Entrepreneurship and the Process of Obtaining Resource Commitments

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Abstract

Most theories of the firm ignore the entrepreneurial process of how the various resources of the firm are combined in the first place. This paper examines the process of how an entrepreneur obtains commitments from multiple resource providers to create a new venture. Resource providers may be reluctant to commit to an unproven concept, and the commitment of one gives external validation for the others. The entrepreneur has to decide in what order to approach potential providers, and what to bargain for. The optimal sequence of commitments depends on the entrepreneur's own credibility. Additional problems arise when no resource provider wants to be the first to commit. In this case the entrepreneur may shuttle between resource providers for a long time and the venture may never get started. The paper also shows how, as a result of the entrepreneurial process, the resources in a firm may differ from their first-best combination.

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1 Introduction

Entrepreneurship involves a process of garnering resources, transforming an idea into a viable economic entity. Schumpeter, for example, argued that new ventures are essentially new combinations of existing resources. The entrepreneur's role is to bring about this new combination, convincing the current controllers of resources to make their resources available for the newly proposed use.

What challenges do entrepreneurs encounter in this process? Especially when they seek to implement fundamentally new ideas, entrepreneurs have to generate interest for a concept that is typically unproven and poorly understood. They may have difficulty to credibly convey the value of the underlying opportunity, or even get the attention of the current controllers of resources. Conversely, when faced with such a proposal, resource providers need to convince themselves of the merits of the proposed venture. For this, they want to rely not only on their own evaluation, but also on any signs of external validation. This may lead to some unwieldy interdependencies. Bhide and Stevenson (1992), for example, describe:

> [...] the desire of each participant to hold off a commitment until others have signed on. Customers are reluctant to spend time to evaluate, much less place an order [...] until the entrepreneur can actually deliver a product; employees are hesitant to commit to a job until the financing is in place; and investors are unwilling to step forward unless customers have shown a willingness to buy.

How do entrepreneurs solve this challenge? Consider the case of the Orbital Science corporation, a pioneering firm in commercial space exploration. At the beginning, it required a project contract from NASA, a contracting partnership with an established aerospace partner, and a substantial amount of financial backing. Sahlman, Stevenson and Turner (1989) describe the difficult process of how the entrepreneurs gradually obtain commitments from NASA, Martin Marietta and Rothschild. Everyone looks at what the others are doing, and the entrepreneurs go through a process of generating interest and obtaining provisional commitments before converting these into firm commitments.

The process is often complicated by the fact that initially the entrepreneur has little credibility. Consider, for instance, the case of Doug Ranalli, the less than 30 years old founder of Fax International Japan (FIJ). In order to implement his business plan of delivering a better fax service between the US and Japan, he needed an established Japanese sales agent as well as some financing from Japanese investors. Timmons and Voorheis (1994) note that:

> FIJ needed capital and credibility, and needed each to get the other.

The case describes how Ranalli seeks to obtain a foot in the door with potential partners. When N.T.T. shows interest, he does not obtain an outright commitment, but manages to convince N.T.T. to draft a letter of interest. He then uses this to enhance his subsequent bargaining position. The case notes:

> Although the letter of interest from N.T.T. did not guarantee that N.T.T. and FIJ would ever reach a final agreement on a sales agent contract, the indication of interest was extremely exciting. [...] Now Ranalli could continue looking for a lead investor, this time with some more leverage.

The process of seeking credibility from partners, however, is not without dangers. Consider the case of Clipper Ventures (see Austin and Käufer, 1993). Its founder, Steve Keiley, was seeking to establishing a transportation company on Lake Malawi. In the process of raising resources, he was introduced to Press, one of the largest and most influential companies in the country. He realized:

> If we could win them as allies or even as investors, that would be virtual guarantee of success. On the other hand, if we got turned down that would send a bad message to the rest of the business community, possibly cutting us off from any further assistance. This might have meant the end of Clipper Ventures.

The examples highlight the gradual and fragile nature of building up commitments and credibility. What can be said more generally about this process of obtaining resource commitments? How do entrepreneurs obtain commitments from key resource providers? What kind of contractual arrangements would they want to use? How can they generate interest, and credibility? The most immediate question for entrepreneurs is typically: Where do I start? In what order should I approach the various resource providers? As economists, we might also want to step back from the immediate concerns of entrepreneurs, and ask some fundamental questions, such as: Does it matter how resource commitments are obtained? Are there any inefficiencies in the process, and of what kind? Do we always end up with the same outcome, or does the process of entrepreneurship itself shape the ultimate structure of firms?

This paper provides a theoretical framework to address these issues. The model considers an entrepreneur that wants to obtain commitments from two resource providers, called 'partners.' Each partner has a monopoly over its resource, generating some hold-up power. The value of the venture is maximized if both partners participate, although it may still have some value if only one partner participates. Partners need to evaluate the opportunity before committing their resources. The commitment of one partner creates external validation for the other.

Resources can be thought of very broadly in this context, including physical assets, intellectual property, human capital or financial capital. Resource partners may be related to the entrepreneur in all parts of the value chain, such as suppliers, investors, employees, distributors or even customers. A commitment may be any kind of contract, such as an asset transfer, supply contract, employment contract, licensing agreement, cooperative agreement, distribution agreement or even a purchase order.

To get some intuition, consider a simplified example that abstracts from informational problems. Suppose an entrepreneur (called E) perceives an opportunity that requires the cooperation of two potential partners, called A and B. Assume that if both partners participate the expected value of the venture is 100. If only A participates, the value is 60 and if only B participates it is 40. Consider the case where E approaches A before B. Using Shapley-Nash, B receives a value of $\frac{1}{3}(100-60) = 13.33$ when bargaining with E and A. Anticipating this, E and A bargain over a surplus of $100 - 13.33 = 86.67$. E can threaten to go off alone with B and still get $\frac{1}{2}40 = 20$. When bargaining with A her bargaining share is thus $\frac{1}{2}(86.67 + 20) = 53.33$. This assumes that the threat of going to B is credible. When we model the information structure explicitly, we will see that the entrepreneur may not have the credibility to go off alone with B. In this case her bargaining share is only $\frac{1}{2}86.67 = 43.33$. Clearly, having credibility allows the entrepreneur to retain more rents. The interesting result is that it also affects the optimal sequence. If instead of approaching A, E had approached B first, she would get $\frac{1}{2}((100 - \frac{1}{3}(100 - 40)) + \frac{1}{2}60) = 55$ with credibility and $\frac{1}{2}(100 - \frac{1}{3}(100 - 40)) = 40$ without credibility. From this example we thus see that with credibility, E prefers to approach the lower value-adding partner B first (since $53.33 < 55$). Without credibility, however, this sequence is inverted: E prefers to approach the higher value-adding partner A first (since $43.33 > 40$).

This example illustrates the basic logic of optimal sequencing. There are two bargaining stages - it is easy to show one-stage simultaneous bargaining is never optimal - and at each stage the entrepreneur wants to use the threat of going with one partner to bargain with the other one. In the absence of informational problems, these threats are all credible, and it is optimal to approach the lower value-adding partner first. Things change when there are informational interdependencies between the partners' decisions. The first partner will only make a commitment that is conditional on the other partner also making a commitment. The entrepreneur is also in more fragile bargaining situation. If she cannot even obtain a conditional commitment from the first partner, the second partner will make a negative inference on the prospects of the proposed venture, and refuse to bargain with her. The optimal sequencing order is inverted, i.e., the entrepreneur now prefers to approach the higher value-adding partner first.

So far, the process of sequencing commitments appears rather smooth. This may not always be the case. Consider the example of Heather Evans, who was seeking to raise funds for her new fashion business. Roberts and Stevenson (1988) report:

> Her business plan had been in the hands of potential investors for over a month now, and her financing group was simply not coming together. Her contact at Arden & Co., a New York investment firm and hoped-for lead investor, was not even returning her phone calls. A small number of private investors had been stringing along for some weeks, but whenever

> Heather tried to go that next step and negotiate specific financing terms with any one of them, the rest of the group seemed to move further away. Heather expressed her frustration: "I was really counting on Arden & Co. to be my lead investor; this would both lend credibility to the deal and give me one party to negotiate terms with."

In this case we find an entrepreneur running from one potential partner to the next. Nobody wants to come forth to make the first commitment, and valuable time gets wasted in the process. Birley and Norburn (1985) describe this as a general problem in entrepreneurial ventures, noting that

> many would-be owners fail at the outset because they cannot step off the credibility merry-go-round.

Our formal model can capture this notion of a "merry-go-round." The analysis so far assumes that both partners are willing to be first in sequence. The equilibrium changes dramatically if partners perceive a disadvantage in being the first to commit. In this case there is a mixed strategy equilibrium, where the entrepreneur shuttles between two 'indecisive' partners, that accept to move only with a small probability. Unlike alternating offer games where the possibility of prolonged offers and counteroffers helps parties to settle up front, the equilibrium here consists of alternating refusals to deal with the entrepreneur, that are actually played out in equilibrium. Moreover, there is a strictly positive probability that the proposed venture will never get started. Seemingly paradoxical, the higher the probability that the entrepreneur gives up (or that the opportunity evaporates) after each shuttling step, the higher the overall probability that the venture will get started. This is because urgency puts greater pressure on partners to make the first move.

The model so far takes the set of partners as given. Especially given the above set of problems, entrepreneurs might want to choose their partners more carefully. Consider the example of a start-up that developed an algorithm for simultaneous voice and data transmission, ideally suited for simultaneous action play. The company's strategy critically depended on finding a corporate customer that would implement its technology. Hellmann (1998) records:

> Initially the company had focussed its efforts on a large volume sale to Sega or Nintendo, but in early 1994 the lack of progress lead the founder to shift their focus to the PC. [...] Thrustmaster appeared to be an attractive potential customer and it seemed to be an attractive back-door to the lucrative PC gaming industry. In the month to follow, the team made several trips to the company's headquarters in Portland to demonstrate their prototype and discuss product design.

Switching partners fundamentally changed the company's strategy. This decision was not based on a belief that Thrustmaster would be the most profitable application, but instead was based on its willingness to be the first to seriously evaluate the opportunity.

To get at these issues, the model considers how an entrepreneur would choose among alternative resource providers. It identifies two reasons why an entrepreneur may choose inefficient resource combinations, i.e., resources that do not maximize the total value of the opportunity. First, there may be a trade-off between efficiency and bargaining power. The entrepreneur may prefer certain resource combinations that allow her to retain a larger fraction of the rents. Second, there is a trade-off between efficiency and urgency, so that an inefficient partner may be chosen for his willingness to be the first to commit.

A number of prominent economists have contributed to various aspects of a theory of entrepreneurship.[1] Yet, the overall neglect of the entrepreneur in economic theory is frequently lamented. Schultz (1980), for example, notes that:

> In a large measure economic theory either omits the entrepreneur or it burdens him with esoteric niceties the implications of which are rarely observable.

This paper focuses on one central aspect of entrepreneurship, namely the process of garnering resources. The importance of this might be easily gleamed from what might be termed the "Harvard - Babson" definition of entrepreneurship (see Timmons, 1994, p.7):[2]

> Entrepreneurship is creating and building something of value from practically nothing. That is, entrepreneurship is the process of creating or seizing an opportunity and pursuing it regardless of the resources currently controlled. [...] Entrepreneurship involves building a team of people with complementary skills and talents; of sensing an opportunity where others see chaos, contradiction, and confusion; and of finding, marshalling, and controlling resources (often owned by others) to pursue the opportunity.

The approach of this paper, namely to capture the core idea of an important business process in a simple game-theoretic model, is akin to Hermalin's (1998) analysis of "leadership." The theme of this paper is related to Anton and Yao (1994, 1995), who examine the problem of how an entrepreneur can sell an idea in the presence of weak property rights. The paper is also related to some recent work by Rajan and Zingales (1997) which examines how the threat of expropriation limits an entrepreneur's ability to hire additional workers. In these papers the entrepreneur is

[1] The writings of Knight (1921), Schumpeter (1934, 1939), Kirzner (1985) and Baumol (1993) stand out. See Ronen (1983), Binks and Vale (1990) or Amit, Glosten and Muller (1993) for some useful overviews.

