}[\alpha](e^2 - I_1I_2\theta_1\theta_2)},$$

$$\mu_2 = \frac{I_2\Big(I_2\theta_2(1-\theta_1+\mathbb{E}[\alpha]\theta_1) - e\Big(\theta_2\big(2-\mathbb{E}[\alpha](1-\theta_1)-\theta_1\big)-1\Big)\Big)}{\mathbb{E}[\alpha](e^2 - I_1 I_2 \theta_1\theta_2)}; \tag{A-69}$$

- Case 2. When $\frac{I_2\theta_2(E[\alpha]\theta_1-\theta_1+1)+I_2(1-\theta_2)}{e-I_1\theta_1\theta_2} \le \min\{E[\alpha]-1, \frac{E[\alpha]I_2-e(E[\alpha]-1)(1-\theta_2)}{I_2}\}$ and $\frac{E[\alpha]I_1-e(E[\alpha]-1)(1-\theta_1)}{I_1} < \frac{I_1(I_1\theta_1(1-\theta_2)-e((E[\alpha]-1)\theta_1^2\theta_2-(E[\alpha]-2)\theta_1-1))}{e(e-I_1\theta_1\theta_2)} \le E[\alpha]-1$, we have that

$$\begin{aligned}\mu_1 &= \frac{I_1\Big(I_1\theta_1(1-\theta_2) - e\Big((E[\alpha]-1)\theta_1^2\theta_2 - (E[\alpha]-2)\theta_1 - 1\Big)\Big)}{E[\alpha]e(e-I_1\theta_1\theta_2)};\\ \mu_2 &= \frac{I_2\theta_2(E[\alpha]\theta_1-\theta_1+1)+I_2(1-\theta_2)}{E[\alpha](e-I_1\theta_1\theta_2)}.\end{aligned} \tag{A-70}$$

- Case 3. When $\frac{E[\alpha]I_2-e(E[\alpha]-1)(1-\theta_2)}{I_2} < \frac{I_2(I_2(1-\theta_1)\theta_2-e((E[\alpha]-1)\theta_1\theta_2^2-(E[\alpha]-2)\theta_2-1))}{e(e-I_2\theta_1\theta_2)} \le E[\alpha]-1$ and $\frac{I_1\theta_1(E[\alpha]\theta_2-\theta_2+1)+I_1(1-\theta_1)}{e-I_2\theta_1\theta_2} \le \min\{E[\alpha]-1, \frac{E[\alpha]I_1-e(E[\alpha]-1)(1-\theta_1)}{I_1}\}$, we have that

$$\begin{aligned}\mu_1 &= \frac{I_1\theta_1(E[\alpha]\theta_2-\theta_2+1)+I_1(1-\theta_1)}{E[\alpha](e-I_2\theta_1\theta_2)};\\ \mu_2 &= \frac{I_2\Big(I_2(1-\theta_1)\theta_2 - e\Big((E[\alpha]-1)\theta_1\theta_2^2 - (E[\alpha]-2)\theta_2 - 1\Big)\Big)}{E[\alpha]e(e-I_2\theta_1\theta_2)}.\end{aligned} \tag{A-71}$$

- Case 4. When $\frac{E[\alpha]I_2-e(E[\alpha]-1)(1-\theta_2)}{I_2} < \frac{I_2(1-\theta_1\theta_2)+e(1-\theta_2)(E[\alpha]-1)\theta_1\theta_2}{e(1-\theta_1\theta_2)} \le E[\alpha]-1$ and $\frac{E[\alpha]I_1-e(E[\alpha]-1)(1-\theta_1)}{I_1} < \frac{I_1(1-\theta_1\theta_2)+e(1-\theta_1)(E[\alpha]-1)\theta_1\theta_2}{e(1-\theta_1\theta_2)} \le E[\alpha]-1$, we have that

$$\begin{aligned}\mu_1 &= \frac{I_1(1-\theta_1\theta_2)+e(1-\theta_1)(E[\alpha]-1)\theta_1\theta_2}{E[\alpha]e(1-\theta_1\theta_2)};\\ \mu_2 &= \frac{I_2(1-\theta_1\theta_2)+e(1-\theta_2)(E[\alpha]-1)\theta_1\theta_2}{E[\alpha]e(1-\theta_1\theta_2)}.\end{aligned} \tag{A-72}$$

In each of the four cases, (I_1, I_2, μ_1, μ_2) is an equilibrium bargaining outcome with Investor i investing I_i for the share of μ_i.

