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The operating agreements of many business ventures include clauses to facilitate the exit of joint owners. In so-called *Texas Shootouts*, one owner names a single buy-sell price and the other owner is compelled to either buy or sell shares at that named price. Despite their prevalence in real-world contracts, Texas Shootouts are rarely triggered. In our theoretical framework, sole ownership is more efficient than joint ownership. Negotiations are frustrated, however, by the presence of asymmetric information. In equilibrium, owners eschew buy-sell offers in favor of simple offers to buy or to sell shares and bargaining failures arise. Experimental data support these findings.

KEYWORDS: Exit Mechanisms for Joint Ownership Ventures, Texas Shootout Clauses, Buy-Sell Mechanisms, Shotgun Provisions, Russian Roulette Agreements, Put-Call Options, Cake-Cutting Rule, Bargaining with Common Values, Experiments, Ultimatum Exchange Environments with Endogenous Offer Types

JEL Categories: D44, C72, C90

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1 Introduction

It is very common for closely-held business ventures, including limited liability companies (LLCs) and partnerships, to contain buy-sell provisions in their operating agreements. These clauses provide an exit mechanism for owners who no longer wish to participate in the business venture. One popular exit mechanism is the so-called "Texas Shootout," a provision where one owner names a price and the other owner is compelled to either purchase the first owner's shares or sell his own shares at the named price.[1] As Circuit Judge Easterbrook recognizes, "The possibility that the person naming the price can be forced either to buy or to sell keeps the first mover honest."[2] Because of their potential for achieving fair and efficient outcomes, these clauses have become practically boilerplate in various business areas[3] such as real estate joint ventures.

Despite their widespread inclusion in business contracts, even the most experienced attorneys have rarely (if ever) seen a Texas Shootout clause triggered.[4] These clauses typically give the owners discretion over whether to use the Texas Shootout as the exiting mechanism. For example, the operating agreement of the Omnibus Financial Group reads:

> "*If for any reason any Member ('the Electing Member') is unwilling to continue to be a member of [the partnership] if another Member ('the Notified Member') is also a member of [the partnership], then the Electing Member* <u>*may give*</u> *the Notified Member written notice stating in such notice the value of a 1% Membership Interest ('Interest Value') whereupon the Notified Member shall, by written notice given to the Electing Member within 30 days from the date of receipt of the Electing Member's notice, elect either to purchase the Electing Member's interest in [the LLC] or to sell to the Electing Member the Notified Member's interest in [the LLC].*"[5]

[1] Practitioners sometimes refer to these clauses as Russian roulette agreements (*Delaney v. Georgia-Pacific Corp*., 601 P.2d 475; 1979), shotgun provisions (*Damerow Ford Co. v. Bradshaw*, 876 P.2d 788; 1994), put-call options (*Resolution Trust Corp. v. Residential Developers Fund Partners,* WL 193363 (E.D.Pa); 1991) and buy-sell mechanisms (*Universal Studios Inc. v Viacom Inc*., 705 A.2d. 579; 1997), in addition to Texas Shootouts (*RDO Foods Co. v. U.S. Int'l, Inc*., 194 F.Supp.2d 962; 2002).

[2] *Valinote v. Ballis*; 295, F3d. 666; 2002.

[3] See, for instance, the "Standard Outline for Partnership or Shareholder Agreement," proposed by Canada Business (http://www.canadabusiness.ca).

[4] E-mail correspondence with transactional real-estate lawyer Stevens Carey, a leading expert on buy-sell clauses, and Warren Kean, the transactional real-estate lawyer who chaired the American Bar Association (ABA) committee that recently published the document "Model Real Estate Development Operating Agreement with Commentary;" June 28-30, July 1-2, 2008.

[5] *Valinote v. Ballis*; F.Supp.2d; 2001 (emphasis added). The model agreement recently published by ABA also includes a shootout clause along these lines (http://www.abanet.org).

In other words, an owner who no longer wishes to participate in the business venture has the freedom and flexibility to negotiate the breakup in other ways, without actually initiating the Texas Shootout procedure.

Our paper explores, both theoretically and experimentally, the private incentives of parties to trigger Texas Shootout clauses. We adopt a framework where two partners initially share ownership of the business assets. Later, an event occurs that makes joint ownership inefficient: the value of the underlying assets is higher if just one partner retains sole control and the other partner departs. We initially assume that the two partners are equally capable of running the firm alone. Bargaining takes a very simple form: a random process (a coin flip) determines which partner will make a take-it-or-leave-offer and which partner will receive that offer. Bargaining is frustrated by the fact that one of the partners has private information about the common underlying value of the business assets. In this setting, when triggered, a Texas Shootout constitutes an optimal exit mechanism because it removes the inefficient "status quo" of joint ownership from the bargaining table.[6]

Although Texas Shootout mechanisms are efficient, we demonstrate that parties are naturally reluctant to initiate or trigger them. A partner—whether informed or uninformed—can often capture greater equilibrium rents through simple offers to buy or simple offers to sell.[7] The threat to remain with the "status quo" of joint ownership is used strategically to extract rents in bargaining and, in the process, can destroy joint value by generating inefficient breakdowns. When the informed partner is the offeror, there is a unique fully-separating equilibrium where buy-sell offers are only made when the common value of the asset is in an intermediate range and the gains from trade are small. If the common value is outside of this intermediate range (or the gains from trade are large), however, the offeror prefers to make a simple offer to buy or a simple offer to sell and bargaining failures arise. When the uninformed partner is the offeror, we show that buy-sell offers are never voluntarily made.

The reluctance of parties to trigger Texas Shootouts – and the potential inefficiencies that may arise – is illustrated by the recent takeover of beer giant Scottish & New Castle (S&N) by a

[6] In theory, Texas Shootouts would be unnecessary for efficiency under symmetric information. Rational partners would negotiate a price for the sale of the asset rather than watching its value dissipate.

[7] Suppose that it is commonly known that the joint asset is \$0 if the two partners stay together, but is worth \$2 with concentrated ownership. In other words, there is \$2 of bargaining surplus on the table. Suppose that Partner 1 can make a take-it-or-leave-it offer to Partner 2. The best buy-sell offer that Partner 1 could make is p = \$1, giving each of the two partners half of the bargaining surplus. Partner 1 can clearly capture the entire bargaining surplus with a simple offer to buy Partner 2's stake for a penny or, analogously, to sell his stake for just under \$2.

consortium formed by the Danish brewer Carlsberg and the Dutch brewer Heineken. The motivation for the takeover was, apparently, Carlsberg's desire to get a 100% control over Baltic Beverages Holding (BBH), a joint venture operation in Russia in which Carlsberg and S&N were already partners.[8] Instead of triggering the pre-existing Texas Shootout clause – which would have effectively forced Carlsberg to offer a fair price[9] – Carlsberg formed a consortium with Heineken and made a simple offer to buy S&N in its entirety. In the words of John Nicolson, the chairman of BBH, "They [Carlsberg] think going for S&N means they can get BBH on the cheap."[10] In response, S&N brought a legal action against Carlsberg claiming that Carlsberg's attempt to win control over BBH without triggering the shootout clause was a breach of their original agreement.[11] Although S&N accepted the consortium's takeover offer in April 2008, the agreement was reached only after many months of costly negotiations.

While our theoretical predictions are aligned with anecdotes and empirical regularities reported by practitioners, actual field data on exit processes and outcomes are not generally available. One rare exception is the recent survey on exit clauses conducted by the National Association of Real Estate Investment Trusts (NAREIT) among its members. All 33 respondents to the survey reported including shootout clauses in their operating agreements, although 82% of them indicated that these clauses were rarely or never used.[12] It is not clear, however, whether the contingencies that could trigger the shootout clause rarely occurred, or whether the parties adopted instead simple offers to buy or to sell as exit mechanisms.

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[8] "Baltic Beverages operates 19 breweries, holding the top position in the Russian, Baltic and Kazakh beer markets, and ranks third in Ukraine. Its brands include Baltika, Arsenalnoe, Slavutich and Alma-Ata […] 'We now [will] have *full control* of our destiny in Russia and other BBH territories and I am truly excited about the new opportunities this will present to us,' said Jorgen Buhl Rasmussen, president and CEO of Carlsberg. Emphasis added. (http://www.ustoday.com; posted on January 25, 2008.)

[9] Practitioners are well aware and inform to their clients that shootouts might elicit litigation in case the price proposed by the offeror appears to be unfair. "In any buy-sell or buyout procedure, unless the process is fair [or appears so], *the initiator can expect a challenge with the resulting delay* and need to negotiate to conclude a termination" (Welborn, C., 1992; emphasis added).

[10] John Nicolson is also S&N's Eastern Europe managing director. He went on to say "They [Carlsberg] knows exactly the value of [BBH]. I know the value of it. And Heineken doesn't." (Simon Bowers, *The Guardian*, November 16, 2007; p. 29, Financial Section).

[11] S&N requested an arbitration tribunal in the Stockholm Chamber of Commerce to confirm that Carlsberg had breached the agreement over its joint venture (William Lyons, *Scotland on Sunday*, November 4, 2007). The decision of the tribunal was due on July 3, 2008 (Gelu Sulugiuc, *Reuters UK*, January 3, 2008; http://uk.reuters.com).

[12] Public letter from George Yungmann, Senior Vice-President, Financial Standards, NAREIT, to Russell Golden, Chairman of Emerging Issues Task Force, Financial Accounting Standards Board, October 22, 2007; http://www.reit.com/portals/0/files/nareit/htdocs/members/policy/ accounting/Letter%20to%20FASB%20re%20EITF0706.pdf.

We conducted a series of experiments with human subjects in order to assess the theoretical prediction that economic agents will eschew Texas shootout mechanisms in favor of simple offers to buy or simple offers to sell their ownership stakes.[13] Computational demands on the subjects were reduced by using a simple binary setting with two asset types. We considered three different information treatments: symmetric information, asymmetric information with the uninformed party making a final offer, and asymmetric information with the informed party making a final offer.[14] In equilibrium, (1) simple offers to buy or to sell would be always chosen and (2) breakdowns would occur in the information treatment where the uninformed party makes the final offer. The experimental results generally supported these theoretical predictions. The subjects largely avoided making buy-sell offers and inefficiencies due to bargaining failure were observed. Moreover, although symmetric information reduced the incidence of inefficient breakdowns, it did not eliminate breakdowns entirely. To the best of our knowledge, ours is the first experimental study of partnership dissolution mechanisms where Texas shootouts are not mandatory. Our paper also contributes to the experimental economics literature by providing the first empirical evidence on ultimatum exchange environments *with endogenous offer types*.[15]

Our paper is part of a large literature on mechanisms for dividing valuable assets among multiple parties, a literature that includes the classic cake-cutting problem.[16] Seminal work by Crawford (1977) assesses the properties of the equilibrium of the game induced by a *mandatory* "divide-and-choose" method. He shows that the allocations generated by these mechanisms are "envy-free," in the sense that neither party prefers the allocation received by the other, but they do not necessarily satisfy Pareto efficiency or equity. Crawford (1979, 1980) proposes two procedures for overcoming these deficiencies: setting the offeree's payoff in case of rejection equal to a fair division (to achieve efficiency),[17] and auctioning the role of the offeror (to achieve equity).[18]

[13] See Kittsteiner and Ockenfels (2006) for a discussion of the use of experimental economics methods to study market design mechanisms.

[14] Note that, under simple-buy or simple-sell offers, our experimental setting resembles an ultimatum exchange environment with *endogenous offer types* and positive outside options.

[15] Blount and Larrick (2000) study ultimatum environments with endogenous frame types (division-of-the-pie and claim-from-a-common-pool frames) under complete information. We thank Rachel Croson for pointing out this paper.

[16] One famous (and practical) solution to this problem is provided by the divide-and-choose method: one person divides the cake into two pieces, and the other person chooses a piece.

[17] Crawford called this technique "EDDC," referring to the equal-division divide-and-choose method.

[18] Bassi (2006) experimentally studies the properties of these two mechanisms. Her findings support the theoretical predictions. Note that the environment used in this study involves mandatory buy-sell mechanisms.

Using a mechanism-design approach, McAfee (1992) studies partnership dissolution mechanisms in an independent private values environment. He shows that the person receiving the buy-sell offer is in a relatively advantageous position, and that these mechanisms may result in inefficient outcomes. McAfee (1992) and Cramton, Gibbons and Klemperer (1987) explore alternative partnership dissolution mechanisms, such as a simultaneous sealed-bid auction where the partner with the high bid gets the partnership asset at a price equal to a pre-determined combination of the two bids. Kittsteiner et al. (2008) experimentally study the efficiency property of the buy-sell and the sealed-bid auction procedures in mandatory environments. Contrary to the theoretical predictions, they find that both procedures are efficient. In a recent theoretical work, de Frutos and Kittsteiner (2008) argue that the inefficiency of buy-sell mechanisms (McAfee, 1992) is mitigated if the parties bid to determine the offeror. Jehiel and Pauzner (2006) and Fieseler et al. (2003) analyze the partnership dissolution problem in settings characterized by interdependent values and asymmetric information. They show that efficiency is even harder to achieve in these settings (see also Moldovanu, 2002, and Kittsteiner, 2003).[19] None of the papers in this literature consider the strategic use of exit clauses in decentralized bargaining environments. As a result, the idea that making buy-sell offers may not be unilaterally profitable for the partners has been overlooked.

As the literature moved to the assumption of common values, some of the focus has shifted away from bargaining efficiency towards fairness considerations (Brams and Taylor, 1996; Morgan, 2003).[20] The focus on fairness is justified, at least implicitly, by the observation that if an asset has a value that is common to all individual parties then no allocative efficiency implications are raised by an ex-post assignment of ownership to one partner or the other. In our model, however, Texas Shootouts raise salient efficiency implications even in the context of common values. In this context shootouts restrict strategic behaviors that interfere with the allocation of the asset to one party or another when joint ownership is no longer desirable.