[2] Further useful references in the business literature on entrepreneurship include Bhide (1998), Drucker (1985) and Sahlman and Stevenson (1992).

concerned with curtailing access to her venture (namely, her intellectual property). In this paper the entrepreneur wants to raise - rather than curtail - the interest of potential partners. The analysis of bargaining with multiple parties is also related to the work of Admati and Perry (1991), Cai (1996) and Stole and Zwiebel (1996).

The results of this paper have some interesting implications for the theory of the firm.[3] Irrespective of what particular version - be it the property rights view (Hart, 1995), the firms as a nexus of contracts (Jensen and Meckling, 1976, Baker, Gibbons and Murphy, 1997, see also Holmström and Roberts, 1998), the resource-based view of the firm (Penrose, 1959, Wernerfelt, 1984), or indeed many others ones - there is an obvious gap in the various theories of the firm, namely that they do not explain how these firms were put together in the first place. The point of this paper is that the resources (or assets, or contracts etc.) of a firm may not only be determined by their efficiency, but also by the entrepreneurial process of how they are brought together. Unlike in evolutionary theories of the firm (see Nelson and Winter, 1982), however, this notion of path-dependency emanates from rational maximizing behavior.

The remainder of the paper is organized as follows. Section 2 develops the base model. Section 3 analyzes the optimal sequencing decision of the entrepreneur. Section 4 examines the properties of the shuttle equilibrium. Section 5 examines potential inefficiencies in the choice of partners. It is followed by a brief conclusion.

2 The Model

Consider a model with three agents. The entrepreneur, denoted by E, wants to pursue an opportunity that requires the cooperation of two resource providers, denoted by A and B. For linguistic simplicity we will refer to resource providers as partners. E is indispensable to the new venture. Her challenge is to obtain a commitment of resources from the partners without giving away too much of the rents.

All parties have linear risk-neutral utility. The expected value of the proposed venture depends on who participates. In principle there can be 7 different coalitions. The coalitions $\{E\}$, $\{A\}$, $\{B\}$ correspond to no coordination of resources and utilities are normalized to be zero. Since E is indispensable, the coalition $\{A, B\}$ also has a value zero. The expected values generated by the remaining coalitions $\{E, A\}$, $\{E, B\}$ and $\{E, A, B\}$ are denoted by r_A, r_B and r_{AB}. E is also wealth constraint, so that she can only give partners a stake in the surplus generated by the new venture. A contract will consist of a resource commitment, together with a rule for the division of the surplus generated. A contract may also specify a contingent commitment, where a partner commits to provide the resource only if the other partner also makes a commitment.

[3] Obviously, the results apply not only to the creation of new firms, but also more broadly to the creation (or re-organization) of economic entities. The model is particularly well suited, for instance, to study the formation of inter-firm alliances, or the consolidation of existing firms in a market.

E has an unproven concept. Each partner needs to evaluate the opportunity, before he can contract with E. Evaluation is a non-verifiable action, with private costs denoted by d_{Aj}, where $j = 1, 2$ indicates whether A is the first or second partner to evaluate the opportunity.[4] (For notation that naturally applies to both partners, throughout the paper we will only state it for the A partner.) It is natural to assume the evaluation costs can only go down if a partner moves from being the first to being the second to evaluate, i.e., $d_{A1} \geq d_{A2}$. Evaluation generates a signal that is privately observed by the evaluating partner. The signal can take two values, H_A and L_A. The high signal H_A is received with probability μ_A, so that the low signal L_A is received with $\bar{\mu}_A \equiv 1 - \mu_A$. Since there are two signals, the probability of two high signals is denoted by μ_{AB}, and the conditional probability of a good signal for B, gives than A had a good signal by $\mu_{B|A} = \dfrac{\mu_{AB}}{\mu_A}$. The signals of A and B may be (imperfectly) correlated. If one partner perceives a low signal, the other partner would no longer want to commit his resources, i.e., $r_i(L_A, L_B)$, $r_i(L_A)$, $r_i(L_B)$, $r_i(L_A, H_B)$, $r_i(L_A, H_B) < 0$ for $i = \{A\}, \{B\}$ or $\{AB\}$. E, however, may still want to pursue the opportunity even after a bad signal. We say that E has "the entrepreneurial spirit" if she wants to pursue the opportunity even after a negative signal, and unless specified otherwise, we will make this assumption.[5] Two good signals are better than one, so that $r_i(H_A, H_B) \geq r_i(H_i)$. For a non-trivial analysis we assume $r_{AB}(H_A, H_B) > 0$, but no assumption is needed on whether $r_A(H_A)$ or $r_A(H_A, H_B)$ is positive or negative.

When E chooses to approach a partner, the following stage game is played out (see figure 1). The partner chooses either not to evaluate the opportunity, in which case the stage game ends. We call this outcome "postponement." Alternatively, he may choose to evaluate the project. After the evaluation he may choose not to bargain with E, in which case the stage game ends once again. We call this outcome "rejection." Alternatively, he may choose to bargain. Following Binmore, Rubinstein and Wolinsky (1986) and Hart and Mas-Colell (1996) we use a bargaining game with breakdown, which yields Nash-Shapley values. We discuss this modeling choice in

[4] These costs can be thought of as direct costs, e.g., the cost of checking on information and references, or the opportunity cost of time of examining the business plan. Moreover, one may also think of the evaluation costs as the 'psychic costs' and the general reluctance of parties to commit to a new venture, especially if it contains a significant degree of novelty. If we think of a partner as a corporation, the evaluation cost may also be the cost of getting corporate approval. For example, there may be a champion in the partner company that needs to engage in some lengthy internal debates in order to get internal buy-in to proceed and work with the entrepreneur.

[5] Entrepreneurs are frequently eager to pursue their business opportunities despite the advent of negative information. We can think of this as emanating from a small private benefit of pursuing the venture, such as if E increases her human capital, if she can extract value from some ex-post renegotiation, or simply if she gains some intrisic utility from it. The private benefit is assumed to be small in the sense that it doesn't impose a binding constraint on the division of surplus if the venture succeeds. No separate notation is needed then, since the private benefits can be included in the coalition values r_i.

the appendix (A1). In this game, two outcomes are possible: either the two parties find an "agreement," or there is a "breakdown." In both cases the stage game ends there.

The stage game is embedded in the following extensive form game. E first chooses to approach one partner, and the two play the above stage game. If the outcome of the stage game is an agreement, the two of them proceed to approach the second partner.[6] In all other cases, E may proceed to approach the second partner on her own, again to initiate the stage game. After approaching the second partner, E may come back to the first partner, and so forth. Following Stole and Zwiebel (1996ab), however, we assume that all breakdowns are final, so that two partners cannot bargain with each other in a later stage game, if they had a breakdown in an earlier stage game. Between each stage game, we apply a discounting factor δ. This can be interpreted as time discounting, or as the probability that the opportunity evaporates (maybe because somebody else implemented the opportunity, or because E found something better). Once E has a commitment from at least one of the partners she may implement the project. The value of the venture is subsequently realized and each party collects its contractually specified rewards. E may also choose to give up at any point of the game.[7]

The moves of a stage game are only observable to the participating players. If a partner agrees to bargain, he thereby reveals that he has obtained a high signal. All bargaining thus occurs under symmetric information. The only potential point of asymmetric information is across stage games. In particular, if E approaches the second partner without an agreement from the first, the second partner cannot directly observe whether the previous stage game ended with postponement, rejection or breakdown.

3 What partner comes first?

3.1 Optimal Sequencing

The entrepreneur's problem is to choose the order in which to approach the two partners. We solve the game by backwards induction. Consider the case where at the first node of the stage game all partners always prefer to evaluate the opportunity, rather than to postpone. The conditions for this are derived explicitly in the next section.

Consider the second stage bargaining and suppose that in a first stage, E had

[6] The stage game with E and the first partner approaching the second partner is identical to the game described above, except that in the bargaining, the second partner will face both E and the first partner.

[7] E may also bargain with the two partners simultaneously, provided that they are both willing to engage in simultaneous bargaining. Since the simultaneous bargaining case is suboptimal, we first focus on the sequential cases and come back to it later in the analysis.

decided to approach A, that A saw a high signal and the two parties had agreed on a contract. As we will see below, optimal features of that contract include that the commitment of A is contingent on an agreement with B. The optimal contract also specifies that E cannot form a coalition with B without A. From the fact that A was willing to make a conditional commitment, B can infer than A must have received a high signal. He will need to do his own evaluation. If B gets the L_B signal, he declines to bargain. From this, A infers that B saw L_B, E is unable to meet the contingency, and the venture comes to a halt. With probability $\mu_{B|A}$, however, B will also get H_B. In this case he will initiate bargaining. The value of the grand coalition $\{E, A, B\}$ is given by $r_{AB}(H_A, H_B)$. We also need to consider the value for the sub-coalitions. Because E is contractually tied, the value of the coalition $\{E, B\}$ is zero. The value of the coalition $\{A, B\}$ is zero anyway. As for the $\{E, A\}$ coalition, both E and A are insiders to the bargaining. From the willingness of B to bargain, they both know that B saw the high signal. In case of a breakdown with B, they are thus willing to renegotiate their conditional contact into a commitment. The value of their coalition is thus $Max[0, r_A(H_A, H_B)]$. With this, the Shapley values of the second stage bargaining game are given by

$$share_2(E) = \frac{1}{3} r_{AB}(H_A, H_B) + \frac{1}{6} Max[0, r_A(H_A, H_B)]$$
$$share_2(A) = \frac{1}{3} r_{AB}(H_A, H_B) + \frac{1}{6} Max[0, r_A(H_A, H_B)]$$
$$share_2(B) = \frac{1}{3} r_{AB}(H_A, H_B) - \frac{1}{3} Max[0, r_A(H_A, H_B)]$$

Consider next the second stage bargaining when E approaches B without a contract from A. It is easy to distinguish postponement from either rejection or breakdown. In the former case, E will ask B for a conditional commitment, but in the latter two cases, E knows that A will never agree to commit his resource, and so E will ask for an unconditional commitment. The case of postponement is analogous to a first stage bargain, which we will analyze below. Consider thus the cases where E approaches B without A. Either A saw the high signal and had a bargaining breakdown with E, or A saw the low signal, and because of her entrepreneurial spirit continues to pursue the opportunity anyway. A rejection from A happens with probability $\bar{\mu}_A$ *on the equilibrium path*, but a breakdown occurs only *off the equilibrium path*, and has thus a probability measure zero. This implies that B will always have a belief that E was rejected because A saw the low signal. He will therefore simply refuse to deal with E, and all parties get a utility of zero.[8]

[8] One might wonder if B couldn't just ask A whether there was a breakdown or a rejection. Two reasons suggest why this would be difficult. First, A has no more interest in E's venture. If asked by B he has no incentive to tell the truth in either case. In fact, if one wants to put a human interpretation to this game, it would be likely that A is dismayed at E for the breakdown, and is therefore unlikely to endorse her for B. But even if A would be willing to tell the truth, it suffices that B has even a small cost of communication to prevent him from asking A. This is precisely because B is not willing to incur even a small cost for something with a probability zero.