If $\mathbb{E}[\alpha] < 1 + \frac{1}{1-\theta_1\theta_2}$, there exists an equilibrium with the equilibrium investment as $I_1 = e$ and $I_2 = 0$, and the equilibrium share of investor i as $\mu_1 = \frac{1-\theta_1\theta_2+\mathbb{E}[\alpha]\theta_1\theta_2}{\mathbb{E}[\alpha]}$ and $\mu_2 = 0$;

If $\mathbb{E}[\alpha] < 1 + \frac{1}{1-\theta_1\theta_2}$, there exists an equilibrium with the equilibrium investment as $I_1 = 0$ and $I_2 = e$, and the equilibrium share of investor i as $\mu_1 = 0$ and $\mu_2 = \frac{1-\theta_1\theta_2+\mathbb{E}[\alpha]\theta_1\theta_2}{\mathbb{E}[\alpha]}$. ■

A.6. Experimental Protocol and Instructions

In this Appendix we provide details on our protocol for running experiments online as well as the instructions. As noted in the main text, we adapted the procedures suggested by Zhao et al. (2020) and Li et al. (2020). Specifically, the steps from recruiting to payment were as follows:

1. Participants were recruited from the general subject population using the University's recruiting platform (SONA). Subjects were explicitly told that the study would be online and that

they would be emailed a Zoom link 1-2 hours before the scheduled time. When participants connected to the Zoom meeting, they were held in a waiting room until they could be checked in.

2. 15 minutes before the start of the session, one experimenter began to check in participants one at a time, checking their ID and changing their name to "User x", where x is a number. After check-in, the participant's video was turned off and the participant was placed in a breakout room that was also monitored by another experimenter.
3. Once all participants were checked-in, general instructions were provided to all participants. Specifically, they were told that they would be placed in one of two (SI) or three (TI) breakout rooms, where they would be asked to turn on their video feed.[21] Participants were informed that they would never interact with another participant in the same breakout room. That is, all entrepreneurs were placed in the same breakout room, and similarly for those in the role of Investor 1 and Investor 2. Each breakout room was also monitored by an experimenter.
4. Subjects then read the instructions specific to the experiment and answered the comprehension questions. The experimenter in each breakout room was there to handle questions. If necessary, temporarily moving a participant to a private breakout room to answer questions or provide assistance.
5. Subjects participated in the main experiment in their respective breakout room.
6. At the conclusion of the experiment, all breakout rooms were closed and participants were asked to complete a separate survey with their name and address so that payments could be processed. This was done in order to de-link decisions from the experiment and personally identifying information. After participants completed the survey, they were free to leave the Zoom meeting.
7. Consistent with IRB guidelines, subjects were then mailed (within one business day) a debit card with the amount earned in the experiment.

A.6.1. Experimental Instructions

Below we reproduce the instructions for the SI-PoorEnt Treatment. The instructions for the remaining treatments and Preferred Stock contracts are analogous. The reproduced text omits the quiz questions as well as the additional measurements (risk aversion and fairness norm elicitation). The entrepreneur's view of instructions is shown (The investor's view is analogous). Indentation and fonts have been adapted for clarity of exposition.

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[21] Requiring subjects to display their video is mentioned by Li et al. (2020) as an important factor in ensuring that participants remain attentive throughout the experiment.

This study is about startup ownership. There are two parties: the entrepreneur and the investor, who must together decide how to divide the ownership of the startup. You will participate in 10 rounds of this study. In each round you will be the entrepreneur. n each round you will be matched at random with another person participating in this session, and that person will be the investor. Each round will consist of an interactive negotiation exercise between you and the investor. In each round you will have an opportunity to earn ”points”. At the end of the study one of the 10 rounds will be selected at random. Then, your point earnings from that round will be converted to US Dollars at the rate of 2 cents per point, and added to your participation payment of 8USD.