The rest of the paper is organized as follows. Section 2 sets out the theoretical framework and presents our main theoretical result that parties tend to eschew buy-sell offers in favor of simple offers to buy or sell. Section 3 presents experimental evidence on the behavior of economic agents in non-mandatory shootouts environments. Section 4 extends the theoretical analysis by allowing for heterogeneous abilities of partners. In this scenario, Texas shootouts are triggered by the

[19] See also Minehart and Neeman (1999) and Levin and Tadelis (2005).
[20] Morgan (2003) studies a common-value framework under a more general information structure. He does not consider decentralized bargaining, simple-buy and simple-sell offers, and heterogeneous abilities. Morgan's work and our own were pursued independently.

stronger and better informed partner to extract greater value from the weaker partner. Section 5 offers concluding remarks.

2 Theoretical Framework

Suppose that two risk-neutral partners, $i = 1, 2$, jointly own the business assets, whose (future) value is x.[21] The initial ownership stakes of the two partners are θ_1 and θ_2, where the shares are strictly positive and $\theta_1 + \theta_2 = 1$. Partner 1 is better informed than Partner 2: he privately observes the value of the business assets, x, which is non-contractible, drawn from a commonly known distribution $f(x)$, and is positive on its support $[0, 1]$. In real-world settings, non-managing investors (limited partners) might be the less informed partners. Given that they have weaker control rights over the business assets and are less likely to participate in the business activities, non-managing investors might be less familiar with the value of the business assets than the managing investors (general partners).

Under joint ownership, the partners receive their respective shares of the assets' value, $\theta_1 x$ and $\theta_2 x$. Although presumably joint ownership of the business assets was originally desirable, an event has occurred that makes joint ownership inefficient. We assume that the value created by the assets is higher under the sole control of just one of the two partners, $x + a$, where a is strictly positive and is common knowledge. The assumption that the asset creates more value with concentrated ownership may be justified in a number of different ways. First, it may reflect an underlying moral-hazard-in-teams problem (Holmstrom, 1982) in which joint ownership leads to underinvestment relative to the socially efficient level. Second, the partnership may, by its very nature, require investments from each partner that are duplicative at this stage in the firm's life cycle. Finally, but certainly not least likely, the partnership may be in deadlock, wherein irreconcilable differences between partners prevents the business from moving forward.[22]

We assume that negotiations take the following simple form: a random process (a coin flip) determines the offeror, i.e., the partner who makes a single take-it-or-leave-it offer to the offeree

[21] According to Hauswald and Hege (2006), 80% of all joint ventures incorporated in the US between 1985 and 2000 are two-partner joint ventures.

[22] It may also reflect private benefits of control that are outside the model. A sole partner, for example, may gain disproportionate non-pecuniary benefits such as respect and prestige in the business community or disproportionate pecuniary benefits from invitations to serve on corporate boards.

(the partner who receives the offer).[23] The offer is denoted by p^{ik}, where indicator $i \in \{1, 2\}$ refers to the partner making the offer, and indicator $k \in \{B, S, T\}$ tells whether it is a simple offer to buy at the given price *(B)*, a simple offer to sell at that price *(S)*, or a buy-sell offer which gives the receiver the option to either buy or sell at the named price *(T)*.[24] The prices here are normalized to represent 100% of the company's stock.[25]

Two environments are studied: a mandatory Texas Shootout environment and a non-mandatory Texas shootout environment. In the mandatory shootout environment, the offeror is *compelled* to make a buy-sell offer, and the offeree then decides whether to buy or sell at the named price. In the non-mandatory shootout environment, the offeror *may* choose a buy-sell offer but is not required to do so. Instead, he may choose to make a simple offer to buy the other partner's shares, a simple offer to sell his own shares, or make no offer at all. If the offeree rejects a simple offer (or if the offeror decides to make no offer), the parties remain in the inefficient status quo of joint ownership.

Note that the receiver of a buy-sell offer p^{iT}, whether he is informed or uninformed about the value of the asset, prefers to exercise the option to buy or sell rather than remain with the status quo of joint ownership in our model. It is straightforward to establish this fact. Suppose that the offeree believes that the asset is worth $\tilde{x}$ on average, so if he rejects the buy-sell offer he receives an expected status quo payoff of $\theta_i \tilde{x}$. When $p^{iT} > \tilde{x}$, he clearly prefers selling at price p^{iT} to joint ownership, since he receives $\theta_i p^{iT} > \theta_i \tilde{x}$. When $p^{iT} < \tilde{x}$, then he prefers to buy at price p^{iT} than to remain in joint ownership. His expected payoff from buying at price p^{iT}, $\tilde{x} + a - \theta_j p^{iT}$, is larger than $\tilde{x} + a - \theta_j \tilde{x} = \theta_i \tilde{x} + a$ and is therefore larger than his expected status quo payoff $\theta_i \tilde{x}$. Therefore a risk-neutral receiver of a buy-sell offer would certainly be willing to exercise the option to either buy or sell. We will show, however, that in non-mandatory environments, the offeror, whether he is informed or uninformed about the value of the asset, will be generally hesitant to make a buy-sell offer.

We use the following notation: $\pi_j^{ik}(x)$ is the equilibrium probability that Partner *j* ends up owning the asset given the offer of type *k* made by Partner *i,* and $S_j^{ik}(x)$ is Partner *j's* equilibrium

[23] In his work on divide-and-choose methods in mandatory environments, Crawford (1977, 1979, and 1980) also assumes that the role of offeror is randomly determined (by the toss of an unbiased coin).
[24] "*T*" refers to the Texas Shootout.
[25] If Partner 1 offers p^{1B} and Partner 2 accepts, then Partner 1 would pay $\theta_2 p^{1B}$ to acquire Partner 2's stake.

surplus, or his payoff above the status quo payoff $\theta_j x$. Our equilibrium concept is the perfect Bayesian equilibrium. We focus on the fully-separating equilibria in which Partner 1's offer reveals his privately-observed type.[26] While some proofs are included in the text, most are relegated to Appendix A.

2.1 Mandatory Texas Shootouts

Informed Offeror

Suppose that Partner 1, the informed partner, wins the coin-flip and makes a buy-sell offer *p*. Partner 2 can buy Partner 1's stake at that price, giving the two partners payoffs $\{\theta_1 p, x+a-\theta_1 p\}$, or can sell his own shares to Partner 1 at that price giving payoffs $\{x+a-\theta_2 p, \theta_2 p\}$. The fully-separating perfect Bayesian equilibrium has a particularly simple form: Partner 1 offers a fair market value to the uninformed partner, $p^{1T}(x) = x + a$, making Partner 2 indifferent between buying and selling at that price. Partner 2 subsequently randomizes between buying and selling.[27]

Proposition 1: Suppose that the Texas Shootout is mandatory and that Partner 1, the informed partner, makes the buy-sell offer. There exists a unique fully-separating equilibrium of the continuation game where $p^{1T}(x) = x + a$, $\pi_1^{1T}(x) = \theta_1$, *and* $\pi_2^{1T}(x) = \theta_2$.[28]

It is not hard to show that it is incentive-compatible for Partner 1 to offer $p^{1T}(x) = x + a$. Indeed, suppose Partner 1 offers an arbitrary buy-sell price, *p*. Since Partner 2 buys with probability θ_2 and sells with probability θ_1 regardless of the price being offered, Partner 1's expected profit is $\theta_2[\theta_1 p] + \theta_1[x + a - \theta_2 p] = \theta_1[x + a]$, which is *independent of the price* offered. Partner 1 is therefore willing to make the fully revealing offer $p^{1T}(x) = x + a$.

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[26] There are multiple signaling equilibria when Partner 1, the informed partner, makes the offer.

[27] Morgan (2003) has a "purified" version of this result in a model that abstracts entirely from efficiency considerations.

[28] Note that there are also pooling equilibria. Suppose, for example that all types offer the same buy-sell price $p = E(x) + a$. It is rational for Partner 2 to randomize between buying and selling with probabilities θ_2 and θ_1, respectively. Given that Partner 2 is mixing in this way, it is rational for Partner 1 to offer $p = E(x) + a$ regardless of his type. As demonstrated in the text, Partner 1 is indifferent among the different price offers.

In equilibrium, the partners share the surplus, a, in proportion to their initial ownership stakes. Interestingly, the probability that a partner "wins" the shootout and is the ultimate owner of the assets is equal to his initial equity stake. To put it somewhat differently, the pattern of ownership is "sticky" – a partner who owns a greater share of the partnership before the breakup is more likely to be the owner after the breakup. To see the intuition behind this result, consider the extreme case where Partner 2 has a 99% stake in the asset, but chooses to buy out Partner 1 with only .5 probability (based on a flip of an evenly weighted coin). Hence, when Partner 1 names a low-ball price, he acquires an additional 99% of the asset for a discount with even odds, and risks being underpaid for just 1% of the asset with the same odds. Given that Partner 2 chooses to buy the asset with such low probability relative to his ownership interest, Partner 1 is encouraged to downwardly distort the announced asset price. Indeed, unless Partner 2 chooses to buy the asset in direct proportion to his ownership interest, Partner 1 will have incentive to misrepresent the asset's value.

Uninformed Offeror

Now suppose instead that Partner 2, the uninformed partner, makes the buy-sell offer p^{2T}. Knowing the true value of the asset, *x,* Partner 1 will "buy" instead of "sell" if $x + a - \theta_2 p^{2T} > \theta_1 p^{2T}$. In other words, he buys when the asset's value is sufficiently high. This implies a cutoff, $x^{2T} = p^{2T} - a$, where Partner 1 sells his stake to Partner 2 when x is below the cutoff and buys Partner 2's stake when x is above the cutoff. Partner 2's problem is to find the best cutoff, x^{2T}, and corresponding offer, $p^{2T} = x^{2T} + a$, to maximize his expected payoff:

$$x^{2T} = \arg\max_{z} \int_0^z [x + a - \theta_1 (z + a)] dF(x) + \int_z^1 \theta_2 (z + a) dF(x) . \tag{1}$$

Proposition 2: Suppose that the Texas Shootout is mandatory and that Partner 2, the uninformed partner, makes the buy-sell offer. In equilibrium, $p^{2T} = x^{2T} + a$, *where* $F(x^{2T}) = \theta_2$. *If* $x < x^{2T}$, *then Partner 1 sells his stake to Partner 2; if* $x > x^{2T}$, *then Partner 1 buys Partner 2's stake.*

This result makes intuitive sense. When Partner 2 raises the buy-sell price slightly (and the associated cutoff, x^{2T}), he *pays* a higher price for Partner 1's stake if Partner 1 decides to sell, but also *receives* a higher price should Partner 1 decide to buy. The marginal cost for Partner 2 of raising the price slightly is $\theta_1 F(x^{2T})$, since types below x^{2T} would have sold their stakes for the lower price. The benefit for Partner 2 of raising the price slightly is that he receives a better price for selling his own stake when Partner 1 decides to buy. The marginal benefit is $\theta_2 [1-F(x^{2T})]$, since he receives the higher price from those types above x^{2T}. This marginal benefit is relatively large (and the marginal cost relatively small) when Partner 2's initial stake, θ_2, is large. When θ_2 is higher, Partner 2 will name a higher price and will be a net buyer with a higher probability.

2.2 Non-Mandatory Texas Shootouts

In this section, we assume that the business agreement includes a Texas Shootout clause, in which the parties have *the option* to use shootouts as an exit mechanism, but *other mechanisms are also allowed*. Hence, the offeror *is not compelled* to make, but may make, a Texas Shootout offer. This environment reflects real-world settings in which shootouts are generally non-mandatory. We will show that parties are hesitant to make buy-sell offers, i.e., they are "gun shy." The reason for this is that the Texas Shootout mechanism gives a large part of the bargaining surplus to the offeree, surplus that may be retained by the offeror with a simple offer to buy or a simple offer to sell. This effect is exacerbated when the offeror is uninformed, since the offeree can take full advantage of her superior informational position when deciding whether to buy or sell. As a result, inefficient breakdowns will occur.[29] Indeed, we will show that the parties' reluctance to make buy-sell offers reduces social welfare in the presence of asymmetric information.

The reluctance of the parties to *make* buy-sell offers is easily illustrated for the special case where x is known by both parties (i.e., a symmetric information setting). Partner 1's best buy-sell offer, p^{1T}, may be found by using backwards induction. Recall that given a price, p, Partner 2 will sell to Partner 1 if $p > x + a$ and will buy when $p < x + a$. Working backwards, it is not hard to see that the best offer (from Partner 1's perspective) makes Partner 2 exactly indifferent between buying

[29] The Coase conjecture, that bargaining will resolve itself in the "twinkling of an eye," does not extend to common value bargaining games, even when it is common knowledge that gains from trade exits. Vincent (1989) shows that inefficient breakdowns may persist in infinite-horizon bargaining games, and despite the common knowledge that there are gains from trade. A more familiar manifestation is Akerlof's (1970) lemons problem. Empirical evidence supports these theoretical claims (Kennan and Wilson, 1989, 1993; Cramton and Tracy, 1992, 1994). See Ausubel et al. (2002) for a survey on bargaining with incomplete information.

and selling: $p^{1T}(x) = x + a$.[30] In equilibrium, the two partners would share the bargaining surplus in proportion to their initial ownership stakes: $S_i^{1T}(x) = \theta_i a$. It should now be clear why Partner 1 is unwilling to make a buy-sell offer. He can extract all of the bargaining surplus, *a,* through a simple offer to buy Partner 2 out for $p^{1B}(x) = x$ (plus a penny) or through a simple offer to sell his stake to Partner 2 for $p^{1S}(x) = x + a/\theta_1$ (minus a penny).[31] Now let's reintroduce asymmetric information.