We are now in a position to examine the first stage bargaining. If A receives the low signal (with probability $\bar{\mu}_A$), he will refuse to bargain with E. While E would want to approach B, she will also get rejected by B, and the venture comes to a halt. With probability μ_A, however, A receives the high signal, and the joint surplus is

$$\delta\mu_{B|A}(\frac{2}{3}r_{AB}(H_A, H_B) + \frac{1}{3}Max[0, r_A(H_A, H_B)])$$

When E bargains with A over this surplus, E has no outside options, since E cannot get a deal from B unless A is on board. E and A thus split the surplus equally. Define

$$\rho_i = Max[\delta\mu_{AB}r_i(H_A, H_B), 0]$$

ρ_i is the ex-ante value of the coalition of E and $i = \{A\}, \{B\}, \{AB\}$. The ex-ante utilities in the game where E approaches A before B are thus given by

$$\begin{aligned} u_{EAB} &= \frac{1}{3}\rho_{AB} + \frac{1}{6}\rho_A \\ u_{1A} &= \frac{1}{3}\rho_{AB} + \frac{1}{6}\rho_A - d_{A1} \\ u_{2B} &= \frac{1}{3}\rho_{AB} - \frac{1}{3}\rho_A - \delta\mu_A d_{B2} \end{aligned} \tag{1}$$

Note that if the cost of evaluation is very large, the participation constraint of a partner is not satisfied. We assume that the project is sufficiently attractive (ρ_{AB} sufficiently large) for all participation constraints to be satisfied at all times. Note also that the above game uses the standard assumption that players know the structure of the game, i.e., B knows that E approached A before approaching B. This assumption is actually not necessary. If a player is not certain about whether or not he is the first to be approached, then he will always ask for a conditional commitment. This ensures that E wasn't already rejected by the other partner.[9]

We can now address the question of what partner E wants to approach first. If instead of approaching A before B, E approaches B before A then

[9] The other reason why the conditional commitment is used, is, obviously, that with an uncontingent contract, E would want to pursue the venture, even if the other partner had a low signal. Adding the contingent clause prevents E from pursuing such a negative value project. Strictly speaking, if there are no costs of renegotiation and no uncertainty about the order of play, then the conditional commitment is only weakly optimal. Under these circumstances, it would also be possible for the first partner to write an unconditional contract and renegotiate that contract in case that the second partner does not commit. Any small renegotiation costs, or small uncertainty about the order of play, however, make the conditional commitment strongly optimal. Another problem with the unconditional contract is that it rewards entrepreneurs with bad opportunities. This can lead to adverse selection and moral hazard problems not formally modeled here. The conditional commitment naturally averts these problems.

$$
\begin{aligned}
u_{EBA} &= \frac{1}{3}\rho_{AB} &+\frac{1}{6}\rho_B & \\
u_{2A} &= \frac{1}{3}\rho_{AB} &-\frac{1}{3}\rho_B &-\delta\mu_B d_{A2} \\
u_{1B} &= \frac{1}{3}\rho_{AB} &+\frac{1}{6}\rho_B &-d_{B1}
\end{aligned} \tag{2}
$$

We say that a partner is more valuable if $\rho_A > \rho_B$, i.e. if the partner adds more value to the project on his own.[10] It is useful to define the following notation. Let Θ_A denote A's relative preference for being first in sequence, i.e.,

$$\Theta_A \equiv u_{1A} - u_{2A}$$

Let Δ denote E's relative preference for the AB over BA sequence, i.e.,

$$\Delta \equiv u_{EAB} - u_{EAB}$$

From (1) and (2) we immediately obtain $\Delta = \frac{1}{6}(\rho_A - \rho_B)$. With this, we can state the following proposition.

Proposition 1 *If $\Theta_A > 0$ and $\Theta_B > 0$, then E prefers to approach the more valuable partner first, i.e., E prefers the AB sequence over the BA sequence whenever $\rho_A > \rho_B$.*

The key intuition for proposition 1 is that E wants to use the threat of going off with one of the partners against the other partner. Consider figure 2, which shows the potential threats used by E. While E would want to use threats at both bargaining stages, the threat is only credible at the second stage. In the first stage E doesn't have any credible threats, because without the commitment of the first partner, she has no credibility off-the-equilibrium-path with the second partner. By contrast, in the second stage, her threat is effective, since the first partner is now an insider that can distinguish a breakdown from a rejection. The choice of whom to approach first boils down to optimally choosing threats. If the only credible threat occurs at the second, stage, E prefers to approach the more valuable partner first, in order to enlist him to provide the strongest possible threat at the second stage.[11]

In the appendix (A1) we show that proposition 1 is fairly robust to alternative game-theoretic specifications. In a generalized Shapley solution where each player has an individual bargaining weight, it remains true that a player is more likely to be the first in sequence if he is more valuable. Interestingly, sequencing does not depend on E's bargaining weight, but only on the relative bargaining weight of

[10] This is equivalent to adding more value in the presence of the other partner, i.e., $\rho_A > \rho_B \Leftrightarrow \rho_{AB} - \rho_B > \rho_{AB} - \rho_A$.

[11] Note also that the sequence chosen by E is not necessarily efficient. The AB sequence is efficient whenever $d_{A1} + \delta\mu_A d_{B2} < d_{B1} + \delta\mu_B d_{A2}$, i.e., whenever the total evaluation costs are lower. These costs, however, are borne by the partners, and E does not take them into account.

A and B. E prefers to bargaining first with the player with the lower bargaining weight, i.e., the player that extracts a lower fraction of surplus over outside options. The appendix (A1) also examines some alternative bargaining concepts that are not based on Shapley values, and finds that proposition 1 remains valid.

3.2 The role of credibility

The lack of credibility in the first stage is critical to proposition 1. Consider now a world where E does have credibility. Credibility could come from a number of sources. For one, if E does not have what we call the "entrepreneurial spirit," (i.e., private benefits of pursuing even a bad venture) she will actually be more credible. Also, if partners could observe each others signals or the details of the bargaining process, then they would be able to distinguish a rejection from a breakdown. Finally, if E were independently wealthy, cash could always make up for credibility, i.e., her willingness to pay could indirectly reveal her private information.

In all of these cases, E would not continue to pursue the venture after the low signal. This would give her credibility off the equilibrium path, after a breakdown with the first partner. The second stage of bargaining is the same as before. In the first stage of the AB sequence, however, E now has the option of approaching B in case that there is a breakdown with A. With credibility, B knows that E and A must have had a breakdown. He is thus willing to bargain for an unconditional contract over $r_B(H_A, H_B)$. Knowing this, E's outside option at the first stage now becomes

$$\delta\mu_{B|A}(\frac{1}{2}Max[0, r_B(H_A, H_B)])$$

so that E's share is given by

$$\frac{1}{2}\delta\mu_{B|A}(\frac{2}{3}r_{AB}(H_A, H_B) + \frac{1}{3}Max[0, r_A(H_A, H_B)] + \frac{1}{2}Max[0, r_B(H_A, H_B)])$$

and A's share is given by

$$\frac{1}{2}\delta\mu_{B|A}(\frac{2}{3}r_{AB}(H_A, H_B) + \frac{1}{3}Max[0, r_A(H_A, H_B)] - \frac{1}{2}Max[0, r_B(H_A, H_B)])$$

Then we have for the AB sequence

$$\begin{aligned} u_{EAB} &= \frac{1}{3}\rho_{AB} \quad +\frac{1}{6}\rho_A \quad +\frac{1}{4}\rho_B \\ u_{1A} &= \frac{1}{3}\rho_{AB} \quad +\frac{1}{6}\rho_A \quad -\frac{1}{4}\rho_B \quad -d_{A1} \\ u_{2B} &= \frac{1}{3}\rho_{AB} \quad -\frac{1}{3}\rho_A \quad -\delta\mu_A d_{B2} \end{aligned} \tag{3}$$

and for the BA sequence

$$
\begin{aligned}
u_E &= \frac{1}{3}\rho_{AB} && +\frac{1}{6}\rho_B && +\frac{1}{4}\rho_A \\
u_A &= \frac{1}{3}\rho_{AB} && -\frac{1}{3}\rho_B && -\delta\mu_B d_{A2} \\
u_B &= \frac{1}{3}\rho_{AB} && +\frac{1}{6}\rho_B && -\frac{1}{4}\rho_A && -d_{B1}
\end{aligned} \tag{4}
$$

E's relative preference for the AB over BA sequence is now given by $\Delta = \frac{1}{12}(\rho_B - \rho_A)$.

Proposition 2 *If E has credibility off the equilibrium path, and $\Theta_A > 0$, $\Theta_B > 0$, E prefers to approach the less valuable partner first, i.e., whenever $\rho_A < \rho_B$.*

This is exactly the opposite result to proposition 1. Whenever A is the more valuable partner, E now prefers to go to B before going to A. Consider again figure 2. With credibility, E has two points at which she can use the threat of one partner against the other. She can now decide at which point what threat is more effective. At the first stage the stakes are larger, as E is alone to face the first partner, and she needs to give up half of the surplus over outside options. At the second stage, however, the power of the second partner is diluted by the presence of the first partner (who is on her side), and the second partner extracts only a third of the surplus over outside options. As a consequence, E prefers to use the stronger threat at the first stage. But this implies that the more valuable partner must come second. Hence proposition 2.

From the above reasoning, it is interesting to ask to what extent Proposition 2 depends on the bargaining concept used. In the appendix (A1) we show that proposition 2 continues to hold for a generalized Shapley solution where each player has an individual bargaining weight. In fact, with credibility, bargaining weights don't matter at all for sequencing. Proposition 2 changes when one considers non-Shapley bargaining concepts. In particular, one may consider bilateral bargaining concepts, where at each stage the new party bargains against the existing parties. In our case this means that at the second stage the second partner bargains against a joint unit of E and the first partner. For bilateral bargaining, we consider both a Binmore, Rubinstein and Wolinsky (1986) breakdown model and a Rubinstein (1982) discounting model. In the breakdown model we find the Nash solution at each stage, so that the new partner can always get half of the surplus over outside options at each stage. In this case sequencing doesn't matter, i.e., E is now indifferent as to when to use the stronger threat. This indifference result also carries over to the discounting model. The intuition is that E always has to face both partners and that with only bilateral bargaining it doesn't matter when she faces them. Note, however, that Proposition 1 does not change for these bilateral bargaining concepts. As a consequence, there remains a clear contrast between propositions 1 and 2: in the case of no credibility E prefers to sequence the more valuable partner first, whereas with credibility sequencing now doesn't matter.

Given that E is always better off with credibility, one might ask if E could not always generate credibility by somehow making information public. The problem, however, is that the partner who has the credible information does not want to make it public. Once a partner has observed the high signal, he is eager to bargain privately with E.

Closely related to this, we can now also see why there never is any simultaneous bargaining. The willingness of the partners to participate in a simultaneous bargaining would signal that they received a high signal. The simultaneous bargaining Shapley values (excluding due diligence costs) are given by

$$\begin{aligned} u_E &= \frac{1}{3}\rho_{AB} & +\frac{1}{6}\rho_A & +\frac{1}{6}\rho_B \\ u_A &= \frac{1}{3}\rho_{AB} & +\frac{1}{6}\rho_A & -\frac{1}{3}\rho_B \\ u_B &= \frac{1}{3}\rho_{AB} & -\frac{1}{3}\rho_A & +\frac{1}{6}\rho_B \end{aligned} \tag{5}$$

The first partner is always better off bargaining individually than agreeing to a three-way bargaining.[12]

Finally, it is worth mentioning briefly how these results extend to the case of more than two partners. While the general case of n partners is intractable, the appendix (A2) considers an example with three partners. It shows that for the first step, proposition 1 is the relevant one. E has no credibility and prefers to approach the most valuable partner first. But after the first step, the logic of proposition 2 applies. She approaches partners in increasing order of value-added. The intuition is that once E has the first partner on board, she can use his credibility to optimally sequence the remaining partners.

4 What if partners don't want to commit first?

In the analysis so far E is able to sequence the commitments of the two partners in an orderly matter. This is because partners are always willing to be the first to evaluate the project, rather than postpone. Consider now the case where this is no longer the case. This can be true both in the model with and without credibility, whenever $\Theta_A < 0$ and $\Theta_B < 0$. In the case without credibility, this is equivalent to (for A, similarly for B)

$$\frac{1}{6}\rho_A + \frac{1}{6}\rho_B < d_{A1} - \delta\mu_B d_{A2} \tag{6}$$

and with credibility it is equivalent to (for A, similarly for B)

[12] This is true for the case without credibility. In the case with credibility, it is E that would never choose to have three-way bargaining.

$$\frac{1}{6}\rho_A + \frac{1}{12}\rho_B < d_{A1} - \delta\mu_B d_{A2} \quad (7)$$

In both cases the left-hand side represents the first-bargainer advantage, i.e., the benefit to bargain down the other partner with E, rather than being bargained down by E and the other partner. The size of the bargain advantage depends on the strength of these bargaining threats ρ_A and ρ_B. The right-hand side represents the first-evaluator disadvantage, i.e., the cost of having to evaluate an unproven concept that has not been pre-screened by anybody else. The second evaluator may not only have lower evaluation costs (if $d_{A1} > d_{A2}$), but he also has to evaluate only those projects that have already passed the other partners test (as measured by μ_B).[13]

If conditions (6) or (7) are satisfied for both partners, neither wants to be the first to scrutinize the deal. When E approaches A, A would like decline dealing with E, send her to B and hope that she will come back with a contract from B.[14] Obviously, B wants to do exactly the same thing. This cannot represent an equilibrium yet.