The investor has 200 points that she/he can invest in your startup. However, the share of the startup that the investor will receive in exchange for her/his investment is not known. Rather, you and the investor will negotiate the share that the investor receives. Then, the following can happen:

- Negotiations succeed. If negotiations succeed, there are two possible outcomes:
    - Startup succeeds: If the startup succeeds, it will be worth $200 \times 11 = 2200$ points, and that value will be divided between you (the entrepreneur) and the investor depending on the outcome of the negotiations.
    - Startup fails: If the startup fails, the value of the investment is multiplied by 1. This means, if the startup fails, it will be worth $200 \times 1 = 200$ points, and that value will be divided between you (the entrepreneur) and the investor depending on the outcome of the negotiations.
- Negotiations fail. If the negotiations fail, the investor gets to keep her/his 200 points and you (the entrepreneur) receive zero.

Note: the investor cannot invest partial amounts (any amount less than 200 points). In other words, either all 200 points are invested or nothing is invested.

As mentioned on the previous screen, it is possible that the startup fails. In particular,if the investor and the entrepreneur come to an agreement, there is an 80% chance that the startup fails and a 20% chance that it succeeds. If the startup fails, its value is equal to 200 points. If the startup succeeds, the value of the investment is multiplied by 11 as explained on the previous screen. That is, the startup will be worth $200 \times 11 = 2200$ points. Once the startup value is known, it will be divided between the investor and the entrepreneur according to the outcome of the negotiations.

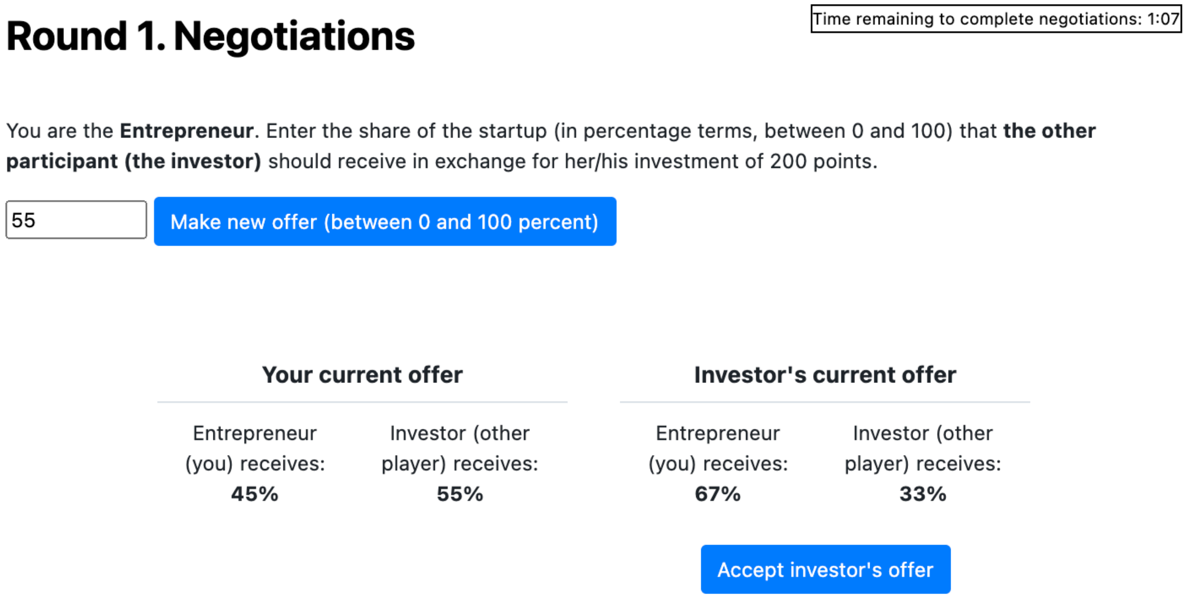
For example, suppose you have accepted an offer that gives the other participant (the investor) 65 percent of the startup and gives you (the entrepreneur) 35 percent of the startup. Then, if the startup succeeds, the other participant (the investor) will receive $2200 \times 0.65 = 1430$ points, and you will receive the remainder; i.e., 770 points. In contrast, if the startup fails, the investor will receive $200 \times 0.65 = 130$ points and you will receive 70 points.