Informed Offeror

Suppose that Partner 1, the informed partner, can make a take-it-or-leave-it offer to Partner 2. We will show that Partner 1 will avoid making a buy-sell offer when the value of the asset is either sufficiently high or sufficiently low, and inefficient breakdowns will occur. In an intermediate range, however, Partner 1 may voluntarily choose to make a buy-sell offer.

Proposition 3: Suppose that buy-sell offers are non-mandatory. There exists a unique fully-separating equilibrium of the continuation game when the informed partner, Partner 1, makes the offer. Let $\hat{x} = \min\{\theta_2, -(a/\theta_1)\ln(\theta_1)\}$ *and* $\hat{\hat{x}} = \max\{\theta_2, 1 + (a/\theta_2)\ln(\theta_1)\}$.

i. *If* $x \le \hat{x}$ *Partner 1 offers to sell his shares to Partner 2 for* $p^{1S}(x) = x + a/\theta_1$.

$\pi_1^{1S}(x) = 0$, $\pi_2^{1S}(x) = e^{-\theta_1 x/a}$, $S_1^{1S}(x) = ae^{-\theta_1 x/a}$, *and* $S_2^{1S}(x) = 0$.

ii. *If* $x \in (\hat{x}, \hat{\hat{x}}]$ *then Partner 1 makes a buy-sell offer* $p^{1T}(x) = x + a$.

$\pi_1^{1T}(x) = \theta_1$, $\pi_2^{1T}(x) = \theta_2$, $S_1^{1T}(x) = \theta_1 a$, *and* $S_2^{1T}(x) = \theta_2 a$.

iii. *If* $x > \hat{\hat{x}}$ *Partner 1 offers to buy Partner 2's shares for* $p^{1B}(x) = x$.

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[30] If $p^{1T} > x + a$, Partner 2 strictly prefers to sell, and Partner 1 could profitably lower the price. If $p^{1T} < x + a$, Partner 2 strictly prefers to buy and so Partner 1 could profitably raise the price. Any probability of mixing buying and selling constitutes an equilibrium of the subgame. The payoffs of the two parties are the same whether Partner 2 buys or sells.

[31] The reluctance to make buy-sell offers would also appear in an infinitely-repeated version of this model. To see why, suppose the partners believe that the Texas Shootout will be invoked at period *t + 1,* where they will split the surplus in proportion to their initial ownership stakes as described above. Partner 2's outside option, when viewed from period *t,* is $\delta\theta_2(x + a)$, where δ is the common discount factor. Partner 1 surely prefers a simple offer to buy for $p^{1B} = \delta(x + a)$ to a buy-sell offer where he splits the surplus 50-50. We conjecture that this dynamic game will feature delay when the partners are privately informed about the common value of the asset. See Vincent (1989).

$$\pi_1^{1B}(x) = e^{-\theta_2(1-x)/a},\ \pi_2^{1B}(x) = 0,\ S_1^{1B}(x) = ae^{-\theta_2(1-x)/a},\ and\ S_2^{1B}(x) = 0\ .$$

According to this proposition, Partner 1 is "gun shy," avoiding buy-sell offers at the extremes of the distribution. The intuition is pretty straightforward. Suppose that $x = 0$, so the asset is worthless when owned jointly. Following the first part of the proposition, Partner 1 offers to sell the asset for $p^{1S}(0) = a/\theta_1$ and Partner 2 accepts this offer for sure, $\pi_2^{1S}(0) = 1$. Partner 1 is able to extract the entire bargaining surplus, *a,* in this extreme case. When x rises the separating equilibrium has the feature that $p^{1S}(x)$ rises and Partner 2 randomizes between accepting and rejecting.[32] Partner 2's probability of acceptance, $\pi_2^{1S}(x) = e^{-\theta_1 x/a}$, is falling in the common value of the asset, x.

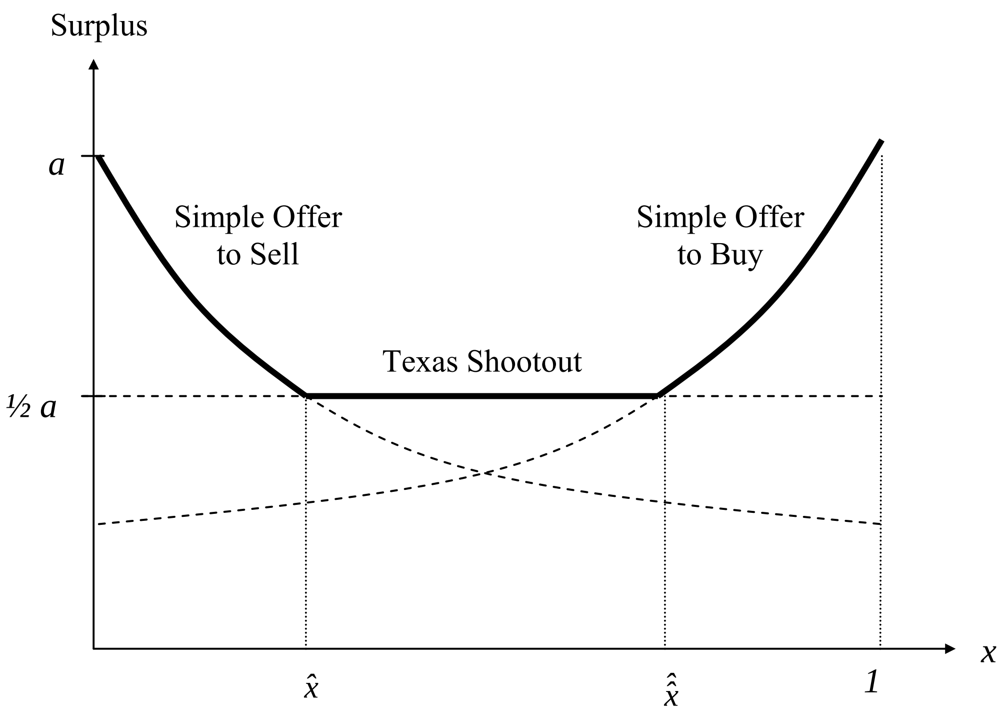

Figure 1: Partner 1's Surplus in the Signaling Equilibrium

$(\theta_1 = \theta_2 = 1/2)$

When Partner 1's offer rises – signaling that the value x is higher – then a lower probability of acceptance by Partner 2 is necessary in order to maintain incentive compatibility for Partner 1 (it

[32] If he rejects the offer, he gets the status quo payoff of $\theta_2 x$. If he accepts, he gets $x + a - \theta_1 p^{1S}(x) = \theta_2 x$ as well.

mitigates his temptation to raise the selling price). Partner 1's equilibrium surplus in the low range is proportional to Partner 2's equilibrium probability of acceptance and is depicted in the left-hand side of Figure 1. When x is in the low range, then Partner 1's surplus falls as x rises. (Partner 2, on the other hand, receives no rents here – he is indifferent between purchasing the shares and the status quo of joint ownership.)

When x is in the highest range, on the other hand, Partner 1 will choose to make a simple offer to buy Partner 2's stake. When $x = 1$, its highest level, Partner 1 offers to buy Partner 2's stake for $p^{1B}(1) = 1$ and Partner 2 always accepts, $\pi_1^{1B}(1) = 1$. There is no reason for Partner 2 to be dubious here: a price of 1 is an excellent price! Notice that Partner 1 extracts all of the bargaining surplus, a, when $x = 1$. More generally, when x falls below 1 then Partner 1 offers $p^{1B}(x) = x$ and the probability of acceptance, $\pi_1^{1B}(x) = e^{-\theta_1(1-x)/a}$, is lower when x is farther from 1. Again, this is necessary to maintain incentive compatibility for Partner 1 since Partner 1 is tempted to pretend to have a lower type in this range. As shown in the right hand side of Figure 1, Partner 1's surplus, $a\pi_1^{1B}(x)$, is rising in x, the common value of the asset, and equal to a when $x = 1$.

In the middle range, however, incentive compatibility would require that a simple offer to buy or a simple offer to sell be accepted with probability less than θ_1, leaving Partner 1 with a surplus of less than $\theta_1 a$.[33] It is therefore in Partner 1's interest to use the Texas Shootout, guaranteeing himself his proportional share of a in this middle range. Indeed, the cutoffs $\hat{x}$ and $\hat{\hat{x}}$ in the proposition are where Partner 1's surplus from the simple offers is equal to $\theta_1 a$. The next result follows immediately from Proposition 1.

Corollary 1: If $a < -\theta_1\theta_2/\ln(\theta_1)$, *then* $(\hat{x}, \hat{\hat{x}}]$ *is a non-empty set and Partner 1 makes a buy-sell offer with positive probability in equilibrium. When* $a \geq -\theta_1\theta_2/\ln(\theta_1)$, *then* $(\hat{x}, \hat{\hat{x}}]$ *is an empty set and Partner 1 does not make a buy-sell offer in equilibrium.*

Uninformed Offeror

We will now show that Partner 2, the uninformed partner, would never find it in his private interest to make a buy-sell offer – he is "gun shy." To see why, suppose that the two partners initially have

[33] When $\pi_2^{1S}(x) = -(a/\theta_1)\ln(\theta_1)$, then $\pi_2^{1S}(x) = \theta_1$.

equal ownership stakes, $\theta_1 = \theta_2 = 1/2$. We know from Proposition 2 that the best buy-sell offer that Partner 2 can make is $p^{2T} = x_0 + a$, where x_0 is the median of the distribution of types. The Texas Shootout is a very unattractive mechanism from Partner 2's perspective. If the asset is worth more than average — i.e., it is a "plum," $x > x_0$ — then Partner 1 will buy out Partner 2 at the median price. If the asset is worth less than average — i.e., it is a "lemon," $x < x_0$ — then Partner 1 sells out at the median price and Partner 2 is stuck with a less valuable asset. In both cases, Partner 2 is getting the "short end of the stick." When the bargaining surplus, *a,* is very small (so the status quo of joint ownership is almost as efficient as concentrated ownership), then Partner 2, the uninformed partner, clearly has no incentive to make a buy-sell offer. He would rather remain with the status quo. As the bargaining surplus grows the figurative "stick" is getting longer, increasing Partner 2's incentive to make a buy-sell offer. Although Partner 2 is still getting the short end of the stick, there comes a point where he prefers the short end of the stick to having no stick at all.

Lemma 1: Let $\hat{a} = (\theta_1/\theta_2)\int_0^{x^{2T}} (x^{2T} - x)dF(x) + \int_{x^{2T}}^{1} (x - x^{2T})dF(x) > 0$. *When* $a < \hat{a}$, *Partner 2, the uninformed partner, prefers the status quo of joint ownership to making a buy-sell offer. When* $a > \hat{a}$, *Partner 2 prefers making a buy-sell offer to the status quo of joint ownership.*

Proposition 4 states that the uninformed partner will eschew the Texas Shootout and make simple offers instead. This is true regardless of the value of *a*. Intuitively, simple offers create a threat of breakdown (and continued joint ownership), strengthening Partner 1's private incentive to accept an offer. Although simple offers lead to inefficient breakdowns in equilibrium, they increase Partner 2's share of the bargaining surplus.

Proposition 4: Partner 2, the uninformed partner, would never make a buy-sell offer voluntarily. He necessarily prefers a simple offer to buy Partner 1's stake (or a simple offer to sell his own stake) to making a buy-sell offer or remaining with the status quo of joint ownership.

Taken together, the results of this section suggest that buy-sell offers are only rarely made in non-mandatory environments. Since the bargaining tactics of offerors involve simple offers to buy or simple offers to sell, breakdowns occur in equilibrium. According to the experience of practitioners, departing members of joint business ventures tend to negotiate outside of the shootout mechanism. Hence, inefficiencies may arise.

3 Experimental Evidence

This section reports the results from a series of experiments with human subjects. We investigate whether the behavior of the subjects follows the theoretical prediction that non-mandatory Texas Shootouts will be eschewed in favor of simple offers to buy or simple offers to sell. To reduce the cognitive demands on the subjects, we adopt a simple numerical example of the binary version of the model.[34] Despite its simplicity, this binary setting captures the strategic environment of the more general case presented earlier. Importantly, this setting allows us to explore the private incentives of the parties to trigger a non-mandatory Texas Shootout clause. Three information environments are considered: symmetric information (S), asymmetric-information/uninformed offeror (A/UO), and asymmetric-information/informed offeror (A/IO). Note that, in case of simple-buy or simple-sell offers, our setting resembles an ultimatum strategic environment with positive outside options and *endogenous offer types*.[35]

3.1 Binary Example

Suppose that two partners have equal ownership stakes in the company.[36] If the partners stay together, the value of the business assets is either low ($x_L = 150$) or high ($x_H = 400$). Suppose further that the probabilities of encountering low and high values are 3/4 and 1/4, respectively. If sole ownership is achieved, then the total value of the business assets is $x + a$, where the surplus $a = 100$.

[34] See Appendix B for a general analysis of the binary version of the model.

[35] Few labels are used to motivate the bargaining game: "value of the business assets," "business partners," "offer to sell," "offer to buy," "partnership dissolution," and "sole ownership." The choice of labels is aligned to the real-world settings in which these mechanisms are used.

Our experimental environment is an extension of Hoffman et al.'s (1994) "buyer-seller exchange environment with random entitlement," under positive outside options, endogenous offer types, and multiple rounds. Experimental work on ultimatum strategic environments under symmetric information and exchange settings conducted by Fouraker and Siegel (1963) and by Hoffman et al. (1994, 1996) find support to the subgame perfect equilibrium concept. As suggested by Hoffman et al. (1996), the behavior of subjects conform the subgame perfect equilibrium predictions because the exchange environment "legitimatize[s] the property rights implied by player 1's assignment to the advantageous position of first mover" (p. 291). In fact, this exchange context elicits "common expectations on a more self-regarding offer by the first mover" (Hoffman et al., 1994; p. 351; see also David and Holt, 1993).