There are two types of sequential equilibria in this game, 'asymmetric' pure strategy equilibria and a mixed strategy equilibrium. The pure strategy equilibria are simple but not very robust. It may be that A has strategy of always accepting to move first and B doesn't, or vice versa. Or it may be that the first (second) player approached always accepts first. These pure strategy equilibria, however, require particular beliefs off the equilibrium path. For example, suppose that in the pure strategy equilibrium where A is supposed to always evaluate first, A were to postpone. If B were to have the very reasonable belief that after A postponed, he would continue to do so, then B would move. This breaks the equilibrium. Incidentally, it is also exactly what A was hoping for.

This problem with beliefs off the equilibrium path is related to the problem of equilibrium selection. If the two partners are unsure who is supposed to move first, it seems unclear why they would happen to have the right belief structure for the pure strategy equilibrium. The potential confusion over which pure strategy equilibrium gets selected naturally leads to the mixed strategy equilibrium. Indeed, the mixed strategy equilibrium does not require any assumptions on off-the-equilibrium-path behavior. Each player can only observe the past actions of the other player, but not the actual probability with which a player moves or postpone. If a player were to change his strategy, the other player would never know. Put differently, every history of the play is on the equilibrium path, so that players never have to rethink their strategies.[15]

[13] In the appendix we show that for bilateral bargaining concepts the condition $\Theta_A < 0$ may hold even if there are no evaluation costs. This is because with bilateral bargaining, there may be a disadvantage to bargain first.

[14] If a partner postponed, E will approach the other partner for a contingent commitment. This way postponement is always easily distinguishable from rejection or breakdown, where E would ask for an unconditional commitment.

[15] The problem with the asymmetric pure strategy equilibria and the attractiveness of the mixed

We immediately state the main results of this section. Since the proof is somewhat more involved, it is relegated to the appendix (A3).

Proposition 3 *If $\Theta_A < 0$, $\Theta_B < 0$, there exists $\hat{\delta} < 1$, such that for all $\delta > \hat{\delta}$ there exists a stationary mixed strategy equilibrium with the following properties:*

(i) E may have to shuttle back and forth between the two partners, who randomize between moving first or postponing their move.

(ii) There is a strictly positive probability that the venture never gets started.

(iii) The lower the urgency (higher δ), the greater the probability that the venture never gets started.

(iv) The greater the first-mover disadvantage $\mid \Theta_A \mid$, the greater the probability that the venture never gets started.

(v) The equilibrium is Pareto-inefficient.

(vi) As $\delta \to 1$, the order in which E approaches the partners becomes irrelevant.

The first fundamental property of the mixed strategy equilibrium is that neither partner is willing to move first with certainty. The randomization might be interpreted as "indecisiveness." The important implication of this is that in equilibrium E can expect to be shuttling back and forth between the two partners, possibly for a long time. This shuttling behavior is not informative in any sense, but is simply a consequence of the reluctance of the partners to commit first. This is quite different from alternating offer bargaining games, where the anticipation of any back and forth helps parties to settle up front. In this model, the shuttling is actually played out in equilibrium.

The second fundamental property of the equilibrium is that the commitment of resources may never be reached, even though it is valuable. There is a strictly positive probability that the shuttling is never resolved, i.e., that the opportunity actually evaporates.

The third property is one of the most surprising. It states that the *lower* the probability that the opportunity evaporates at any point in time (higher δ), the *higher* the overall probability that it actually evaporates. The reason for this surprising result is that the relationship between the per-period probability and the overall probability is not a mechanical one, but depends on the endogenous behavior of the partners. The less likely it is that the opportunity evaporates, the less urgency the partners will feel to make a move. This worsens the problem of postponement, and actually makes it overall more likely that no partner will have made a move before the opportunity has evaporated.

Another interesting way of looking at this is to interpret δ as a measure of E's perseverance. We discover a new variant of Murphy's law: "the greater the entrepreneur's perseverance, the greater the indecisiveness of her partners." Indeed, if

strategy equilibrium are reminiscent of other well-known games such as the battle-of-the-sexes or the war-of-attrition game.

E keeps coming back to partners, her perseverance harms her strategically. Indeed, coming back only reaffirms the partner's wait-and-see attitude.[16]

The fourth property of the equilibrium is more straightforward. The larger the disadvantage of moving first, the stronger the partner's reluctance to do so, and the higher the probability that the opportunity evaporates. The fifth property provides a strong welfare result, namely Pareto-inefficiency. In particular, E and the second partner would be better off, if the first partner would simply agree to move first. The last property shows that E essentially looses control over the sequencing in the shuttling equilibrium. Her choice of what partner to approach first becomes virtually irrelevant if she will have to shuttle between these partner anyway.

The shuttle equilibrium has a number of paradoxical characteristics, that nonetheless may be painfully familiar to many entrepreneurs. At the heart of the problem is that E may not always be able to resolve coordination failures between the various resource providers. In the model E is somewhat constraint in terms of how she can resolve these coordination failures. An interesting question to ask is what additional instruments would need to introduced into the model to resolve the coordination failure. The appendix (A4) discusses a large number of alternative coordination devices. It suggests that it may be impossible for E herself to resolve the coordination failure, and that the two partners might solve the coordination failure themselves only under some highly idealized circumstances.

5 What kind of partners?

The model so far assumes that the partners are exogenously given. In this section we ask what kind of resource combination might arise when E can choose between alternative partners. In particular, we are interested in whether and how the process of obtaining commitments affects the actual resource choices of a new venture. We will distinguish between two distinct drivers of partner choices. In the first subsection E's choices are driven by a desire to maximize bargaining power, in the second they are driven by a desire for a more orderly sequencing process. For tractability, we will assume there is a single irreversible partner choice, but we will also discuss what happens if this assumption is relaxed. To keep the exposition short, we only treat the case where E has no credibility. The case where E has credibility is very similar.

[16] Another interesting implication of this result is a potential positive feedback mechanism for urgency in entrepreneurial opportunities. In an environment in which there is urgency, say because other entrepreneurs may snatch away the opportunity any time soon, our entrepreneur will be faster in bringing the resources together. But this may increase the urgency felt by these other entrepreneurs. These dynamics bear some resemblance to the pace at which Internet companies are created these days, where the fast pace of the competition might actually help entrepreneurs to gather their own resources faster.

5.1 Choosing inefficient partners for their bargaining power

Assume E can choose among two resource providers for each resource need A and B. We denote the partners by A', A'', B' and B''. Designate the pair (A', B') as the most efficient combination, i.e., $\rho_{A'B'} > Max[\rho_{A'B''}, \rho_{A''B'}, \rho_{A''B''}]$. For expositional simplicity, assume also that $Min[\rho_{A'}, \rho_{A''}] > Max[\rho_{B'}, \rho_{B''}]$, so that E always prefers to approach an A partner first. We can immediately state the main proposition of this subsection.[17]

Proposition 4 *Suppose all partners are always willing to move first. In order to retain a larger fraction of the rents, E will choose an inefficient first partner A'' instead of A' whenever*

$$(\rho_{A''} - \rho_{A'}) > 2(\rho_{A'B'} - Max[\rho_{A''B'}, \rho_{A''B''}])$$

If she chooses A'' as her first partner, she will also choose B'' over B' as her second partner whenever

$$\rho_{A''B'} < \rho_{A''B''}$$

The most fundamental insight from proposition 4 is that E will not necessarily choose those partners that provide the greatest value. Instead, E is concerned with protecting herself against hold-up. She therefore is willing to accept a less efficient resource provider, if that partner allows her to capture more rents.

What kind of partner provides better protection to E? The critical condition is that $\rho_{A''}$ is larger than $\rho_{A'}$, sufficiently larger to compensate for the loss of efficiency from $\rho_{A'B'}$ to $Max[\rho_{A''B'}, \rho_{A''B''}]$. This says that in the absence of any B partner, A'' generates more value than A'. There are several interpretations for this. We can think of A'' as an individualist employee, that it well capable of handling the job by him- or herself, but is a poor team player. Or A'' is a 'jack-of-all-trades' that can also handle some of B's task. A', on the other hand, is a specialist that is better at performing the A task, but is inadequate to handle the B task. Or if we think of partners as suppliers, we might think that A'' provides a good standardized solution, but that A' would provide a customized solution that is superior, but only if there also is a B component.

The second part of proposition 4 says that once E chose one inefficient partner (A'' instead of A'), she might also want to change the other partner (B'' instead of B'). This happens whenever B'' is a better fit than B' for A''. This result is interesting, since it indicates that in order to better retain rents, the entire structure of a venture - all of its key resources - may be chosen differently from their first best combination.

As mentioned above, the analysis so far assumes irreversible partner choices. This is the appropriate assumption in a variety of circumstances. There may be some underlying technology or strategy choices that determines the choice of partners. for

[17] The proof involves straightforward calculations and is omitted here.

example, the entrepreneur may need to make some design choices at the beginning of the game. Those choices would then be made with a view on what partners E wants to work with later. Alternatively, there may be significant costs for E to approach partners. The model only focuses on the evaluation costs incurred by the partner, but a straightforward extension is to include similar costs for E. For instance, there may be costs in educating a partner about the opportunity. Or there may be a problem of weak intellectual property rights, where valuable information is leaked every time E approaches a partner. In all of these cases, E makes an initial choice what partners to work with, and then sticks with them throughout.

Nonetheless, there are other circumstances, where E may be approaching multiple competing partners, and possible reverse earlier partner choices. In this case, two additional concerns complicate the analysis. First, at the time of bargaining we need to take into account potential competition between two providers of similar resources. Second, we need to ask if there might be additional bargaining stages where inefficient partner choices are actually reversed. In the appendix (A5) we show how E can use the bargaining threats of choosing among the alternative providers of resources. The basic insight from proposition 4 about choosing partners for their bargaining protection remains valid. If evaluation costs are low, however, the inefficient partner is replaced in a final bargaining round with the efficient player. Somewhat more surprisingly, this may not be true if evaluation costs are high. In this case there may be an endogenous irreversibility, where the benefits for the efficient partner do not outweigh his private costs.

5.2 Choosing inefficient partners to improve the sequencing process

The analysis so far considered the case where all players are always willing to move first. The choice of partners becomes particularly interesting, when this is only true for some, but not all partners. In this case, E chooses partners partly for their willingness to move first.

To organize the analysis, it is useful to consider figure 3, which maps out partners' willingness to move first (as measured by Θ_A and Θ_B). For any pair of partners A and B, there are four different parameter regions. The top left quadrant (called choice region) represents the region where both partners are willing to move first, so that E can chose an optimal sequence (as in section 3). The bottom right quadrant (called shuttle region) represents the region where neither partner is willing to move first, resulting in the shuttle equilibrium (as in section 4). The two remaining quadrants (called "A first" and "B first") represent the intermediate cases, in which only one partner is willing to move first. The equilibrium is straightforward in this case, in that E has no choice but to approach the willing partner first.

We will now consider how E would choose among alternative partners, when different partner combinations are located in different quadrants of figure 3. For this, consider how the model parameters influence how partner pairs fall into the four regions. First note that $\frac{\partial \Theta_A}{\partial \rho_{AB}} = 0$.[18] The willingness to move first is not influenced by the overall size of the opportunity. While it affects the utility of the partners, it does not affect the *difference* in utilities of moving first or second. Next, note that $\frac{\partial \Theta_A}{\partial \rho_A} > 0$ and $\frac{\partial \Theta_B}{\partial \rho_A} > 0$. This says that the higher ρ_A, the greater A's willingness to move first. A larger value of ρ_A implies a greater first-bargainer advantage. Interestingly, a higher value of ρ_A also has a positive effect on B's willingness to move first. There is greater disadvantage for B to be bargained down in the second stage of bargaining. In figure 3, an increase in ρ_A can thus be represented as a vector pointing to the north-east. Changes in ρ_{AB}, however, do not affect the position in figure 3.