Alternatively, suppose you made an offer that gives the other participant (the investor) 25 percent of the startup and gives you (the entrepreneur) 75 percent of the startup, and that offer has been accepted. Then, if the startup succeeds, the other participant (the investor) will receive receive $2200 \times 0.25 = 550$ points, and you will receive the remainder, 1650 points. In contrast, if the startup fails, the investor will receive $200 \times 0.25 = 50$ points and you will receive 150 points.

[...Subjects complete quiz questions...]

On the next screen, you will have 90 seconds to reach an agreement between you (the entrepreneur) and the other participant (the investor). Specifically, you will make and receive offers regarding the percentage amount that the investor receives in exchange for her/his investment of 200 points. Both you and the other participant can make as many offers as you wish in the 90 seconds available for negotiations. If you wish, you can also accept the most recent offer made by the other participant (the investor). If time expires without an offer being accepted, then the round ends and no investment is made. In this case, the investor keeps her/his 200 units and you (the entrepreneur) receive zero.

Figure A1 Negotiation Interface With Sample Offers: SI-PoorEnt and SI-RichEnt Treatments



Round 1. Negotiations

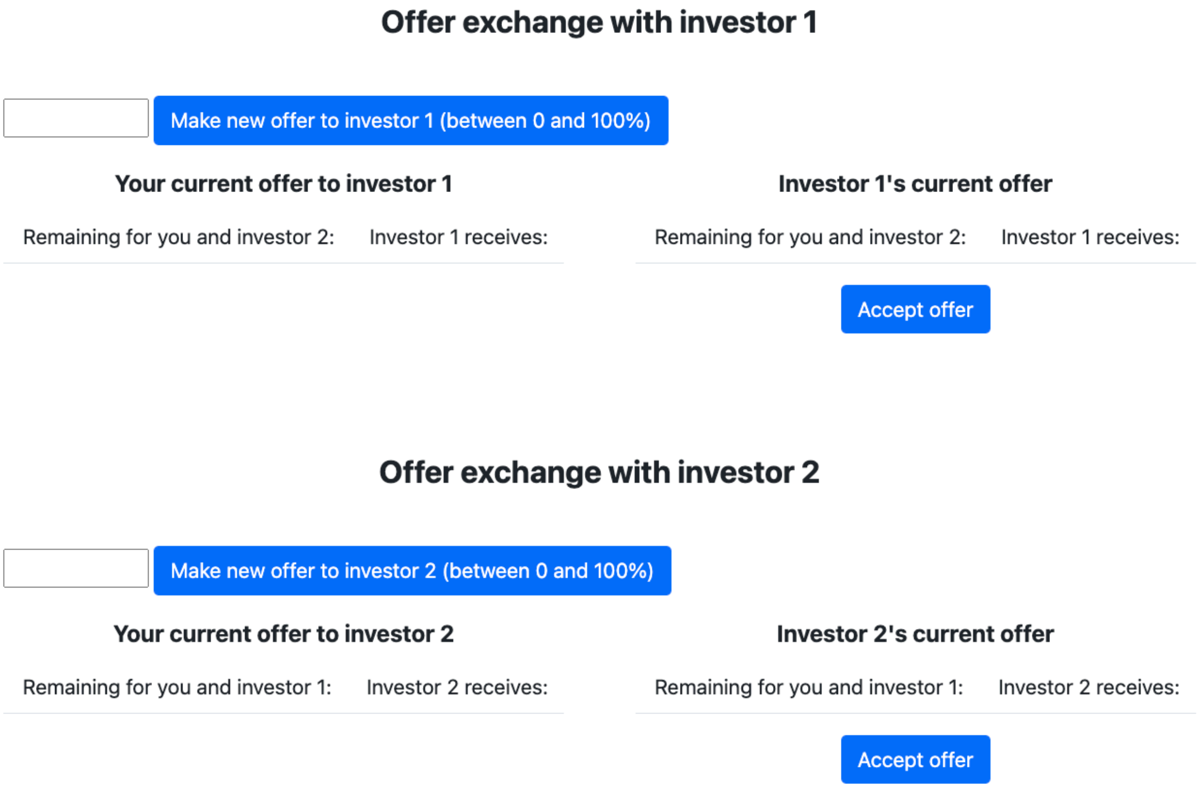
Time remaining to complete negotiations: 1:07