[36] According to Hauswald and Hege (2006), more than 70% of the two-partner joint ventures incorporated in the US between 1985 and 2000 have 50-50 equity allocations.

To make the environment more natural for our subjects, we normalized the price offers to reflect just the 50% stake in the firm that would change hands (rather than maintaining the more general representation from the last section).

Consider the three information environments (symmetric information, asymmetric-information/uninformed offeror, and asymmetric-information/informed offeror). Game theory predicts that we would only observe simple offers from the following set: {75, 175, 200, 300}. Suppose first that the two partners are symmetrically informed about x. The offeror would either offer to buy his partner's stake for $x/2$ (plus a penny perhaps) or to sell his own stake for $x/2+a$ (minus a penny), and his partner would accept. Note that the offeror is taking the entire pie for himself, leaving no surplus for the receiver. Since x can either take on the values of 150 or 400, a total of four offers are generated: 75 and 200 are the offers to buy (under low and high asset values), and 175 and 300 are the offers to sell (under low and high assets values).

Suppose now that the parties are asymmetrically informed. When the offeror is the uninformed party, his optimal strategy is to make a simple offer to buy his partner's stake for $x_L/2=75$ (an offer that will be accepted if and only if the asset value is low).[37] When the offeror is privately informed, he can extract the entire bargaining surplus by offering to sell his 50% stake for $x_L/2+a=175$ when the asset value is low, and offering to buy his partner's 50% stake for $x_H/2=200$ when the asset value is high.[38] Buy-sell offers are not made in equilibrium.[39]

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[37] An offer to buy for 75 gives the offeror an expected payoff of $(.75)(250-75)+(.25)(200)=181.25.$ This is the best he can possibly do. If he offered to buy for 200 instead, both types would accept and he would receive 112.5 on average. If he offered to sell his stake for 175 it would always be accepted, but this would also yield a lower payoff. It is easily verified that the offer to buy for 75 dominates all other simple offers. The offer to buy for 75 also dominates all buy-sell offers. If $p^T=125$, the uninformed offeror will receive exactly 125 whether the asset value is low or high (if the asset value is high the offeree will certainly buy). If he offers $p^T=250$, the offeror receives a payoff of zero when the asset value is low (since the offeree sells) and a payoff of 250 if the asset value is high, an expect payoff of 62.5.

[38] Note that the uninformed partner is willing to accept these offers *regardless* of his beliefs about the offeror's type. This fully-separating equilibrium is supported by the following beliefs. When faced with an offer to buy (sell) the offeree believes that the asset value is high (low). He will therefore accept any offer to buy (sell) above 200 (below 175) and reject otherwise. When faced with a buy-sell offer of $p^T \in [125,250]$, the uninformed offeree believes that asset value is low with probability $2-p^T/125$ and high with probability $p^T/125-1$, and randomizes 50/50 between buying and selling. This gives the offeror exactly 50% of the bargaining surplus. When faced with a buy-sell offer below 125, the offeree believes the asset value is low and buys. This gives the offeror *even less* than 50% of the surplus. An analogous statement could be made for a buy-sell offer above 250.

Note that, although game theory gives crisp equilibrium predictions, these equilibrium offer prices are unlikely to be chosen in practice. The large experimental literature on ultimatum games has shown that proposals involving very skewed division of the surplus are rarely made by actual subjects. Although there is considerable variation in the observed proposals in the laboratory, the observed behavior rarely involves offers lower than 30% of the surplus (Hoffman et al., 1994; see also Davis and Holt, 1993).[40] Indeed, it is not uncommon for subjects to exhibit a preference for an equal division of the surplus, corresponding to proposals in the 50-50 range. By analogy to the ultimatum game literature, we would expect subjects in our environment to propose divisions of the surplus that are consistent with these ranges.

To reduce the computational burden on our subjects, we limited the offeror's choice to a set of six offer prices (identical across conditions). In particular, we modified the equilibrium offer prices described above to include behaviorally-relevant divisions of the surplus. We added ε to the equilibrium simple offers to buy, and subtracted ε from the equilibrium simple offers to sell. In theory, any positive value $\varepsilon > 0$ would break indifference on the part of the offeree, but we chose the value $\varepsilon = 30$, to create the 30-70 split of the surplus.[41] Adding 30 to the equilibrium offers to buy (75 and 200) yields modified offers of 105 and 230. Subtracting 30 from the equilibrium offers to sell (175 and 300) gives us modified offers of 145 and 270. We also included two additional offer prices: 125 and 250. Including these two offer prices serves two purposes. First, these offer prices allow for an equal division of the bargaining surplus when the offeror makes a simple offer to buy (or sell). As mentioned above, such equal divisions are not uncommon in experimental studies of ultimatum games. Second, these values correspond to the equilibrium prices in a Texas Shootout, for the low and high asset values. To summarize, we restricted the offer prices to the following set: {105, 125, 145, 230, 250, 270}.

[INSERT TABLE 1 HERE]

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[39] This is because the distribution is binary. With intermediate types, buy-sell offers may be chosen by informed offerors as we saw earlier for continuous distributions.

[40] The mode offers made by the subjects in Hoffman et al.'s (1994) buyer-seller exchange environment with random entitlement represented a 30-70 and 40-60 splits of the surplus.

[41] Note that the choice of ε and the choice of the few labels used in our experiments also follow some of the features used by Fouraker and Siegel (1963). In contrast to other experimental studies on ultimatum games in which subjects are supposed to split a $10 pie, in Fouraker and Siegel's (1963) environment, all bargaining is described as a buyer-seller transaction, in which the seller makes an ultimatum (take-it-or-leave-it) price offer to the buyer, the buyer decides a quantity (that can be zero), and, the equilibrium payoffs imply a 27-73 split.

Table 1 summarizes the point predictions under non-mandatory Texas shootouts. Consider the top half of the table. When the parties are symmetrically informed, the offerors make simple offers to buy or simple offers to sell in the subgame-perfect Nash equilibrium. When $x = 150$, for example, the offeror will either offer to buy for 105 or offer to sell for 145 and the offeree will accept. The offeror's payoff is 145 and the offeree's payoff is 105. Now consider the bottom half of the table. With asymmetric information, inefficiencies arise when the uninformed partner is the offeror. There is a unique perfect Bayesian equilibrium where the uninformed offeror makes a simple offer to buy for 105. When $x = 400$, the informed offeree rejects this offer and the parties remain in the inefficient status quo of joint ownership.[42] When the informed partner is the offeror, on the other hand, there is a separating equilibrium where the offeror makes a simple offer to sell for 145 or a simple offer to buy for 230, for low and high asset values, respectively.[43] In sum, buy-sell offers are never made in equilibrium; and, efficiency is always achieved in symmetric information settings, and inefficiency occurs in asymmetric information environments in which the uninformed party is the offeror and the value of the asset is high.

3.2 Games and Sessions

Subjects played 8 practice rounds[44] and 16 actual rounds[45] using network computer terminals. Before the beginning of the first actual round, the computer randomly assigned a role to the subjects: Player 1 or Player 2 (Player 1 was the offeror in the S and A/IO and S conditions, and offeree in the A/UO condition). Before the beginning of each actual round, the computer randomly

[42] The offer to buy for 105 is accepted if and only if the assets have low value, giving the offeror a payoff of (.75)(250-105) + (.25)(200) = 158.75. One can easily verify that this is better for the offeror than any other offer to buy within the offer set. Within this set, the best offer to sell is a price of 145. This offer would always be accepted, but gives the offeror a strictly lower payoff. As above, the best buy-sell offer is a price of 125, but this gives the offeror a payoff of just 125.

[43] As above, these offers would be accepted by the uniformed offeree regardless of his beliefs about the value of the assets. This equilibrium gives the offeror 70% of the bargaining surplus, more than the 50% that would be obtained through buy-sell offers.

[44] The purpose of these practice rounds was to allow subjects to become familiar with the structure of the game, with the consequences of their choices and the choices of the other players, and with the likelihood of confronting low and high types of business assets. During the practice rounds, subjects experienced each role four times.

[45] Interaction between players was done through a computer terminal, and therefore, players were completely anonymous to one another. Hence, this experimental environment did not permit the formation of reputations. Given the randomization process used to form pairs, and the diversity of offer types and prices that subjects confronted (due to the heterogeneity of offer types and prices), the sixteen actual rounds do not represent stationary repetitions of the game. Consequently, we can treat each round as a one-shot experience.

formed pairs.[46] Then, the computer randomly chose the value of the business assets (low with probability .75 and high with probability .25). This value was revealed to both players in the symmetric information condition (S) and was revealed only to Player 1 in the asymmetric information conditions.[47]

The subjects played a two-stage game. In the first stage, the offeror made a take-it-or-leave-it offer to the other subject, the offeree.[48] The offeror chose the type of offer (a simple-buy offer, a simple-sell offer, or a buy-sell offer)[49] and the offer price. The offer price was restricted to be chosen from the set {105, 125, 145, 230, 250, 270}.[50] The terms of the offer (type of offer and price) were then revealed to the offeree. In the second stage, the offeree was required to respond to the offer. In case of a simple-buy or a simple-sell offer, she chose between accepting and or rejecting the offer; in the case of a buy-sell offer, she chose between buying and selling at the named price.[51] We ran twelve 120-minute sessions of 6 to 12 subjects each (4 sessions per condition; 116 subjects in total)[52] at the University of Alberta School of Business labs. The subject pool (undergraduate and graduate students from the University of Alberta) received their monetary payoffs in cash ($5 participation fee and $17 game earnings, on average) at the end of the session.[53]

3.3 Results

Table 2 provides the descriptive statistics per experimental condition.[54] The inefficiency rate in the last column is defined as the percentage of total pairs in which rejection occurred, i.e., percentage of total pairs that remained in an inefficient joint ownership. The rejection rate of a simple-buy (or a

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[46] Subjects were not paired with the same partner in two immediately consecutive rounds.
[47] It was common knowledge that Player 1 received this information.
[48] In the A/UO condition, Player 2 (the uninformed player) was the offeror; and, in the S and A/IO condition, Player 1 (the informed player) was the offeror.
[49] In order to reduce the computational costs on subjects, and given that making no offer is a strictly dominated strategy for the offeror, we omitted this option.
[50] This set was the same for all conditions.
[51] See Appendix C for a sample of the instructions for the A/IO environment. A complete set of instructions and software screens are available upon request.
[52] The number of subjects and observations (number of subjects, number of pairs for the 16 rounds) per condition is as follows: (38, 304), (36, 288) and (42, 336), for the S, A/UO, and A/IO conditions, respectively. In addition to these sessions, we ran several pilot sessions.
[53] We used a laboratory currency called the "token" (the conversion rate token/dollars was informed to the subjects).
[54] Given the consistency of the aggregate data across rounds since early stages, we decided to include the 16 rounds in our analysis. Note that the qualitative results still hold when only the last 8 rounds of play are considered.

simple-sell) offer is defined as the percentage of total pairs in which the offeree received a simple-buy (or simple-sell) offer and rejected it. The buy rate of a buy-sell offer is defined as the percentage of total pairs in which the offeree received a buy-sell offer and decided to buy.[55] Information about the mode and mean offers is also provided.

[INSERT TABLE 2 HERE]

Our results indicate that *simple-buy and simple-sell offers are generally chosen in non-mandatory shootouts environments*. When both partners were symmetrically informed about the value of the business assets, 94 and 91% of all offers made were simple-buy or simple-sell offers (for low and high asset values, respectively).[56] When information was asymmetric, 84% of uninformed offerors chose simple-buy or simple-sell offers, and 62 and 72% of informed offerors chose simple-buy or simple-sell offers (for low and high asset values, respectively).[57]

Our findings also suggest that *inefficient breakdowns occur in non-mandatory shootouts environments*, even in case of symmetric information.[58] As predicted by the theory, the lowest rate of breakdown was observed when the players were symmetrically informed. The inefficiency rate

[55] The frequency, rejection, and buy rates per offer type refer to *all* prices proposed by the offerors under the specific offer type.

[56] It is interesting to note that when the offeror chose to make an off-equilibrium buy-sell offer instead, he made the expected buy-sell offer of 125 in 92% of the instances when the asset value was low, and the expected buy-sell offer of 250 in 100% of the instances when the asset value was high. So although making a buy-sell offer is an off-the-equilibrium-path strategy, the subjects apparently had a basic understanding of its properties.

[57] Mitzkewitz and Nagel (1993) study ultimatum games under incomplete information and divide-the-pie environments. They suggest that the offeror's proposal might be based on her expectation about the acceptance level, and on her aspirations (minimum acceptable payoff). In case of ultimatum games under complete information, Hoffman et al. (1994) states that the offeror's subjective probability about the acceptance of offer captures her expectations. Extending these claims to our environment, we can hypothesize that the choice of off-equilibrium buy-sell offers might obey to the offeror's expectation about the acceptance of a simple offer to buy or to sell, and her aspirations (to obtain a payoff at least equal to 125). Pessimistic expectations could be reinforced by the observation of rejection of simple offers to buy or to sell (see discussion of inefficiency below).

Note that under symmetric information and off-equilibrium beliefs about acceptance of a simple-buy or sell offer, only buy-sell offers involve certainty about both parties' payoffs. Then, the choice of off-equilibrium buy-sell offers in those environments might also reflect risk-averse attitudes on offerors. Finally note that the choice of off-equilibrium buy-sell offers might obey to cognitive limitations that preclude offerors from predicting the effects of the more complex simple offers to buy or to sell (see Blount and Lerrick, 2000).