Consider now again the trade-off between A' and A'', where $\rho_{A'B} > \rho_{A''B}$ but $\rho_{A'} < \rho_{A''}$. For the moment, suppose also that B' and B'' are identical. Consider the case of vector 1 in figure 3, which goes from the "B first region" to the "choice region." Formally, we have

$$\Theta_{A''}(A'', B') > 0 > \Theta_{A'}(A', B') \text{ and } \Theta_{B'}(A'', B') > \Theta_{B'}(A', B') > 0$$

A' never wants to move first, whereas A'' is glad to move first. If E were to choose A', then she would have to sequence B before A', whereas A'' is glad to be first in sequence. The benefit for E of choosing A'' is added flexibility in the sequencing of partners. Since E prefers to sequence the higher value-added partner first, she will prefer A'' over A' whenever

$$u_E(A''B') > u_E(B'A') \Leftrightarrow (\rho_{A''} - \rho_{B'}) > 2(\rho_{A'B'} - \rho_{A''B'}) \tag{8}$$

Note that this condition is different from the condition in proposition 4. Indeed, since $\rho_{A'} > \rho_{B'}$, it may well be that $2(\rho_{A'B'} - \rho_{A''B'}) > (\rho_{A''} - \rho_{A'})$, so that A'' would not have been chosen for bargaining reasons alone. The reason that A'' is chosen is that he is willing to move first. This allows E to sequence partners in her preferred order.

There are a number of very similar trade-offs. Consider vector 2 in figure 3, which goes from the "shuttling region" to the "A first region". Again, A' never wants to move first, whereas A'' is glad to move first. This time, however, this happens in a situation where B' does not want to be first either. Choosing A'' becomes particularly important for E, since it avoids a shuttle equilibrium. Not only can E now always get an AB sequence, but more importantly, E moves from a positive to a zero probability of breakdown. Choosing the inefficient partner thus allows E to form an orderly sequencing of resources, rather than a inorderly shuttling. Two more constellations are worth mentioning briefly. Vector 3 in figure 3 indicates a case where A'' actually

[18] For the derivative w.r.t. ρ_i we hold the information structure $\{\mu_A, \mu_B\}$ constant, i.e., we consider a pure change in $r_i(H_A, H_B)$.

brings the game directly from the "shuttling region" into the "choice region." And vector 4 in figure 3 indicates a case where A'' brings the game from the "shuttling region" into the "B first region." It is also straightforward to extend the argument to the case where B' and B'' are not identical. In this case we might find that B'' is chosen not only to because possible advantages of matching low complementarity partners, i.e., if $\rho_{A''B''} > \rho_{A''B'}$. It may also be that B'' contributes to moving the game into a preferred region. Vector 5 in figure 3 shows one of the many possible examples.

Consider next trading off partners with different evaluation costs.[19] We have $\frac{\partial \Theta_A}{\partial d_{A1}} < 0$ and $\frac{\partial \Theta_B}{\partial d_{A1}} = 0$. The analysis is very similar to the above. Consider the case where A'' has a lower evaluation cost. Vector 6 in figure 3 shows the benefit of moving from the "B first region" to the bargaining region and vector 7 shows the benefit of moving from the "shuttle region" to the "A first region." If B'' has a lower evaluation cost, then vector 8 in figure 3 shows the benefit of moving from the "shuttle region" to the "B first region." In all of these cases, E would be glad to accept a less efficient partner, if that partner is more willing to be the first to evaluate the opportunity.[20] [21]

We summarize the results as follows:

Proposition 5 *An entrepreneur may choose an inefficient partner combination in order to facilitate the process of obtaining resource commitments. She may be willing to give up a large amount of the value, if she can replace a partner that is not willing to move first with one that is willing to do so. A higher stand-alone value or a lower evaluation cost increase the willingness of a partner to move first.*

The important intuition here is that E does not only care about the efficiency of the resources that are gathered, but also about the willingness of the resource providers to cooperate in the process of combining these resources. Even a small difference in a partner's benefit of moving first (i.e., ability to extract rents), or his cost (read 'attitude') of evaluating an unproven concept, may change the resource combination and thus the development path of an entrepreneurial venture.

It is worth pointing out that proposition 5 depends on the irreversibility assumption. Indeed, competition between resource partners solves the problem of not wanting to move first. To see this, consider the following simple example, based on vector

[19] For simplicity, we define a lower evaluation as a lower value of d_{A1}. The analysis is analogous if we define it as a lower value of some parameter x, where $\frac{\partial d_{A1}(x)}{\partial x} \geq \frac{\partial d_{A2}(x)}{\partial x}$.

[20] Note that the more stringent criterion for efficiency is that A'' provides less value than A' gross of evaluation costs, e.g., $\rho_{A''B} - d_{A''1} - \delta\mu_{A''}d_{B2} < \rho_{A'B} - d_{B'1} - \delta\mu_{B'}d_{A2}$ for vector 6.

[21] To see the effect of a better signaling technology, one can use a simple linear parametrization, and show that $\frac{\partial \Theta_A}{\partial \mu_A} < 0$ and $\frac{\partial \Theta_A}{\partial \mu_B} \lesseqgtr 0$. A partner with a better evaluation capability (i.e., low μ) would also be more willing to be first, although it could be that a better evaluation technology increases the incentives for the other partner to free ride on that partners evaluation.

1 in figure 3. Without competition, A' would prefer to move second. Suppose now that there is competition from A''. If A' were to postpone evaluation, E would have a choice of either approaching B and then come back to A', or else, E could approach A'' and then B. If (8) is satisfied, E prefers the latter. But this implies that A' lost out on the opportunity. He will therefore prefer to move first, rather than postpone. Competition from A'' thus eliminates A' incentives to postpone.[22]

6 Concluding thoughts

This paper examines the process of how an entrepreneur obtains resource commitments to create a new venture. Ideally, E approaches potential partners sequentially, and partners make commitments that are conditional on all other partners also committing. If, however, partners are unwilling to be first to commit, the entrepreneur may shuttle between partners for a long time, and in equilibrium the opportunity may evaporate before any commitments have been made. The entrepreneur may also choose partners that do not provide the highest value, if these partner provide her better protection against hold-up in bargaining, or if they show a greater willingness to commit first.

These results have implications for the theory of the firm. In the theories of Grossman, Hart and Moore (see Hart, 1995), hold-up matters to the extent that it affects non-contractible human capital investments. In these theories the firm always consists of the efficient set of assets, and the boundaries of the firm are chosen in order to limit the damage of holdup problems. In the current paper, hold-up also affects the boundaries of the firm, but in a very different way. In this model hold-up complicates the entrepreneurial process of bringing the assets into the firm. As a consequence, the efficient combination of assets may never be reached in the first place. The entrepreneur may deliberately chose inefficient asset providers, if this allows her to better protect herself against hold-up in the process of assembling those assets. Even more dramatic, the entrepreneur may not even be able to bring about any combination of assets, namely if assets owners hold up the opportunity for too long.

The results of this paper also suggest a number of interesting empirical predictions. The analysis suggests that the strategically relevant unit of analysis should be the sequencing of resource commitments, rather than the sequencing of actual resource deployments. If one were to look at the sequence of contracts obtained by an entrepreneur, the model predicts that in the early stages the entrepreneur will seek to obtain conditional commitments, especially when there are informational interdependencies across potential resource providers. If the entrepreneur has low

[22] Obviously, competition changes A' postponement strategy only if the second partner is a sufficiently close competitor. Indeed, if condition (8) is violated, i.e., $u_E(A''B') < u_E(B'A')$, then E cannot commit to ever approach A'' before B, and A' will continue to postpone.

(high) credibility, little (much) wealth, or a high (low) private benefit in pursuing the venture, she will prefer to enlist the highest (lowest) value-added partner first. The theory also makes some predictions about the likelihood of "shuttling behavior," an interesting and important phenomenon that might well be empirically observable. Shuttling (or delay) should be more likely, the greater the evaluation costs of partners, the lower the credibility of the entrepreneur, and the lower the alternatives available to the entrepreneur. As for the choice of resources, the model predicts that resource providers are chosen not only for their value added, but also for their stand-alone value. Resource choices are biased towards too few complementarities between the resources utilized in the venture. Interestingly, if resource choices can be reversed over time, one would expect a pattern where complementarities increase with the age of the venture. Resource choices should also be biased toward those resource providers that have a lower cost of evaluating opportunities, even if they are less efficient.

This paper takes a new approach for looking at the forgotten child in economics, namely entrepreneurship. The analysis in this paper opens up multiple lines of future research. It provides a natural starting point for developing further theories of entrepreneurship that examine the microeconomic foundations of how entrepreneurs create value. It also suggests that examining the entrepreneurial process provides a fresh perspective on the theory of the firm.

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Appendix

A1: Discussion of bargaining concepts

The basic model uses the Nash-Shapley value as its equilibrium concept. Recent advances in game theory have justified the use of the Nash-Shapley value as the outcome of a simple alternating offer game (Binmore, Rubinstein, Wolinksy, 1986, for the Nash solution, and Hart and Mas-Colell 1996, for the generalized Shapley solution). The fundamental assumption of these games is that parties make alternating offers, and after one party made an offer that was not accepted by the other parties, there is a (vanishingly small) probability that this party will drop out and get its outside option. We can use this framework as the non-cooperative foundation for the stage games in our model. E chooses a first partner and bargains under alternating offers. If there is a breakdown, then two parties go their own ways, and E can try to bargain with the second partner, again using alternating offers. If there is a breakdown between two parties, we adopt the approach of Stole and Zwiebel (1996ab) that assumes that breakdown is terminal, so that the two parties cannot bargain again at some later point in the game. This game yields the Nash-Shapley value for each stage game.

The alternative offers of the stage game do not interact with the moves of the extensive form game, i.e., the parties proceed in the extensive game only after a resolution of the stage game. Stole and Zwiebel suggest a simple procedure where two partners bargain for a unit of time and make accelerating offers, so that the stage game always finishes before either partner can make a move in the extensive game. Alternatively, one could assume that, if any one party initiates bargaining with the third party, the other party simply believes that a breakdown occurred. Even without such a belief, however, premature switching is not a problem in this model. Because E chooses the order of sequencing, she always prefers to bargain with the partner she chose first. The stationary structure of the game implies that switching partners prematurely is thus never credible.

We have thus establishes that there exists a non-cooperative game that yields the equilibrium used in the main part of the paper. Obviously, changing assumptions about the bargaining process might also affect the outcomes (see, for example, the discussion in Binmore, Osborne and Rubinstein, as well as in Hart and Mas-Colell, 1996). There are, in principle, infinitely many games that could be postulated, and it is unlikely that the results are robust to all such permutations. We limit our discussion here to examining how robust the results are to some of the more common alternative bargaining concepts. In particular, we consider a generalized asymmetric Shapley value, and we examine well-known two bilateral (as opposed to multilateral) bargaining games.

Consider first a generalization of the Shapley value, where each player has its own bargaining weight. This might be interpreted as a measure of individual bargaining skill. Let w_E, w_A and w_B denote each parties relative bargaining weights. If, for example, E bargains with A, then she will receive a share of $\frac{w_E}{w_E + w_A}$ of the surplus over outside options, and if she bargains against A and B, then she will receive a share of $\frac{w_E}{w_E + w_A + w_B}$ of the surplus over outside options. We normalize so that $w_E + w_A + w_B = 1$, it is convenient to use the shorthand $w_{EA} = w_E + w_A$, and note that $w_{EA} = \bar{w}_B \equiv 1 - w_B$.