You are the **Entrepreneur**. Enter the share of the startup (in percentage terms, between 0 and 100) that **the other participant (the investor)** should receive in exchange for her/his investment of 200 points.

55

Your current offer		Investor's current offer	
Entrepreneur (you) receives:	Investor (other player) receives:	Entrepreneur (you) receives:	Investor (other player) receives:
45%	**55%**	**67%**	**33%**

Figure A2 Offers Exchange: TI-PoorEnt and TI-RichEnt Treatments



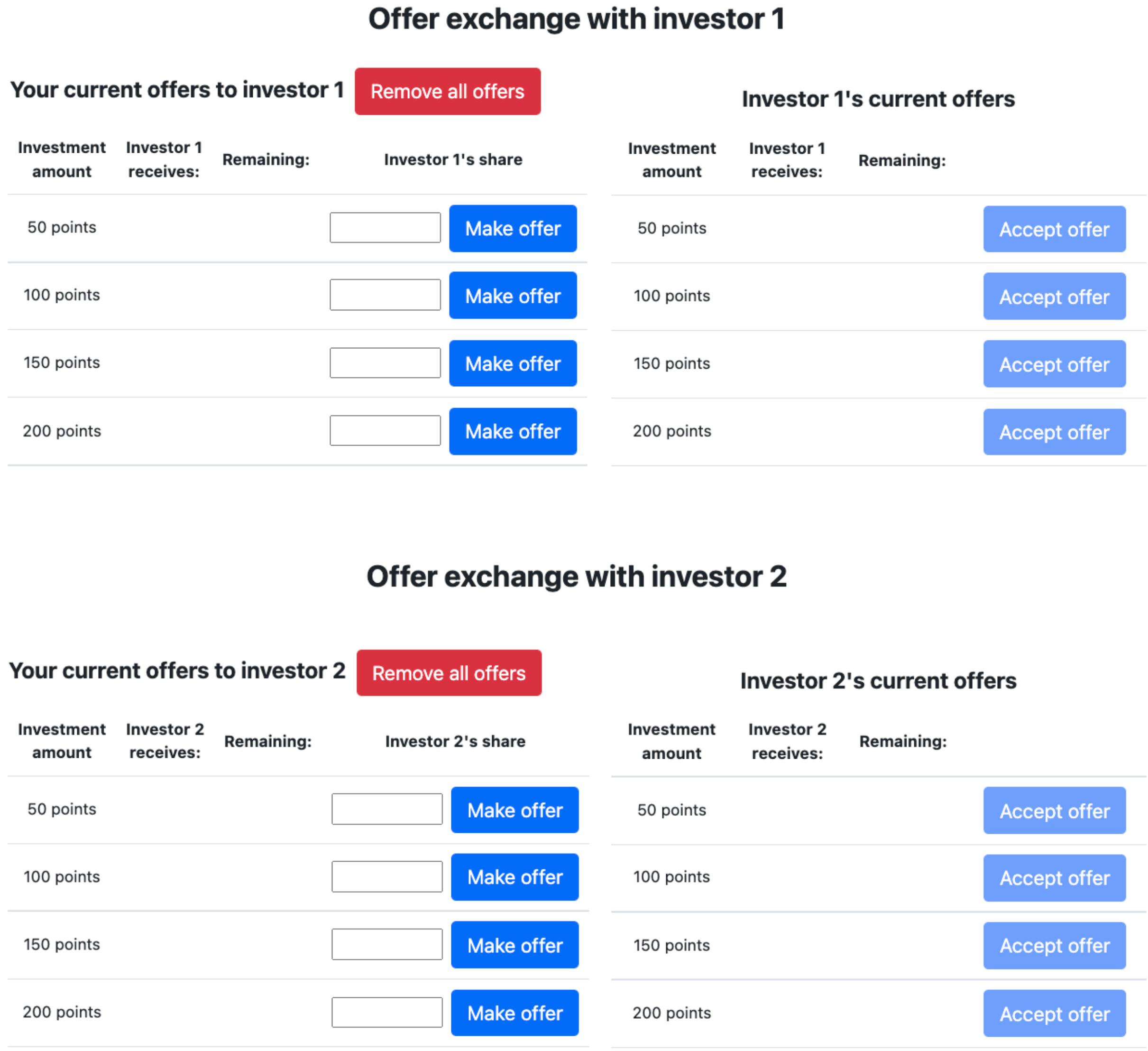
Offer exchange with investor 1

Your current offer to investor 1		Investor 1's current offer	
Remaining for you and investor 2:	Investor 1 receives:	Remaining for you and investor 2:	Investor 1 receives:

Offer exchange with investor 2

Your current offer to investor 2		Investor 2's current offer	
Remaining for you and investor 1:	Investor 2 receives:	Remaining for you and investor 1:	Investor 2 receives:

Figure A3 Offers Exchange: TI-Alt Treatment



Offer exchange with investor 1

Your current offers to investor 1

Investment amount	Investor 1 receives:	Remaining:	Investor 1's share	
50 points				Make offer
100 points				Make offer
150 points				Make offer
200 points				Make offer

Investor 1's current offers

Investment amount	Investor 1 receives:	Remaining:	
50 points			Accept offer
100 points			Accept offer
150 points			Accept offer
200 points			Accept offer

Offer exchange with investor 2

Your current offers to investor 2

Investment amount	Investor 2 receives:	Remaining:	Investor 2's share	