[58] Inefficiency rates are equal to .14, .24, and .26 were observed in case of the symmetric, uninformed-offeror, and informed-offeror conditions, respectively (under a low asset value). Similarly, in case of a high asset value, the inefficiencies rates are equal to .16, .51, and .39, for the symmetric, uninformed-offeror, and informed-offeror conditions, respectively.

under symmetric information was 15% (pooled data on asset values).[59] The fact that the rejection rates of simple-buy and simple-sell offers in symmetric information settings are positive rather than zero (as the theory predicts) suggests fairness considerations on offerees.[60] Also as predicted by the theory, the highest inefficiency rate was observed when the uninformed player made the offers and the value of the business assets was high (51%). The most common proposal in this environment was a simple offer to buy for 105. Not surprisingly, this offer was rejected 100% the time by the informed offeree when the asset value was high.[61] Note that the high rejection rates of simple-buy and simple-sell offers in the asymmetric-information environments might be due, in part, to offers that are off the equilibrium path.[62] When offerors made the equilibrium offers in the experimental sessions, these offers were generally accepted (i.e., the offerees' responses followed the equilibrium point predictions stated in Table 1).[63]

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[59] This inefficiency rate is 76% higher than the one observed in Hoffman et al. (1994) under a random entitlement and exchange environment (8.5%). Three possible features of our design might explain this difference. First, our setting involves endogenous offer types. The presence of buy-sell offers, and their intrinsic equitable-split quality, might elicit fairness considerations on offerees. Second, our environment involves positive outside options (not present in Hoffman et al., 1994). In Knetz and Camerer's (1994) experiments on ultimatum games with positive outside options (divide-the-pie environment), nearly half of the offers were rejected (a rejection rate 50% higher than in previous ultimatum game experiments). They suggest that outside options induce subjects to "'egocentrically' apply different interpretations of the amount being divided, which create persistent disagreement" (p.65). Third, our environment involves not only proposals made by "sellers" (simple-sell offers) but also proposals made by "buyers" (simple-buy offers). "[I]t is the seller who is thought to be justified in naming a price" (Hoffman et al., 1994; p. 369). Then, weaker "legitimization" of the role of offeror might be observed in an exchange environment in which the buyer is the first mover, and hence, higher rejection rates might occur. Our results confirm these claims: the rejection rates of simple offers to sell and to buy are equal to 9% and 21%, respectively (pooled data on asset values) in symmetric information environments.

[60] For the case of simple-buy offers, the rejection rates are 19 and 25%, for low and high values of the business assets, respectively; for the case of simple-sell offers, on the other hand, the rejection rates are 11 and 4%, for low and high values of the business assets, respectively.

[61] The rejection rate of all simple-buy offers (pooled data on offer prices) is 97%. See Table 2.

[62] These off-equilibrium simple-buy or simple-sell offers might suggest computational limitations in dealing with complex asymmetric-information environments. Importantly, in case of the informed-offeror condition, some of the off-equilibrium offers (especially in case of high-asset values) suggest greediness. This behavior is not generally observed under symmetric information. Previous work on ultimatum games under asymmetric information suggests that proposers might act with greater impunity in environments in which the responders do not know the size of the pie. Indeed, Croson's (1996) study on ultimatum games with uninformed offerees finds that proposers offer significantly less when they know that responders have no knowledge of the pie size. Boles et al.'s (2000) assessment of deception in repeated ultimatum bargaining suggest that "[P]roposers [are] more deceptive when the pie size [is] not known" (p. 248). Similar to our study, this behavior "[surfaces] more frequently when the stakes were higher." (p. 257).

[63] In fact, (i) under the A/UO condition, simple-buy equilibrium offers equal to 105 were accepted 83% of the time in case of low asset value (and, as predicted by the theory, always rejected in case of high asset value); and, (ii) under the A/IO condition and low asset value, the offerees accepted simple-sell equilibrium offers equal to 145 in 80% of the cases; and, under a high asset value, they accepted simple-buy equilibrium

[INSERT TABLE 3 HERE]

Next, we will use regression analysis to more thoroughly test the effects of symmetric information on efficiency. We take pairs of conditions and estimate probit models.[64] Each probit model includes a treatment dummy variable as its regressor.[65] Table 3 indicates that symmetric-information significantly reduces the likelihood of inefficiency in 6 and 4 percentage points, with respect to the uninformed offeror and informed offeror environments, respectively (p = .089 and p = .001).[66]

Finally note that, although our setting involves an ultimatum strategic environment with positive outside options and *endogenous offer types*, our findings are aligned with seminal papers on ultimatum environments under exchange settings (Fouraker and Siegel, 1963; Hoffman et al., 1996, 1994). Indeed, our findings under symmetric information also provide support to the subgame perfect Nash equilibrium concept. As predicted by the theory, 83% of subjects made simple-buy equilibrium offers equal to 105 or simple-sell equilibrium offers equal to 145, and 84% of these offers were accepted (under a low asset value).[67] Notably, this behavior emerged since early rounds and was consistent across rounds. These results suggest that our experimental environment legitimatized the assignment of the advantageous role of offeror under symmetric information (and

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offers equal 230 in 100% of the cases. Note that the positive rejection rates under the A/UO condition and low asset value might suggest fairness considerations on offerees.

[64] Note that, within a session, each person plays in 16 rounds and interacts with other players during the session. Our regression analysis involves robust standard errors which account for the possible dependence of observations within session.

[65] The treatment dummy variable is constructed as follows. For example, for the case of the probit model that evaluates the effect of symmetric-information on efficiency by considering the symmetric and uninformed-offerors environments, the dummy variable will take a value equal to 1 if the observation pertains to the S condition, and a value equal to 0 if the observation pertains to the A/UO condition. The data for the A/UO and S conditions are pooled to estimate this probit model. Marginal effects of treatments are reported here.

[66] We also conducted regression analyses to evaluate the effects of symmetric information on the likelihood of rejection of simple-buy and simple-sell offers and on the likelihood of buy-sell offers. Our findings suggest that (i) symmetric information significantly reduces the likelihood of rejection in 7 percentage points, with respect to the uninformed offeror and informed offeror environments (p = .043 and $p < .001$, respectively); and, (ii) symmetric information significantly reduces the likelihood of buy-sell offers in 3 and 7 percentage points, with respect to the uniformed offeror and informed offeror conditions, respectively (p = .050 and $p < .001$). Note that regression analysis also suggests that the uninformed offeror environment significantly reduces the likelihood of buy-sell offers in 20 percentage points, with respect to an informed offeror environment (p = .001). Finally note that most qualitative results still hold when only the last 8 rounds of play are considered (except for the effect of symmetric information on the likelihood of buy-sell offers with respect to the uninformed offeror condition, which is not significant).

[67] Similarly, under a high asset value, 74% of subjects made simple-buy offers equal to 230 or simple-sell offers equal to 270, and 89% of these offers were accepted.

hence, reduced the presence of fairness considerations on offerors and offerees).[68] However, the strictly positive rejection rates of equilibrium simple-buy and simple-sell offers indicate that fairness considerations might emerge even in environments where the right to be the offeror is legitimized.

4 Heterogeneous Abilities: An Extension

In this section, we consider the possibility that Partner 1, the better informed partner, is also in a better position to run the firm alone.[69] Formally, we assume that Partner 1 will generate value $x + a$ if he owns the asset, while Partner 2 can do no better as a sole owner than the status quo of joint ownership, x. In real-world settings, as mentioned before, managing investors (general partners) have stronger control rights over the business assets than non-managing investors (limited partners) and are more likely to participate in the business activities. Then, they might be not only more familiar about the value of the business assets but also more capable to run the business.[70]

Lemma 2: Suppose that the Texas Shootout is mandatory and the partners have heterogeneous abilities to run the firm alone.

i. If Partner 1, the informed and more able partner, makes the buy-sell offer, then there is a fully separating equilibrium where $p^{1T}(x) = x$, $\pi_1^{1T}(x) = \theta_1 + \theta_2 e^{-(1-x)/a}$, *and* $\pi_2^{1T}(x) = \theta_2 - \theta_2 e^{-(1-x)/a}$.

ii. If Partner 2, the uninformed and less able partner, makes the buy-sell offer, then $p^{2T} = x^{2T} + a$, *where* $F(x^{2T}) + af(x^{2T}) = \theta_2$.

Partner 2 is in a particularly vulnerable position when making a buy-sell offer in this new setting. It is useful to recall our earlier metaphor where Partner 2 breaks a stick into two pieces and

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[68] Note that, the 50-50 split (an offer price equal to 125 or 250, for low and high asset values, respectively; symmetric information) was chosen only 11% of the time (pooled data on asset values) in our study, while approximately 18% of the time in Hoffman et al. (1994). In contrast to these findings, the 50-50 split was chosen, on average, 40% of the time in previous experiments on ultimatum games under a divide-the-pie environment.

[69] There are additional normative implications when the partners' competences are asymmetric. The question becomes not only whether the partnership is dissolved (avoidance of the status quo) but who gets sole control (allocative efficiency).

[70] Differences in individual capacity with respect to the asset may also result from the refusal from key suppliers and customers to deal with the other partner for non-productive reasons.

then Partner 1 can choose which piece to take. As before, Partner 1 (the better informed partner) will keep the longer piece for himself. But Partner 2 is even worse off than before because in addition to getting the short piece of the stick, he derives no benefit from sole ownership relative to the status quo. Partner 1, on the other hand, is in a particularly strong position to make a buy-sell offer. In the fully separating equilibrium, Partner 2 is rendered indifferent between buying Partner 1's stake and selling his own stake and receives none of the surplus. Partner 1, on the other hand, is able to extract much more of the surplus through the Texas Shootout.

Proposition 5: Suppose that the Texas Shootout is non-mandatory. Partner 2, the uninformed and less able partner, would strictly prefer to make a simple offer to sell his stake to Partner 1 rather than make a buy-sell offer. In contrast, Partner 1, the informed and more able partner, prefers to make a buy-sell offer.

The second part of Proposition 5 may be surprising. Formally, suppose that Partner 1 is trying to decide between a buy-sell offer and a simple offer to buy the asset.[71] The fully-revealing price offered in these two scenarios would be exactly the same: $p^{1T}(x) = p^{1B}(x) = x$. The scenarios differ, however, in Partner 2's *response* to the offers. Suppose that Partner 1 offers to buy for $p^{1B} = \tilde{x}$ (which may not reflect his true type x). If Partner 1's simple offer to buy the asset is rejected, then Partner 1 receives his status quo payoff $\theta_1 x$. The probability that Partner 2 rejects this simple offer must be high enough to maintain incentive compatibility for Partner 1 (so he doesn't exaggerate his type). Now consider the buy-sell offer $p^{1T} = \tilde{x}$. If Partner 2 decides to buy Partner 1's stake instead of sell his own, Partner 1 receives a payoff equal to $\theta_1\tilde{x}$. This implies an additional cost if Partner 1 tries to "low-ball" Partner 2 by pretending to have a low type and offering a lower price (since Partner 1 will receive a lower price if he turns out to be a net seller). Incentive compatibility is easier to achieve with buy-sell offers than with simple offers to buy. In other words, Partner 1 succeeds in acquiring the asset more often when he makes a buy-sell offer than when he makes a simple offer to buy.[72]

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[71] The simple offer to buy the asset necessarily dominates a simple offer to sell the asset to Partner 2. This is because Partner 2 creates no surplus from ownership, so there would be no surplus for Partner 1 to extract by selling to Partner 2.

[72] See Appendix A for a complete proof of the proposition.

Proposition 6: Suppose that the partners have heterogeneous abilities to run the firm alone. Social welfare is (weakly) higher when buy-sell offers are mandatory rather than non-mandatory.

Unlike the analysis in the main section of the paper, the Texas Shootout does not lead to the first-best outcome when partners have heterogeneous abilities. It is socially efficient for Partner 1 to own the asset, but in equilibrium either partner may end up with ownership and control of the firm. Never-the-less, the Texas Shootout leads to a weakly higher level of social welfare. When buy-sell offers remain non-mandatory, Partner 2 will forego the buy-sell offer in favor of a simple offer to sell his shares to Partner 1. Although this private decision creates more profits for Partner 2, the gain is more than offset by the losses to Partner 1. Intuitively, if Partner 2 were forced to make a buy-sell offer instead then he would be more "generous" in his offer to avoid the downside of buying Partner 1's shares at an inflated price and Partner 1 would buy with a higher probability.

5 Conclusions

Proponents of the use of Texas Shootout clauses as exit mechanisms advocate their potential for achieving fair and efficient outcomes. Although non-mandatory shootout clauses (under which, the partners may, but are not required to, make buy-sell offers) are commonly included in the operating agreements of closely-held business ventures, these clauses are rarely triggered. To the best of our knowledge, our paper is the first to explore, theoretically and experimentally, the private incentives of the parties to trigger a non-mandatory Texas Shootout clause in a decentralized bargaining environment. Ours paper is also the first experimental study on ultimatum exchange environments with *endogenous offer types.*

In our theoretical framework, we assume that both partners are equally capable of running the business alone. The dissolution of the partnership is assumed to be jointly efficient. Negotiations are frustrated, however, by the presence of asymmetric information – one partner had better information about the asset value than the other. Buy-sell offers are jointly desirable in this setting because they lead to immediate dissolution of the partnership with one partner owning the asset and the other partner walking away with cash in her pocket. Yet this jointly efficient outcome is elusive because the partners are reluctant to make buy-sell offers. We show that, in an attempt to grab bargaining surplus, the partners will choose to forgo the Texas Shootout in favor of simple offers to buy or simple offers to sell. The downside of these bargaining tactics is that the rejection of these simple offers – and rejection does arise in equilibrium – leads the partners to remain in an ongoing partnership that would be more valuable dissolved.