Consider the case where E has no credibility. Expressing all terms in ex-ante values (ρ_i), we have in the second round $share_2(B) = w_B\rho_{AB} - w_B\rho_A$, so that $share_2(E \cup A) = w_{EA}\rho_{AB} + w_B\rho_A$. In the first round we have $share_1(E) = \frac{w_E}{w_{EA}}(w_{EA}\rho_{AB} + w_B\rho_A)$ and $share_1(A) = \frac{w_A}{w_{EA}}(w_{EA}\rho_{AB} + w_B\rho_A)$. Thus, if E chooses a sequence AB, then

$$\begin{aligned} u_{EAB} &= w_E\rho_{AB} && + \frac{w_E w_B}{\bar{w}_B}\rho_A && \\ u_{1A} &= w_A\rho_{AB} && + \frac{w_A w_B}{\bar{w}_B}\rho_A && - d_{A1} \\ u_{2B} &= w_B\rho_{AB} && - w_B\rho_A && - \delta\mu_A d_{B2} \end{aligned}$$

Using symmetry to calculate the values for the BA sequence, we immediately obtain that E prefers the AB sequence whenever $\Delta = w_E(\frac{w_B}{\bar{w}_B}\rho_A - \frac{w_A}{\bar{w}_A}\rho_B) > 0$. E's sequencing preferences are not affected by her own bargaining strength, but only by the relative strength of A and B. Proposition 1 remains valid in that a greater value-added by a partner makes it more likely that the partner is chosen first. In this specification there is an additional bargaining strength effect. E prefers to go first to the partner with the weaker bargaining strength. This is because she would rather face the stronger bargaining partner at a point when she has gathered greater bargaining strength herself, which is at the second stage.

If E has credibility, her outside option at the first stage is given by $\frac{w_E}{w_{EB}}\rho_B$, so that

$$share_1(E) = \frac{w_E}{w_{EA}}(w_{EA}\rho_{AB} + w_B\rho_A) + \frac{w_A}{w_{EA}}\frac{w_E}{w_{EB}}\rho_B$$
$$share_1(A) = \frac{w_A}{w_{EA}}(w_{EA}\rho_{AB} + w_B\rho_A) - \frac{w_A}{w_{EA}}\frac{w_E}{w_{EB}}\rho_B$$

From this we obtain the following ex-ante utilities for the AB sequence:

$$\begin{aligned} u_{EAB} &= w_E\rho_{AB} && + \frac{w_E w_B}{\bar{w}_B}\rho_A && + \frac{w_E w_A}{\bar{w}_A\bar{w}_B}\rho_B \\ u_{1A} &= w_A\rho_{AB} && + \frac{w_A w_B}{\bar{w}_B}\rho_A && - \frac{w_E w_A}{\bar{w}_A\bar{w}_B}\rho_B - d_{A1} \\ u_{2B} &= w_B\rho_{AB} && - w_B\rho_A && - \delta\mu_A d_{B2} \end{aligned}$$

E's preference for AB over BA is given by $\Delta = w_E\frac{w_A w_B}{\bar{w}_A\bar{w}_B}(\rho_B - \rho_A)$. It is immediate the proposition 2 continues to hold. In fact, the distribution of bargaining skills has no effect at all on the optimal sequence here.

Consider next some alternative bargaining concepts that are prominent in the literature. In particular we examine strictly bilateral (as opposed to multilateral) concepts, where the newly approached partner bargains with the set of existing partners. This means that the partner that is approached second can bargain with E and the first partner as a unit. In this case, the second round of bargaining can be modeled as a bilateral bargaining. We consider both the breakdown model of Binmore, Rubinstein and Wolinsky (1986) and the discounting model of Rubinstein (1982). For simplicity, we consider only the symmetric case.

In the breakdown model the outcome corresponds to the Nash bargaining solution. We have $share_2(B) = \frac{1}{2}(\rho_{AB} - \rho_A)$, so that $share_2(E \cup A) = \frac{1}{2}(\rho_{AB} + \rho_A)$. Without credibility, we have for the first round $share_1(E) = share_1(A) = \frac{1}{4}(\rho_{AB} + \rho_A)$. Thus, if E chooses the AB sequence, then

$$\begin{aligned} u_{EAB} &= \frac{1}{4}(\rho_{AB} + \rho_A) \\ u_{1A} &= \frac{1}{4}(\rho_{AB} + \rho_A) \quad -d_{A1} \\ u_{2B} &= \frac{1}{2}(\rho_{AB} - \rho_A) \quad -\delta\mu_A d_{B2} \end{aligned}$$

E's preference for AB over BA is given by $\Delta = \frac{1}{4}(\rho_A - \rho_B)$, so that proposition 1 holds. Note, however, that the condition $\Theta_A > 0$ is much harder to satisfy. Even if there are no evaluation costs, $\Theta_A < 0 \Leftrightarrow \rho_{AB} > \rho_A + 2\rho_B$. This implies that shuttling is more likely with this bargaining concept.

If E is credible, then we have for the first round $share_1(E) = \frac{1}{2}(\frac{1}{2}(\rho_{AB} + \rho_A) + \frac{1}{2}\rho_B)$. Thus, if E chooses the AB sequence, then

$$\begin{aligned} u_{EAB} &= \frac{1}{4}(\rho_{AB} + \rho_A + \rho_B) \\ u_{1A} &= \frac{1}{4}(\rho_{AB} + \rho_A - \rho_B) - d_{A1} \\ u_{2B} &= \frac{1}{2}(\rho_{AB} - \rho_A) - \delta\mu_A d_{B2} \end{aligned}$$

In this case $\Delta = 0$, i.e. sequencing does not matter.[23] The intuition is that at every bargaining stage E gives up half of the surplus. With credibility E can use each partner as a threat against the other. It then doesn't matter when E exercises the weaker or stronger threat.

Consider next the time discounting model of Rubinstein (1982). We have $share_2(E \cup A) = Max[\frac{1}{2}\rho_{AB}, \rho_A]$. Without credibility, we have for the first round $share_1(E) =$

[23] Note also that the condition $\Theta_A > 0$ is even harder to satisfy: even with $d_A = 0$, we have $\Theta_A < 0 \Leftrightarrow \rho_{AB} > \rho_A + \rho_B$.

$share_1(A) = \frac{1}{2}Max[\frac{1}{2}\rho_{AB}, \rho_A]$. Thus, if E chooses a sequence AB, then

$$\begin{aligned} u_{EAB} &= Max[\frac{1}{4}\rho_{AB}, \frac{1}{2}\rho_A] \\ u_{1A} &= Max[\frac{1}{4}\rho_{AB}, \frac{1}{2}\rho_A] \quad -d_{A1} \\ u_{2B} &= Min[\frac{1}{2}\rho_{AB}, \rho_{AB} - \rho_A] \quad -\delta\mu_A d_{B1} \end{aligned}$$

For $\frac{1}{2}\rho_{AB} < Max[\rho_A, \rho_B]$, E's prefers AB over BA if $\rho_A > \rho_B$. This confirms proposition 1. If $\frac{1}{2}\rho_{AB} > Max[\rho_A, \rho_B]$, then $\Theta_A < 0$ and $\Theta_B < 0$, and we are already in the shuttling region. With credibility, we have for the first round $share_1(E) = Max[\frac{1}{2}Max[\frac{1}{2}\rho_{AB}, \rho_A], \frac{1}{2}\rho_B]$, so that $u_{EAB} = Max[\frac{1}{4}\rho_{AB}, \frac{1}{2}\rho_A, \frac{1}{2}\rho_B]$ and sequencing does not matter to E. The model with discounting thus behaves similarly to the breakdown model.[24]

A2: An example with more than two partners

To examine the behavior of the model with more than two partners, we consider an example with three partners, A, B and C. We will use the natural extension for all the notation and assumptions of the main model. Consider now the ABC sequence. We need to examine what threats are available to the bargaining parties at the three bargaining stages. In the third stage, E, A and B have the threat of doing it on their own. This corresponds to the second step in the game with two partners. At the first stage E is again without outside options, because of the same credibility problem, so this corresponds to the first step of the two partner game. The new element thus concerns the second bargaining step. E and A can threaten B to go off with C. Unlike in the first step, this off-the-equilibrium path threat is credible. The continued presence of A signals to C that B did no reject the opportunity, but that there was a breakdown with B. (Alternatively A could also signal this by offering cash to C.) The presence of A thus solves the credibility problem for E in this second step. Using obvious notation we can solve the three partner game. Straightforward calculations show that

$$\begin{aligned} u_{EABC} &= \frac{1}{4}\rho_{ABC} + \frac{1}{12}\rho_{AB} + \frac{1}{9}\rho_{AC} + \frac{1}{18}\rho_A \\ u_{1A} &= \frac{1}{4}\rho_{ABC} + \frac{1}{12}\rho_{AB} + \frac{1}{9}\rho_{AC} + \frac{1}{18}\rho_A \quad -d_{A1} \\ u_{2B} &= \frac{1}{4}\rho_{ABC} + \frac{1}{12}\rho_{AB} - \frac{2}{9}\rho_{AC} - \frac{1}{9}\rho_A \quad -\delta\mu_A d_{B2} \\ u_{3C} &= \frac{1}{4}\rho_{ABC} - \frac{1}{4}\rho_{AB} \quad -\delta^2\mu_{AB} d_{C3} \end{aligned}$$

[24]Note also that it makes sense to examine the discounting model only in a bilateral bargaining context, since the discounting model is not well behaved with more than two players. See Binmore (1987).

With three partner, E can choose among 6 feasible sequences, namely ABC, BAC, ACB, CAB, BCA, and CBA. Assume the following monotonicity condition:

$$\rho_i \geq \rho_j \Leftrightarrow \rho_{ik} \geq \rho_{jk}, \forall i, j, k \in \{A, B, C\}$$

With this, it is easy to show that E prefers to approach the partner with the highest value first, the partner with the lowest value second and the middle value partner last. For example, the ABC is chosen whenever $\rho_A > \rho_C > \rho_B$. This is very intuitive. In the first step, E has no credibility, so that Proposition 1 applies. After the first step, E gets credibility through the first partner, and thus the results of Proposition 2 holds. As a result E approaches the highest value added partner first. After that, he approaches partners in increasing order of value-adding, thus going to the lowest value-added partner second and the middle partner last.[25] [26]

A3: Proof of Proposition 3

For the mixed strategy equilibrium, let z_A be a stationary strategy of player A, where $z_A \in [0, 1]$ is the probability that player A moves to evaluate, rather than postpones. Let U_A denote A's total utility in the shuttle game, then $U_A = z_A U_A^{move} + \bar{z}_A U_A^{post}$ where $U_A^{move} = u_{1A}$ and $U_A^{post} = \delta z_B u_{2A} + \delta^2 \bar{z}_B U_A$. Solving for U_A, we get $U_A = \dfrac{z_A u_{A1} + \delta \bar{z}_A z_B u_{2A}}{1 - \delta^2 \bar{z}_A \bar{z}_B}$. If $\delta < \dfrac{u_{1A}}{u_{2A}}$ then $z_A = 1$. We will consider the case where $\delta > Max[\dfrac{u_{1A}}{u_{2A}}, \dfrac{u_{1B}}{u_{2B}}] \equiv \hat{\delta}$. Maximizing U_A w.r.t. z_A, the first order conditions provides a solution for z_B:

$$z_B = \frac{u_{1A} - \delta^2 u_{1A}}{\delta u_{2A} - \delta^2 u_{1A}}, \quad z_A = \frac{u_{1B} - \delta^2 u_{1B}}{\delta u_{2B} - \delta^2 u_{1B}} \tag{9}$$

Since $1 > z_A, z_B > 0$,this shows part (i).

Suppose now that E approaches A before B (we will discuss the importance of this below). The total probability that A or B will make the first move are

$$Z_A = z_A + \delta^2 \bar{z}_A \bar{z}_B z_A + (\delta^2 \bar{z}_A \bar{z}_B)^2 z_A + ... = \frac{z_A}{1 - \delta^2 \bar{z}_A \bar{z}_B}$$
$$Z_B = \delta \bar{z}_A z_B + \delta^2 \bar{z}_A \bar{z}_B \delta \bar{z}_A z_B + (\delta^2 \bar{z}_A \bar{z}_B)^2 \delta \bar{z}_A z_B + ... = \frac{\delta \bar{z}_A z_B}{1 - \delta^2 \bar{z}_A \bar{z}_B}$$

[25] While the general case for N players is difficult to tract analytically, it is straightfoward (albeit tredious) to verify that the same result also holds for more than three partners.