50 points				Make offer
100 points				Make offer
150 points				Make offer
200 points				Make offer

Investor 2's current offers

Investment amount	Investor 2 receives:	Remaining:	
50 points			Accept offer
100 points			Accept offer
150 points			Accept offer
200 points			Accept offer

A.7. Additional Experimental Results

Table A3 Summary Statistics on Expected Profits

(a) Expected Profits (Conditional on Full Agreement)

Treatment	**PoorEnt**				**RichEnt**			
	Common		**Preferred**		**Common**		**Preferred**	
	Inv.	**Ent**	**Inv.**	**Ent**	**Inv.**	**Ent**	**Inv.**	**Ent**
SI	340.31	259.69	413.57	186.43	312.18	287.82	377.49	222.51
TI	203.66	192.69	227.95	144.11	204.35	191.30	218.13	163.75

(b) Expected Profits (Unconditional)

Treatment	**PoorEnt**				**RichEnt**			
	Common		**Preferred**		**Common**		**Preferred**	
	Inv.	**Ent**	**Inv.**	**Ent**	**Inv.**	**Ent**	**Inv.**	**Ent**
SI	315.85	218.28	388.29	163.65	285.87	260.42	335.08	206.92
TI	176.48	192.60	208.47	143.07	174.66	212.05	195.75	175.87

Table A4 Underlying Regressions for Table 7

	(1)		(2)	
RichEnt	8.245^{***}	(2.819)	10.550^{***}	(2.625)
TI	-6.267^{**}	(2.568)	-5.544^{**}	(2.457)
Preferred Stock	-1.153	(1.928)	-0.892	(1.979)
RichEnt × TI	-9.306^{***}	(3.359)	-10.101^{***}	(3.748)
RichEnt × Preferred Stock	4.432^{**}	(2.164)	4.028^{*}	(2.273)
TI × Preferred Stock	0.935	(2.411)	0.971	(2.489)
RichEnt × TI × Preferred Stock	0.567	(3.237)	1.107	(3.318)
Controls	No		Yes	
R^2	0.150		0.203	
N	795		795	

Note: *, **, *** denotes significance at the 10, 5 an 1% level, respectively.