In addition to the anecdotal support discussed in the introduction, our theoretical insights are largely confirmed in the laboratory. When given the option to negotiate outside of the Texas Shootout mechanism, the experimental subjects tend to avoid making buy-sell offers in favor of simple offers to buy the other partner's stake or simple offers to sell their own stakes. This leads to bargaining failures, since these simple offers to buy or sell are rejected a significant fraction of the time. Although these inefficiencies are more pronounced in the presence of asymmetric information, we observe bargaining failures in symmetric information settings as well. The theoretical and experimental findings presented here provide an efficiency rationale for adopting mandatory Texas Shootout clauses in business ventures where the owners have similar abilities to run the firm and similar financial resources.

Texas shootout clauses should be adopted with caution when owners do not have equal financial capabilities. Indeed, liquidity constraints faced by one partner can create an advantage for the other partner to acquire the assets at a predatory price.[73] When one partner's superior financial capacity creates a bargaining disadvantage for the other partner, it is not uncommon for the disadvantaged partner to claim improper exclusion or foreclosure. Courts are attentive to these complaints, treating buy-sell offers as only presumptively fair and allowing background fiduciary obligations to limit, though imperfectly, predatory buyouts. Shareholder agreements that give sufficient time to respond to a buy-sell offer and arrange finance and administrative matters might be recommended.[74] Extensions to our work might consider in greater detail the predatory potential of Texas shootouts.

Future work might also explore other reasons for which Texas shootouts are included in business agreements. For instance, Texas shootout clauses may serve as a mechanism for bringing

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[73] Financial advisors warn shareholders about the advantage of the party with the "deeper pockets" under shootout clauses (http://www.kpmg.ca/en/services/enterprise/issuesWealthShareholder.html). Suppose the "deep pockets" partner, Partner 1, knows about Partner 2's liquidity constraint. Then, Partner 1 might trigger the shootouts by proposing a price lower than the value of Partner 2's assets under joint ownership – a predatory offer. Although Partner 2 would prefer to remain with the status quo of joint ownership, the rules of the standard Texas shootout clause (together with her liquidity constraint) would effectively force her to sell her own stake to Partner 1.

[74] Practitioners consider that between 30 to 60 days is a reasonable period of time to finance and respond to a "shotgun" (http://www.kpmg.ca/en/services/enterprise/issuesWealthShareholder.html).

Shareholder agreements that stipulate that the buyout can be funded over time or with profits from the ongoing business might reduce these predatory effects (Stephanie Clifford, *Inc. Magazine*, November 2006; hpttp://www.inc.com/magazine). Companies that help entrepreneurs react quickly to an executed shootouts clause (i.e., venture capital firms that provide funds to the partners) could also attenuate these effects. See, for instance, the case of the firm called Shotgun Fund in Canada (http://www.shotgunfund.com/index.htm).

reluctant parties to the bargaining table (Carey, 2005). By bringing partners together face-to-face, certain deadlock situations might be resolved without an actual dissolution of the partnership (i.e., without triggering the shootout clause). These, and other extensions, remain fruitful areas for future research.

References

Akerlof, G. 1970. “The Market for Lemons: Quality Uncertainty and the Market Mechanism,” *Quarterly Journal of Economics,* Vol. 89, pp. 488-500.

Ausubel, L.M., P. Cramton, and R. Deneckere. 2002. ``Bargaining with Incomplete Information." In: Aumann, R. and Hart, S. (Eds.). *Handbook of Game Theory*, Vol. 3. Amsterdam: Elsevier, Chapter 50.

Bassi, A. (2006), “An Experimental Study of Fair Division.” Manuscript. New York University.

Blount, S. and R.P. Larrick. 2000. "Framing the Game: Examining Frame Choice in Bargaining," *Organizational Behavior and Human Decision Processes*, Vol. 81, pp. 43-71.

Brams, A. and A. Taylor. 1996. *Fair Division: From Cake-Cutting to Dispute Resolution*. New York: Cambridge University Press.

Carey, S.A. 2005. “Buy/Sell Provisions in Real Estate Joint Venture Agreements,” *Real Property, Probate and Trust Journal*, Vol. 36, pp. 651-709.

Cramton, P. and J. Tracy. 1994. “The Determinants of U.S. Labor Disputes," *Journal of Labor Economics*, Vol. 12, pp. 180-209.

Cramton, P. and J. Tracy. 1992. “Strikes and Holdouts in Wage Bargaining: Theory and Data," *American Economic Review*, Vol. 82, pp. 100-121.

Cramton, P., R., R. Gibbons, and P. Klemperer. 1987. "Dissolving a Partnership Efficiently," *Econometrica*, Vol. 55, pp. 613-632.

Crawford, V.P. 1980. “A Self-Administered Solution of the Bargaining Problem.” *Review of Economic Studies,* Vol. 47, pp. 385-392.

Crawford, V.P. 1979. “A Procedure for Generating Pareto-Efficient Egalitarian-Equivalent Allocations.” *Econometrica,* Vol. 47, pp. 49-60.

Crawford, V.P., 1977. “A Game of Fair Division.” *Review of Economic Studies,* Vol. 44, pp. 253-247.

Croson, R.T.A. 1996. "Information in Ultimatum Games: An Experimental Study," *Journal of Economic Behavior and Organization*, Vol. 30, pp. 197-212.

Boles, T, R.T.A. Croson, and J.K. Murnighan. 2000. “Cheap Talk in Bargaining Experiments: Lying and Threats in Ultimatum Games,” *Organizational Behavior and Human Decision Processes*, Vol. 83, pp. 235-359.

Davis, D. and C. Holt. 1993. *Experimental Economics*. New Jersey: Princeton University Press.

De Frutos, M. A., and T. Kittsteiner. 2008. "Efficient Partnership Dissolution under Buy-Sell Clauses," *RAND Journal of Economics,* vol. 39, pp. 184-198.

Fieseler, K., T. Kittsteiner, and B. Moldovanu. 2003. "Partnerships, Lemons, and Efficient Trade," *Journal of Economic Theory*, Vol. 113, pp. 223-234.

Fouraker, L., and S. Siegel. 1963. *Bargaining Behavior*. New York: McGraw-Hill.

Hamilton R. and J. Macey. 2005. *Cases and Materials on Corporations Including Partnerships and Limited Liability Companies*, Thomson-West, Ninth Edition.

Hauswald, R. and U. Hege. 2006. "Ownership and Control in Joint Ventures," Manuscript. American University and HEC School of Management.

Hoffman, E., K. McCabe, K. Shachat, and V.L. Smith. 1994. "Preferences, Property Rights, and Anonymity in Bargaining Games," *Games and Economic Behavior*, Vol. 7, pp. 346-380.

Hoffman, E., K. McCabe, and V.L. Smith. 1996. "On Expectations and the Monetary Stakes in Ultimatum Games," *International Journal of Game Theory*, Vol. 25, pp. 289-301.

Holmstrom, B. 1982. "Moral Hazard in Teams," *Bell Journal of Economics*, Vol. 13, pp. 324-340.

Jehiel, P. and A. Pauzner. 2006. "Partnership Dissolution with Interdependent Values," *RAND Journal of Economics,* Vol. 37, pp. 1-22.

Kennan, J. and R. Wilson. 1993. "Bargaining with Private Information," *Journal of Economic Literature,* 31, pp. 45-104.

Kennan, J. and R. Wilson. 1989. "Strategic Bargaining Models and Interpretation of Strike Data," *Journal of Applied Econometrics,* 4, pp. S87-S130.

Kittsteiner, T., A. Ockenfels, A., N. Trhal. 2008. "An Experimental Investigation of Partnership Dissolution Mechanisms." Manuscript. London School of Economics and University of Cologne.

Kittsteiner, T. and A. Ockenfels. 2006. "Market Design: A Selective Review," *Zeitschriff fur Betriebswirtschaft,* Special Issue.

Knez, M. and C.F. Camerer. 1995. "Outside Options and Social Comparison in Three-Player Ultimatum Game Experiments," *Games and Economic Behavior*, Vol. 10, pp. 65-94.

Levin, J. and S. Tadelis. 2005. "Profit Sharing and the Role of Professional Partnerships." *Quarterly Journal of Economics,* 120, pp. 132-172.

McAfee, R. P. 1992. "Amicable Divorce: Dissolving a Partnership with Simple Mechanisms," *Journal of Economic Theory*, Vol. 56, pp. 266-293.

Minehart, D. and Z. Neeman. 1999. "Termination and Coordination in Partnerships," *Journal of Economics & Management Strategy,* Vol. 8, pp. 191-221.

Mitzkewitz, M. and R. Nagel. 1993. "Experimental Results on Ultimatum Games with Incomplete Information," *International Journal of Game Theory,* Vol. 22, pp. 171-198.

Moldovanu, B. 2002. "How to Dissolve a Partnership," *Journal of Institutional and Theoretical Economics*, Vol. 158, pp. 66-80.

Morgan, J. 2003. "Dissolving a Partnership (Un)Fairly," *Economic Theory*, Vol. 23, pp. 909-923.

Myerson, R. and M. Satterthwaite. 1983. "Efficient Mechanisms for Bilateral Trading," *Journal of Economic Theory*, Vol. 29, pp. 265-281.

Vincent, D. 1989. "Bargaining with Common Values," *Journal of Economic Theory,* Vol. 48, pp. 47-62.

Welborn, C. 1992. *Practical Remedies for Partners' Default and Decision Deadlocks*. ALI-ABA Publication C761.

Table 1: Point Predictions under Non-Mandatory Texas Shootouts

	Informed-Offeror		Uninformed-Offeror	
	$x = 150$	$x = 400$	$x = 150$	$x = 400$
Symmetric-Information[a]				
Offer Type	Simple-Buy/ Simple-Sell	Simple-Buy/ Simple-Sell		
Price Offered	105/145	230/270		
Response	Accept/ Accept	Accept/ Accept		
Offeror's Payoff	145/145	270/270		
Offeree's Payoff	105/105	230/230		
Inefficiency Rate	.00/.00	.00/.00		
Asymmetric-Information				
Offer Type	Simple-Sell	Simple-Buy	Simple-Buy	
Price Offered	145	230	105	
Response	Accept	Accept	Accept	Reject
Offeror's Payoff	145	270	145	200
Offeree's Payoff	105	230	105	200
Inefficiency Rate	.00	.00	.00	1.00

Note: [a] Offeror and offeree are informed players in the symmetric-information condition.

Table 2: Descriptive Statistics

Condition	Simple-Buy Offer[(a)] Freq. Rate	Simple-Buy Offer[(a)] Price	Simple-Buy Offer[(a)] Rej. Rate	Simple-Sell Offer[(a)] Freq. Rate	Simple-Sell Offer[(a)] Price	Simple-Sell Offer[(a)] Rej. Rate	Buy-Sell Offer[(a)] Freq. Rate	Buy-Sell Offer[(a)] Price	Buy-Sell Offer[(a)] Buy Rate	Mean Payoffs[(b)]	Ineff. Rate
$x = 150$											
S	.45	105.0	.19	.49	145.0	.11	.06	125.0	.46	131.7/104.3	.14
[228]		106.6			143.3			126.5		(24.4/14.4)	
		(5.4)			(14.4)			(5.6)			
A/UO[(c)]	.51	105.0	.14	.33	270.0	.54	.16	125.0	.50	115.4/110.5	.24
[216]		112.1			199.7			144.7		(35.9/34.3)	
		(19.2)			(63.4)			(51.0)			
A/IO	.13	125.0	.47	.49	145.0	.40	.38	125.0	.85	116.2/108.2	.26
[242]		117.5			171.5			130.4		(31.4/27.9)	
		(12.2)			(48.0)			(20.9)			
$x = 400$											
S	.58	230.0	.25	.33	270.0	.04	.09	250.0	.71	255.3/229.0	.16
[76]		219.8			268.4			250.0		(25.3/14.8)	
		(33.8)			(5.5)			(.0)			
A/UO[(c)]	.51	105.0	.97	.33	270.0	.11	.16	125.0	1.00	190.8/257.8	.51
[72]		112.6			200.7			146.0		(46.6/75.2)	
		(22.0)			(65.5)			(57.0)			
A/IO	.69	125.0	.55	.03	n.a.[(d)]	.33	.28	250.0	.23	251.1/209.6	.39
[94]		142.8			166.7			236.5		(69.0/55.8)	
		(41.7)			(90.1)			(31.7)			

Note: [(a)] For each condition and offer type, mode and mean prices are presented in the first and second rows of the price column, respectively; standard deviations are presented in parentheses, and sample sizes (number of pairs for the 16 rounds) are in brackets; for each condition and offer type, the frequency, rejection, and buy rates refer to all prices offered; [(b)] mean payoffs correspond to the offeror's and offeree's payoffs, respectively; [(c)] for the A/UO condition, the information related to the offer type and price are the same under both initial values; [(d)] for the A/IO condition and simple-sell offer type, prices 105, 125 and 270 were the only prices chosen and each price was chosen once.

Table 3: Effects of Symmetric-Information on the Likelihood of Inefficiency
(Tests of Differences across Conditions)

Conditions	Marginal Effects
A/UO vs.	$-.055^{*}$
S	(.036)
Observations	592
A/IO vs.	$-.038^{***}$
S	(.010)
Observations	640

Note: The columns report the change in the likelihood of inefficiency due to symmetric-information (probit analysis using sessions as clusters; marginal effects reported); robust standard errors are in parentheses; *** and * denote significance at the 1% and 10%, respectively; observations correspond to number of pairs.

Appendix A: Proofs

This appendix presents the proofs to propositions and lemmas presented in the main text.