[26] The one condition that is necessary is the monotonicity condition. Without this condition, it is possible, for example, to have $\rho_A > \rho_B > \rho_C$, but $\rho_{BC} \gg \rho_{AC}$ so that B might be first in sequence, even though A has the highest stand-alone value. This is because without monotonicity, the importance of a strong stand-alone value may be swamped by the value in a subcoalition with two partners. What matters to E is a weighted sum of the value in the various sub-coalitions. If the monotonicity condition holds, this more complicated ranking is equivalent to the simpler ranking based on the value in the stand-alone coalition only.

The total probability that the proposed venture never gets financed, denoted by Ψ, is $\Psi = 1 - Z_A - Z_B = 1 - \dfrac{z_A + \delta \bar{z}_A z_B}{1 - \delta^2 \bar{z}_A \bar{z}_B}$. Using (9) and after transformation we get

$$\Psi = \frac{(u_{2A} - u_{1A})(\delta u_{2B} - u_{1B})}{\delta(u_{2A}u_{2B} - u_{1A}u_{1B})} > 0$$

This proves part (ii). For parts (iii) and (iv), straightforward calculations reveal that

$$\frac{\partial \Psi}{\partial \delta} > 0, \quad \frac{\partial \Psi}{\partial u_{1A}} < 0 \quad \frac{\partial \Psi}{\partial u_{2A}} > 0$$

Next we calculate the total utilities of the three parties. We have

$$U_A = Z_A u_{1A} + Z_B u_{2A}, \quad U_B = Z_A u_{2B} + Z_B u_{1B}$$

Using (9) we get after transformations

$$U_A = u_{1A}, \qquad U_B = \frac{u_{1B}}{\delta}$$

A receives exactly the same utility in the shuttle equilibrium as he would if he simple were to move first. This is not surprising in the sense that A is always indifferent between moving or postponing. But it is surprising in the sense that A's hope to shift the burden of the first-mover to B is ultimately futile.[27] B obtains a strictly lower utility than u_{2B}. In fact, its utility is only slightly higher than u_{1B}, and as $\delta \to 1$ this difference vanishes to zero. B might get some utility greater than u_{1B} because A might move the first time (which happens with z_A, which tends to zero as $\delta \to 1$). But if A postpones the first time, B's continuation utility is also given by u_{1B}. Finally, E is also worse off than in her preferred equilibrium. To see this, suppose E prefers the AB sequence. We have $U_{EAB} = Z_A u_{EAB} + Z_B u_{EBA} \leq Z_A u_{EAB} + Z_B u_{EAB} < u_{EAB}$. This proves part (v).

Finally, we examine whether in a shuttle equilibrium E actually cares whom she approaches first. The relative preference for approaching AB before BA is given by

$$\Delta = \frac{(1-\delta)}{\delta} \frac{(u_{1A} + u_{2A})u_{1B}u_{EAB} - (u_{1B} + u_{2B})u_{1A}u_{EBA}}{u_{2A}u_{2B} - u_{1A}u_{1B}}$$

It is immediate that as $\delta \to 1$, $\Delta \to 0$, i.e., it becomes entirely irrelevant whom E approaches first. E essentially looses control over the process of obtaining resource commitments. This proves part (vi).

A4: Discussion of alternative coordination devices in the shuttle equilibrium

[27] The fact that the outcome of mixed strategy equilibrium is the same than the outcome if one party we to simply give in is not unusal. In fact, in the battle-of-sexes model the mixed strategy equilibrium typically gives both players a strictly lower utility than in either of the pure strategy equilibria.

Given that the shuttling equilibrium involves a coordination failure at the contracting stage, it might be worthwhile to ask what additional instruments might be used to solve the problem.

Consider first the possibility that E offers a small transfer payments to the first partner for moving first (assuming that the wealth constraint is relaxed slightly). A simple transfer payment would not work for the standard reason that 'bribes' do not affect incentives. After receiving the transfer payment the recipient has no reason to behave any differently. In order to be effective, the transfer payment would need to be conditioned on the evaluation activity. Since evaluation is a non-verifiable action, the only possibility would be to condition on the signing of a contract. Such a "signing bonus," however, is never credible. At the time of bargaining the joint value of an agreement is not affected by a transfer payment between the two parties. And precisely because it is contingent on agreement, the transfer payment does not affect the outside options either. The signing bonus is thus not credible, and E is not able to break the coordination failure on her own.

The situation changes slightly if we consider how the two partners themselves could try to resolve the coordination failure. Again, simple transfer payments will not work, but if the signing bonus for the first partner is not paid by E, but by the second partner, then it does affect the joint value of E and the first partner, and thus the incentive to move first. The second partner would thus have to contractually oblige himself to pay the first partner if the first partner signed a contract that commits his resource to E's venture. The conditions for such a contract to work are quite demanding. First, the transfer payment would have to be large enough to wipe out the entire first-mover disadvantage.[28] Otherwise it wouldn't induce the first partner to move, since he would still prefer to postpone, and since he would know that if the first partner is willing to offer a conditional transfer payment in one period, then he will also be willing to offer it in subsequent periods. Second, the two partners would have to be able to specify exactly what constitutes a legitimate contract between E and the first partner. Indeed, they would have to do this at a point in time when neither partner has spent any time evaluating E's opportunity. If they are unable to describe precisely the contingency for this transfer payment, the second partner might renege on the promise, or E and the first partner might collude to obtain the payment with a pretended contract. Third, there may be a severe adverse selection problem, where the second partner cannot distinguish between a first partner with a truthful opportunity, and one with a fake one, that only allows the first partner to collect a signing bonus from the second partner. The point is that it seems quite difficult in general to get one uninformed party to offer a significant transfer payment to another that is conditional on a contract with yet another third party.

Given all these problems of inducing coordination contractually, one might also consider non-contractual coordination devices. For example, would pre-play commu-

[28] In fact, since E also benefits from the increased joint value, the actual payment has to be strictly larger than Θ_A.

nication help? This is not so clear, since communication doesn't change the partner's economic incentives and since there is no private information to be revealed here.[29] Next, one may wonder if it would help if one party had a reputation for moving first? It certainly would, but the problem is that it is not clear why a party would want to develop such a reputation, given that this is the economically less desirable position to be in. In fact, partners might want to develop a reputation for *not* being first. This would help if only one party had that reputation, but if both partners vie for that reputation, it would actually reinforce the shuttle equilibrium.[30] Finally, one may also wonder whether a small amount of 'altruism' might not solve the shuttling problem? Again, if only one party is altruistic, then it would help. But if both partners are altruistic, then we are back to the same problem as before, namely that each partner hopes that the other will make an altruistic move.[31]

In summary, the robustness of the shuttle equilibrium depends on what additional contracting instruments are assumed to be available. The entrepreneur alone cannot solve the problem, and the partners could only solve it under some idealized conditions, using a fairly sophisticated contract. Another way to look at this is that partners might be able to coordinate in an environment that is sufficiently well defined. In a more "entrepreneurial" environment, however, such coordination is no longer feasible. This is particularly true if the opportunity pursued by the entrepreneur is sufficiently new, that before understanding the basics of the concept, partners are unable or unwilling to make any contractual commitments.

A5: An example of inefficient partner choices with endogenous irreversibility

Consider the same model as in section 5, but relax the assumption of irreversibility. Suppose for simplicity that A' and A'' have perfectly correlated signals (and similarly for B' and B''). Nevertheless, all partners still need to incur their own respective evaluation cost before being in a position to contract. For example, partners may have access to the same industry knowledge, but they cannot (or don't want to) pass on the knowledge from one competitor to the other.[32]

Suppose that E chooses a sequence of $A'B'$. E now has an additional outside option to improve her bargaining power. The second stage bargaining now needs to be modified to account for the fact that there are two potential partners. Suppose E and A' bargain with B'. Their coalition generates a value of $r_{A'B'}$ (for the remainder of this section, all the r_i will be evaluated at $\{H_A, H_B\}$). The subcoalition of $\{E, A'\}$

[29] It might also seem that the use of a public randomization device, if available, might help to coordinate players. The problem, however, is the same as before, namely that the resulting pure strategy equilibria require a very particular belief structure off the equilibrium path.

[30] Another kind of repuation that would help is a reputation of reciprocity between the two partners. But especially for an entrepreneur trying to combine new resource combinations, it is quite unlikely that the partners already have established such reputation between themselves.

[31] It is easy to show that if there is a probability that a player will move altruistically in each period, but this probability is smaller than z_A and z_B respectively, then the mixed strategy shuttle equilibrium remains unchanged.

[32] The extension where each partner has his own signal is tedious, but yieds equivalent results.

still has the option of approaching B'', and the continued presence of A' would signal to B'' that a breakdown rather than a rejection must have occurred with B'. Because of the perfect correlation, B'' will come to exactly the same conclusion as B', so that E, A' and B'' can bargain over $r_{A'B''}$, in which case E and A' would retain a joint value of $\frac{2}{3}r_{A'B''} + \frac{1}{3}r_{A'}$. This implies the following bargaining share for E and A' when bargaining with B':

$$share_2(E) = share_2(A') = \frac{1}{3}r_{A'B'} + \frac{1}{6}(\frac{2}{3}r_{A'B''} + \frac{1}{3}r_{A'})$$
$$share_2(B') = \frac{1}{3}r_{A'B'} - \frac{1}{3}(\frac{2}{3}r_{A'B''} + \frac{1}{3}r_{A'})$$

In the first stage of bargaining, E has the usual credibility problem, so that

$$share_1(E) = \delta\mu_{B|A}(\frac{1}{3}r_{A'B'} + \frac{1}{6}(\frac{2}{3}r_{A'B''} + \frac{1}{3}r_{A'}))$$

and the ex-ante utilities are given by:

$$\begin{array}{lllll} u_E(A'B') & = \frac{1}{3}\rho_{A'B'} & +\frac{1}{9}\rho_{A'B''} & +\frac{1}{18}\rho_{A'} & \\ u_{A'}(A'B') & = \frac{1}{3}\rho_{A'B'} & +\frac{1}{9}\rho_{A'B''} & +\frac{1}{18}\rho_{A'} & -d_{A1} \\ u_{B'}(A'B') & = \frac{1}{3}\rho_{A'B'} & -\frac{2}{9}\rho_{A'B''} & -\frac{1}{9}\rho_{A'} & -\delta\mu_A d_{B2} \end{array}$$

Suppose for simplicity that B' and B'' are identical partners. Then E prefers A'' over A' whenever $(\rho_{A''} - \rho_{A'}) > 8(\rho_{A'B} - \rho_{A''B})$.

The next question is whether it might be possible to continue the bargaining game to replace the existing inefficient partner with the more efficient partner. The additional benefits of replacing one of the partners has to be weighted against the private costs of getting that partner 'up to speed.' Consider first the case with identical B's. Clearly E does not want to replace the inefficient choice A'' before bargaining with B, since bargaining strength is what E wants from A'' for in the first place. After B is on board, the additional gain of replacing A'' with A' is given by $r_{A'B} - r_{A''B}$. When bargaining with $\{E, A'', B\}$, A' would only receive $\frac{1}{4}(r_{A'B} - r_{A''B})$, i.e., a small fraction, of the efficiency gains. Whenever $d_{A3} > \frac{1}{4}(r_{A'B} - r_{A''B})$ then no replacement occurs. This shows that irreversibility may arise endogenously. The main intuition is that the additional gain from replacing the inefficient partner with the efficient partner may not outweigh the evaluation cost. And even if it did, the fraction of the gain received by the inefficient partner may still be to small to compensate him for his evaluation costs.