Proof of Proposition 1: In any separating equilibrium it must be the case that $\pi_1^{1T}(x) = 1$ for at most one value of *x*. Suppose not: there are two types, *x* and x', and two corresponding prices, *p* and p', for which Partner 2 sells his stake with probability 1. Full separation implies $p \neq p'$. This outcome violates incentive compatibility because Partner 1 would offer the lower of the two prices, $min\{ p, p' \}$, whether he is of type *x* or type x'. Similarly, it must be the case that $\pi_1^{1T}(x) = 0$ for at most one value of *x*. If this were not true, then Partner 1 would offer the higher of the two prices, $max\{ p, p' \}$, violating incentive compatibility. Therefore $\pi_1^{1T}(x) \in (0,1)$ for (almost) all types *x*, so Partner 2 is randomizing between buying and selling. Partner 2's indifference implies $p^{1T}(x) = x + a$.

Suppose that Partner 1 is of type *x* but makes an offer, $p^{1T}(\tilde{x}) = \tilde{x} + a$. Partner 1's payoff from this offer is:

$$\pi_2^{1T}(\tilde{x})\theta_1(\tilde{x} + a) + [1 - \pi_2^{1T}(\tilde{x})][x + a - \theta_2(\tilde{x} + a)]$$
$$= \pi_2^{1T}(\tilde{x})[\tilde{x} - x] + x + a - \theta_2(\tilde{x} + a)$$

It must be weakly better for Partner 1 to "tell the truth" and offer $p^{1T}(x) = x + a$, so

$$\pi_2^{1T}(\tilde{x})[\tilde{x} - x] + x + a - \theta_2(\tilde{x} + a) \leq \pi_2^{1T}(x)[x - x] + x + a - \theta_2(x + a)$$
$$\pi_2^{1T}(\tilde{x})[\tilde{x} - x] \leq \theta_2[\tilde{x} - x] .$$

This must be true for all deviations, $\tilde{x}$. If $\tilde{x} > x$ this implies that $\pi_2^{1T}(\tilde{x}) \leq \theta_2$. If $\tilde{x} < x$ this implies that $\pi_2^{1T}(\tilde{x}) \geq \theta_2$. Therefore $\pi_2^{1T}(\tilde{x}) = \theta_2$ and we are done. Q.E.D.

Proof of Proposition 2:

Rearranging expression (1),

$$x^{2T} = \arg\max_z \int_0^z [x + a] f(x) dx - \theta_1(z + a)F(z) + \theta_2(z + a)[1 - F(z)] \text{, or}$$

$$x^{2T} = arg\,max_z \int_0^z [\,x + a\,]\, f(\,x\,)dx + (\,z + a\,)[\,\theta_2 - F(\,z\,)] \;.$$

Differentiating and setting the derivative equal to zero at x^{2T} gives

$$[x^{2T} + a] f(x^{2T}) + \theta_2 - F(x^{2T}) - (x^{2T} + a) f(x^{2T}) = 0 .$$

Further rearranging gives $\theta_2 - F(\,x^{2T}\,) = 0$. The second derivative is negative so we have a global maximum. Q.E.D.

Proof of Proposition 3: We will begin by proving that the offers and acceptance probabilities described in the proposition are, indeed, a fully-separating equilibrium. Then we will prove uniqueness.

Proof of Existence of the Fully-Separating Equilibrium

This equilibrium is supported by the following beliefs. If Partner 1 makes a buy-sell offer of *p*, then Partner 2 believes that Partner 1 is of type $\mu^T(p) = p - a$. (Given this belief, Partner 2 would be indifferent between buying and receiving $\mu^T(p) + a - \theta_1 p = \theta_2 p$ and selling and receiving $\theta_2 p$.) If Partner 1 makes an offer to sell his stake to Partner 2 for price *p* then Partner 2 believes that Partner 1 is of type $\mu^S(p) = p - a/\theta_1$. (Partner 2 would be indifferent between buying from Partner 1 and receiving $\mu^s(p) + a - \theta_1 p = \theta_2 p - (\theta_2/\theta_1)a$ or rejecting Partner 1's offer and remaining with the status quo where Partner 2 receives $\theta_2 \mu^S(p) = \theta_2 p - (\theta_2/\theta_1)a$.) Finally, if Partner 1 makes an offer to buy Partner 2's stake for price *p* then Partner 2 believes that Partner 1 is of type $\mu^S(p) = p$. (Again, Partner 2 would be indifferent between selling his stake to Partner 1 and remaining with the status quo.)

Partner 2's equilibrium strategies (defined in Proposition 3) are a best response to Partner 1's offers. Since Partner 1's offer is perfectly revealing of his type and the offers make Partner 2 indifferent, Partner 2 is willing to randomize between accepting and rejecting (in the case of simple offers to buy or sell) and between buying and selling (in the case of the buy-sell offer).

The fully revealing offer schedule is incentive compatible for Partner 1. First, suppose that Partner 1 makes a buy-sell offer, $p^{1T}(x) = x + a$. As described in the proof and text associated with Proposition 1, this is incentive compatible for type *x* since Partner 2 is mixing according to $\pi_1^{1T}(x) = \theta_1$ and $\pi_2^{1T}(x) = \theta_2$.

Next, suppose Partner 1 is of type *x*. Partner 1's payoff from making an offer to buy Partner 2's stake for $p^{1B}(\tilde{x}) = \tilde{x}$ is $\pi_1^{1B}(\tilde{x})(x + a - \theta_2 p^{1B}(\tilde{x})] + [1 - \pi_1^{1B}(\tilde{x})][\theta_1 x]$.

The first term reflects Partner 1's payoff if the offer is accepted and Partner 1 purchases Partner 2's stake for $\theta_2 p^{1B}(\tilde{x})$. The second term reflects Partner 1's payoff when Partner 2 rejects the offer, since they stay with the status quo of joint ownership. Substituting $p^{1B}(\tilde{x}) = \tilde{x}$ gives

$$= \pi_1^{1B}(\tilde{x})(x + a - \theta_2 \tilde{x}] + [1 - \pi_1^{1B}(\tilde{x})][\theta_1 x]$$

$$= \pi_1^{1B}(\tilde{x})[x + a - \theta_2 \tilde{x} - \theta_1 x] + \theta_1 x$$

$$= \pi_1^{1B}(\tilde{x})[\theta_2(x - \tilde{x}) + a] + \theta_1 x,$$

and substituting the expression for $\pi_1^{1B}(\tilde{x})$ from the proposition gives

$$[e^{-\theta_2(1-\tilde{x})/a}][\theta_2(x - \tilde{x}) + a] + \theta_1 x.$$

Differentiating this expression with respect to $\tilde{x}$ gives

$$[e^{-\theta_2(1-\tilde{x})/a}][-\theta_2] + [\theta_2(x - \tilde{x}) + a](\theta_2/a)e^{-\theta_2(1-\tilde{x})/a} = 0$$

$$-\theta_2 + [\theta_2(x - \tilde{x}) + a](\theta_2/a) = 0$$

$$(\theta_2)^2(x - \tilde{x})/a = 0$$

This is satisfied when $\tilde{x} = x$, so it is incentive compatible for Partner 1 to fully reveal his type through the simple offer to buy. (The second-order condition is satisfied as well).

Next consider simple offers to sell. Suppose Partner 1 is of type *x*. Partner 1's payoff from making an offer $p^{1S}(\tilde{x}) = \tilde{x} + a/\theta_1$ is:

$$\pi_2^{1S}(\tilde{x})(\theta_1 p^{1S}(\tilde{x})] + [1 - \pi_2^{1S}(\tilde{x})][\theta_1 x]$$

$= \pi_2^{1S}(\tilde{x})[\theta_1\tilde{x}+a]+[1-\pi_2^{1S}(\tilde{x})][\theta_1 x]$

$= \pi_2^{1S}(\tilde{x})[\theta_1(\tilde{x}-x)+a]+\theta_1 x$.

Substituting for $\pi_2^{1S}(\tilde{x}) = e^{-\theta_1\tilde{x}/a}$ from the proposition gives us

$(e^{-\theta_1\tilde{x}/a})[\theta_1(\tilde{x}-x)+a]+\theta_1 x$.

Differentiating this expression with respect to $\tilde{x}$ gives

$[e^{-\theta_1\tilde{x}/a}]\theta_1+[\theta_1(\tilde{x}-x)+a](-\theta_1/a)e^{-\theta_1\tilde{x}/a} = 0$

$\theta_1-[\theta_1(\tilde{x}-x)+a](\theta_1/a)=0$

$(\theta_1)^2(x-\tilde{x})/a=0$.

This is satisfied when $\tilde{x}=x$, so it is incentive compatible for Partner 1 to fully reveal his type through the offer. (The second-order condition is satisfied as well).

Suppose Partner 1 is of type *x*. Partner 1's simple offer to sell his stake for $p^{1S}(x)=x+a/\theta_1$ and Partner 2's associated probability of accepting that offer, $\pi_2^{1S}(x)=e^{-\theta_1 x/a}$ gives Partner 1 a higher payoff than making the buy-sell offer when $S_1^{1S}(x)=ae^{-\theta_1 x/a}$ is greater than $S_1^{1T}(x)=\theta_1 a$ or when $x<-(a/\theta_1)\ln(\theta_1)$. Partner 1's payoff from the simple offer to sell is higher than his payoff from the simple offer to buy when $S_1^{1S}(x)=ae^{-\theta_1 x/a}$ > $S_1^{1B}(x)=ae^{-\theta_2(1-x)/a}$, or when $x<\theta_2$. Partner 1's simple offer to buy, and Partner 2's associated probability of acceptance $\pi_1^{1B}(x)=e^{-\theta_2(1-x)/a}$, gives Partner 1 a higher payoff than making the buy-sell offer when $S_1^{1B}(x)=ae^{-\theta_2(1-x)/a}$ is greater than $S_1^{1T}(x)=\theta_1 a$, or when $x>1+(a/\theta_2)\ln(\theta_1)$. We conclude that the strategies in Proposition 3 form a fully-separating equilibrium.

<u>Proof of Uniqueness of the Fully Separating Equilibrium</u>

First, in any equilibrium P1's surplus is bounded below by $\theta_1 a$. P1 can guarantee himself a surplus of $\theta_1 a$ by making a buy sell offer $p^{1T}(x)=x+a$ since P1 receives a surplus of $\theta_1 a$ whether P2 buys or sells at this price. Second, incentive compatibility requires that P1's surplus be continuous over the interval *[0, 1]*. If P1's surplus jumped discontinuously upward (for example) then types "close" to the point of discontinuity could increase their payoffs by misrepresenting their types slightly, violating incentive compatibility.

We will consider equilibria where the type space can be partitioned into intervals in the following sense. There are cutoffs, x_0 through x_N, where $0=x_0<x_1<x_2<....<x_N=1$. We will let I_n refer to the interval $[x_{n-1},x_n)$ for *n=1, …, N* and I_N refer to the interval $[x_{N-1},1]$. Each interval is associated with a particular mode of offer (be it an offer to sell, an offer to buy, or a buy-sell offer) and by construction no two adjacent intervals feature the same mode of offer.

Claim: Consider an interval, I_n. Any fully separating equilibrium must have the following characteristics on this interval. If the interval features

1. *buy-sell offers, then $p^{1T}(x)=x+a$, $\pi_1^{1T}(x)=\theta_1$, $\pi_2^{1T}(x)=\theta_2$, and P1's surplus is $\theta_1 a$.*
2. *buy offers, then $p^{1B}(x)=x$, $\pi_1^{1B}(x)=c^B e^{\theta_2 x/a}\in(0,1)$, and P1's surplus is $ac^B e^{\theta_2 x/a}$ where c^B is a constant.*

3. *sell offers, then* $p^{1S}(x) = x + a/\theta_1$, $\pi_2^{1S}(x) = c^S e^{-\theta_1 x/a} \in (0,1)$, *and P1's surplus is* $ac^S e^{-\theta_1 x/a}$ *where* c^S *is a constant.*

Proof of Claim: See addendum at the end of Appendix A.

Suppose that, in equilibrium, interval I_n where $0 < n < N$ is associated with buy-sell offers. P1's surplus is $\theta_1 a$ on this region and, by continuity, his surplus is arbitrarily close to $\theta_1 a$ for "close types" in the neighboring regions as well. Interval I_{n+1} necessarily features offers to buy. If it featured offers to sell, then (according to the previous claim) P1's surplus would be falling in x over I_{n+1}. This is impossible, since P1's surplus must be everywhere above $\theta_1 a$. Similarly, interval I_{n-1} necessarily features offers to sell.

There is at most one interval that features buy-sell offers. Suppose not: intervals I_n and I_m are both buy-sell regions where (without loss of generality) $m > n$. An earlier argument implies that P1 necessarily makes offers to buy in intervals I_{n+1} and I_{m+1}. Furthermore, his equilibrium surplus at the smallest types in these two intervals must satisfy $S_1^{1B}(x_n) = S_1^{1B}(x_m) = \theta_1 a$. This implies that when $x = x_n$ (which is on the boundary of interval I_{n+1} and I_n) P1 offers to buy for $p^{1B}(x_n) = x_n$ and P2 accepts with probability $\pi_1^{1B}(x_n)\theta_1$, giving P1 a surplus of $\theta_1 a$. Similarly, when $x = x_m$ then P1 offers to buy for $p^{1B}(x_m) = x_m$ and P2 accepts with probability $\pi_1^{1B}(x_m)\theta_1$. The implication that these two acceptance probabilities are the same violates incentive compatibility. Since $x_n < x_m$ the partner P1 with true type x_m would misrepresent himself and offer to buy P2's stake for $p^{1B}(x_n) = x_n$. This is a contradiction.