Figure 1: Partner moves in the stage game

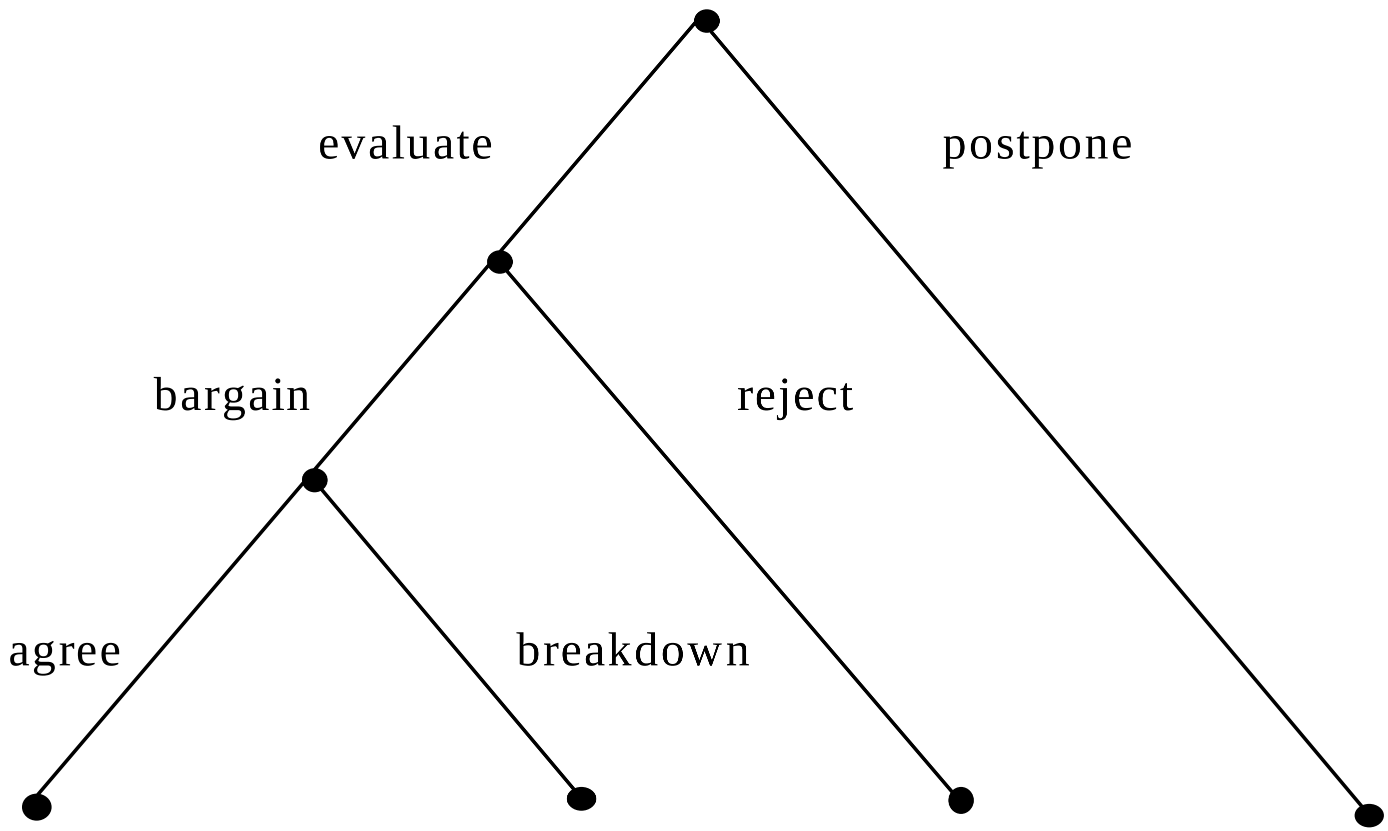
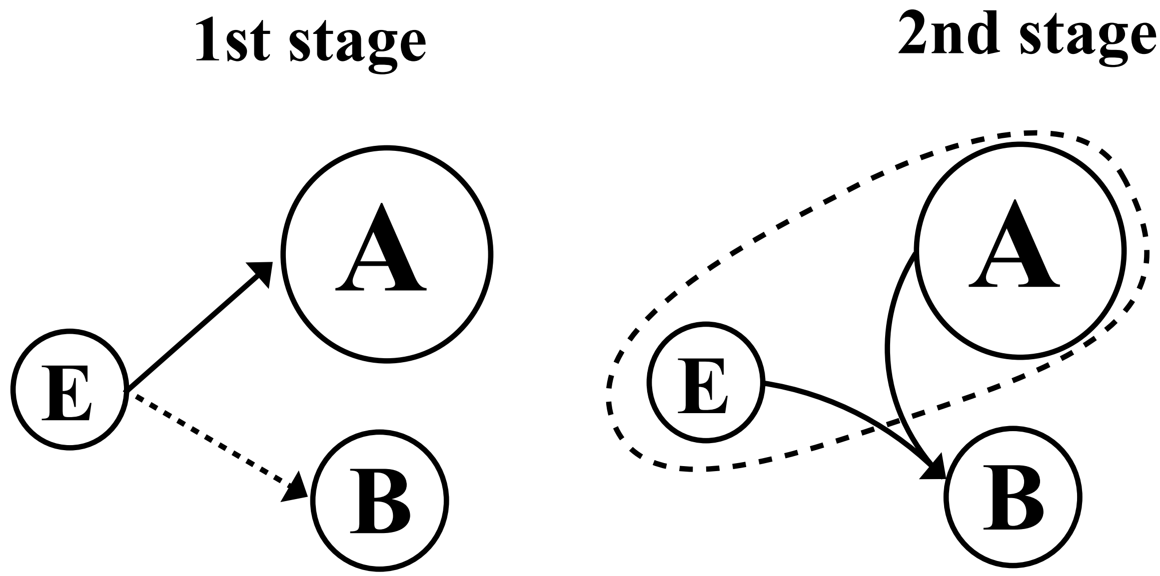


Figure 2

E approaches A before B



E approaches B before A

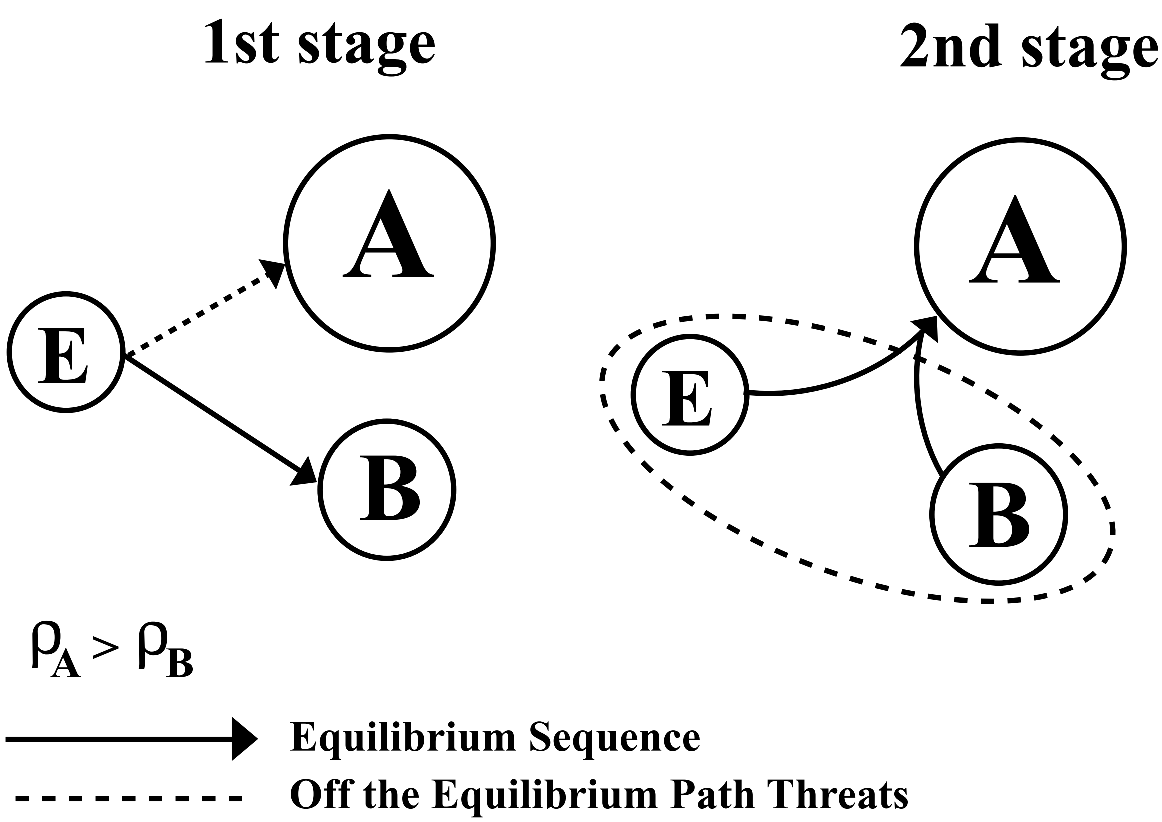
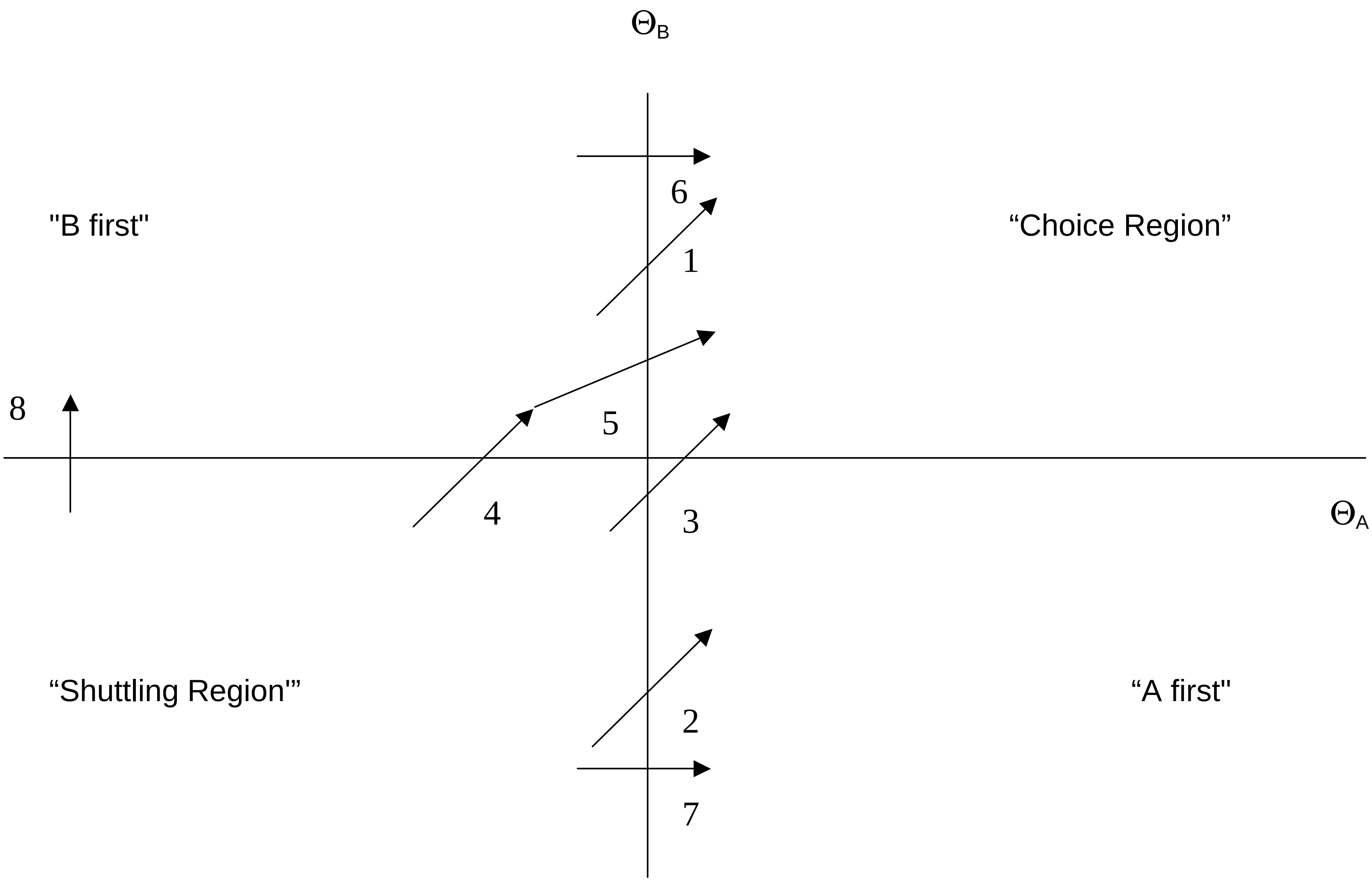


Figure 3



Θ_B
6
"B first"
"Choice Region"
1
8
5
4
3
Θ_A
"Shuttling Region'"
"A first"
2
7