The first interval I_1 = $[0, x_1)$ necessarily features offers to sell, and the constant in this interval $c^s = 1$. If $c^s \neq 1$ then $\pi_2^{1S}(0) < 1$ and Partner 1's payoff is strictly smaller than $\theta_1 p^{1S}(0) = \theta_1 [0 + a/\theta_1]$ so his payoff is strictly smaller than *a.* If Partner 1 is of type $x = 0$, he can guarantee himself a payoff arbitrarily close to a by offering $p^{1S} = a/\theta_1 - \varepsilon$. If Partner 2 believes that Partner 1 is of type $\tilde{x}$ then Partner 2 will accept that offer because his payoff would be $\tilde{x} + a - \theta_1 p^{1S} > \theta_2 \tilde{x}$ for all $\tilde{x}$. Suppose instead that Partner 1 made a *buy-sell offer* in this range. Partner 1's surplus is $\theta_1 a$ for all types in this range. If $x = 0$ then Partner 1 can assure himself a surplus of a by offering $p^{1S} = a/\theta_1 - \varepsilon$ as before. Suppose instead that Partner 1 makes an *offer to buy* in this range. Since $\pi_1^{1B}(x) \in (0,1)$ Partner 1's surplus is strictly smaller than a when $x = 0$. He can assure himself a payoff of a when $x = 0$ by offering $p^{1S} = a/\theta_1 - \varepsilon$ as before. Similarly, the last interval I_N = $[x_{N-1}, 1]$ necessarily features offers to buy and $c^B = e^{-\theta_2/a}$ the highest offer is accepted with certainty, $p^{1B}(1) = 1$.

Suppose intervals I_{m-1} and I_{m+1} both feature offers to buy. It cannot be the case that I_m features a buy-sell offer. If it did not then (as shown earlier) I_{m-1} would feature an offer to sell. The interval I_m also cannot feature offers to sell. Suppose it did. The claim stated earlier implies that P1's surplus would be increasing in the "buy" interval I_{m-1}, decreasing in the "sell" interval I_m, and then increasing again in the "buy" interval I_{m+1}. Continuity implies that the surplus for type x_m (the top type of the lowest interval) is higher than the surplus for type x_{m+1} (the bottom type of the highest interval). Equivalently, the probability that the offer to buy for $p^{1B}(x_{m+1}) = x_{m+1}$ is accepted is lower than the probability that the offer to buy for price x_m (minus epsilon) is accepted. This violates incentive compatibility, since type x_{m+1} would deviate and offer x_m (minus epsilon) rather than x_m. Similarly, if intervals I_{m-1} and I_{m+1} both feature offers to sell then the interval in between cannot feature either buy-sell offers or offers to buy.

Taken together, these results prove that the equilibrium has either two intervals where the first features offers to sell and the second offers to buy, or three regions where the middle region features buy-sell offers. Q.E.D.

Proof of Lemma 1: Suppose that Partner 2 makes a buy-sell offer. From Proposition 2, if $x < x^{2T}$ then Partner 1 sells his stake to Partner 2. Partner 2's ex post surplus is:

$$S_2^{2T}(x) = x + a - \theta_1 p^{2T} - \theta_2 x$$
$$= x + a - \theta_1(x^{2T} + a) - \theta_2 x$$
$$= \theta_2 a - \theta_1(x^{2T} - x)$$

If $x > x^{2T}$, then Partner 1 buys Partner 2's stake and

$$S_2^{2T}(x) = \theta_2 p^{2T} - \theta_2 x$$
$$= \theta_2(x^{2T} + a) - \theta_2 x$$
$$= \theta_2 a - \theta_2(x - x^{2T})$$

Partner 2's expected surplus from the buy-sell offer is therefore:

$$\int_0^1 S_2^{2T}(x)dFx = \theta_2 a - \theta_1 \int_0^{x^{2T}} (x^{2T} - x)dF(x) - \theta_2 \int_{x^{2T}}^1 (x - x^{2T})dF(x).$$

This is clearly negative when $a < \hat{a}$ as defined in the proposition, and is positive otherwise. Q.E.D.

Proof of Proposition 4: We will first prove that Partner 2 would prefer to make a simple offer to buy the asset rather than remain with the status quo. Suppose that Partner 2 makes a simple offer to buy the asset from Partner 1 for $p = x^{2B}$. Partner 1 would accept the offer if x is below x^{2B} and reject the offer if x is above x^{2B}. Partner 2 chooses the cutoff to maximize his surplus,

$$\int_0^{x^{2B}} \left[x + a - \theta_1 x^{2B} - \theta_2 x\right] dF(x) + \int_{x^{2B}}^1 \left[\theta_2 x - \theta_2 x\right] dF(x), \text{ or } -\theta_1 \int_0^{x^{2B}} (x^{2B} - x)dF(x) + aF(x^{2B}).$$

Differentiating this expression gives the slope of this function:

$$-\theta_1 F(x^{2B}) + af(x^{2B}).$$

Since $f(x) > 0$ for all x by assumption, this expression is positive when $x^{2B} = 0$. Therefore, $x^{2B} > 0$, and the associated price $p^{2B} > 0$. Similarly, Partner 2 prefers to make a simple offer to sell the asset rather than remain with the status quo. Suppose Partner 2 makes a simple offer to sell for $p = x^{2S} + a/\theta_2$. Partner 1 accepts the offer if x is above x^{2S} and rejects the offer if x is below x^{2S}. Partner 2 chooses the cutoff to maximize his surplus,

$$\int_0^{x^{2S}} \left[\theta_2 x - \theta_2 x\right] dF(x) + \int_{x^{2S}}^1 \left[\theta_2 p^{2S} - \theta_2 x\right] dF(x), \text{ or } -\theta_2 \int_{x^{2S}}^1 (x - x^{2S})dF(x) + a[1 - F(x^{2S})].$$

Differentiating this expression gives the slope of the surplus function:

$$\theta_2 [1 - F(x^{2S})] - af(x^{2S}).$$

This expression is negative when $x^{2S} = 1$. Therefore Partner 2 will certainly choose a cutoff $x^{2S} < 1$ and a corresponding $p^{2S} < 1 + a/\theta_2$.

Finally, we will show that Partner 2 prefers the simple offer to buy to the Texas Shootout. (By analogy, he would also prefer the simple offer to sell to the Texas Shootout.) Suppose that Partner 2 makes a simple offer to buy the asset from Partner 1 for $p = x^{2T}$, his optimal cutoff from the Texas Shootout where $F(x^{2T}) = \theta_2$. Partner 1 accepts the offer if x is below x^{2T} and rejects the offer if x is above x^{2T}, the same cutoff as before. Partner 2's expected surplus from this simple offer to sell is:

$$\int_0^{x^{2T}} \left[x + a - \theta_1 x^{2T} - \theta_2 x \right] dF(x) + \int_{x^{2T}}^1 \left[\theta_2 x - \theta_2 x \right] dF(x) = aF(x^{2T}) - \theta_1 \int_0^{x^{2T}} (x^{2T} - x) dF(x)$$

$$= \theta_2 a - \theta_1 \int_0^{x^{2T}} (x^{2T} - x) dF(x).$$

The surplus from this (non-optimal) simple sell offer is certainly higher than the surplus from the buy-sell offer when:

$$\theta_2 a - \theta_1 \int_0^{x^{2T}} (x^{2T} - x) dF(x) > \theta_2 a - \theta_1 \int_0^{x^{2T}} (x^{2T} - x) dF(x) - \theta_2 \int_{x^{2T}}^1 (x - x^{2T}) dF(x),$$

where the right-hand side of this expression is from the proof of Lemma 1. Canceling terms,

$$\theta_2 \int_{x^{2T}}^1 (x - x^{2T}) dF(x) > 0.$$

This is true for all $\theta_2 \in (0,1)$ so Partner 2 prefers this (non-optimal) offer to buy to making a buy-sell offer. Analogously, one can show that Partner 2 would prefer to make a simple offer to sell his stake to Partner 1 than make a buy-sell offer. Q.E.D.

Proof of Lemma 2: First, suppose that Partner 1 makes the buy-sell offer. As before, $\pi_1^{1T}(x) \in (0,1)$ for (almost) all x so Partner 2 is randomizing between buying and selling. This implies that Partner 2 is indifferent between buying and selling at this price, so $p^{1T}(x) = x$. Now suppose that Partner 1 has type x but makes an offer, $p^{1T}(\tilde{x}) = \tilde{x}$. Partner 1’s payoff from this offer is:

$$\pi_2^{1T}(\tilde{x})\theta_1\tilde{x} + [1 - \pi_2^{1T}(\tilde{x})][x + a - \theta_2\tilde{x}]$$

$$= \pi_2^{1T}(\tilde{x})[\tilde{x} - x - a] + x + a - \theta_2\tilde{x}$$

In the fully separating equilibrium, Partner 1 finds it optimal to “tell the truth” and offer $p^{1T}(x) = x$ when his type is x. Differentiating with respect to $\tilde{x}$ gives:

$$\frac{\partial \pi_2^{1T}(\tilde{x})}{\partial \tilde{x}} [\tilde{x} - x - a] + \pi_2^{1T}(\tilde{x}) - \theta_2.$$

Partner 1’s payoff must be maximized when $\tilde{x} = x$. Setting this expression equal to zero when $\tilde{x} = x$ gives us the first-order differential equation:

$$-a \frac{\partial \pi_2^{1T}(x)}{\partial x} + \pi_2^{1T}(x) - \theta_2 = 0.$$

The general solution to this equation is

$$\pi_2^{1T}(x) = \theta_2 + ce^{x/a}$$

where c is an arbitrary constant. Not all of these solutions satisfy the second order condition for Partner 1. Differentiating Partner 1's payoff function one more time gives:

$$\frac{\partial^2 \pi_2^{1T}(\tilde{x})}{\partial \tilde{x}^2}[\tilde{x} - x - a] + 2\frac{\partial \pi_2^{1T}(\tilde{x})}{\partial \tilde{x}}.$$

A necessary local second order condition is that this is negative when $\tilde{x} = x$, or

$$-a\frac{\partial^2 \pi_2^{1T}(x)}{\partial x^2} + 2\frac{\partial \pi_2^{1T}(x)}{\partial x} \leq 0.$$

Plugging in the general solution gives

$$-\frac{ce^{x/a}}{a} + \frac{2ce^{x/a}}{a} = \frac{ce^{x/a}}{a} \leq 0.$$

Therefore $c \leq 0$ and $\pi_2^{1T}(x) = \theta_2 + ce^{x/a}$ is decreasing in x and $\pi_1^{1T}(x) = \theta_1 - ce^{x/a}$ is correspondingly increasing in *x*. This is intuitive. If Partner 1 makes a lower offer (indicating that his type is low) then Partner 2 must "discipline" Partner 1 by buying (rather than selling) at that low price. When the price is high, on the other hand, Partner 2 has less reason to be distrustful and can sell to Partner 1 with a higher probability.

In equilibrium it must be the case that $\pi_2^{1T}(1) = 0$ and $\pi_1^{1T}(1) = 1$. That is, Partner 1 succeeds in buying out Partner 2 if Partner 1 makes the highest possible offer. Suppose not: $\pi_2^{1T}(1) > 0$ and $\pi_1^{1T}(1) < 1$. In this case, Partner 1's surplus if his type is $x = 1$ is certainly less than *a*. He can achieve a surplus arbitrarily close to *a* by making a buy-sell offer $p = 1 + \varepsilon$. Partner 2, although he is uninformed, would rationally sell at this prices regardless of his beliefs about Partner 1's type. This gives us the boundary condition for the differential equation: $\pi_2^{1T}(1) = \theta_2 + ce^{1/a} = 0$ or $c = -\theta_2 e^{-1/a}$, and so we have $\pi_2^{1T}(x) = \theta_2 - \theta_2 e^{-(1-x)/a}$.

Now suppose that Partner 2, the uninformed and less able partner makes the offer. Suppose Partner 2 has named a price p^{2T}. Knowing *x*, Partner 1 will "buy" instead of "sell" if $x + a - \theta_2 p^{2T} > \theta_1 p^{2T}$ or $p^{2T} < x + a$. This implies a cutoff, $x^{2T} = p^{2T} - a$, where Partner 1 sells when *x* is below the cutoff and buys when *x* is above the cutoff. Partner 2's problem is to find the best cutoff, x^{2T}, and corresponding offer, $p^{2T} = x^{2T} + a$, to maximize his expected payoff:

$$x^{2T} = \arg\max_z \int_0^z [x - \theta_1(z + a)] f(x)dx + \int_z^1 \theta_2(z + a) f(x)dx.$$

Rearranging terms,

$$x^{2T} = \arg\max_z \int_0^z xf(x)dx + (z + a)[\theta_2 - F(z)]$$

Differentiating this expression with respect to z and setting the derivative equal to zero shows that the cutoff satisfies

$$x^{2T} f(x^{2T}) + \theta_2 - F(x^{2T}) - (x^{2T} + a) f(x^{2T}) = 0$$

$$\theta_2 - F(x^{2T}) - x^{2T} f(x^{2T}) = 0.$$

$F(x^{2T}) + af(x^{2T}) = \theta_2$. Q.E.D.

Proof of Proposition 5: First, Partner 2's expected payoff from making a simple offer to sell the asset to Partner 1 is exactly the same as it was in the previous section. (Partner 2 could never own the asset by himself in this scenario.) Partner 2's payoff from making a buy-sell offer, on the other hand, is lower than it was before. To see this clearly, consider an arbitrary buy-sell offer $p' = x' + a$. If $x < x'$ then Partner 1 sells his stake to Partner 2. Partner 2's surplus is smaller than it was for the case where Partner 2 was equally capable at managing the assets by himself. Indeed, Partner 2's surplus in this scenario is negative: $x - \theta_1 p' - \theta_2 x \quad = x - \theta_1 (x' + a) - \theta_2 x$ $= -\theta_1 a - \theta_1 (x' - x) < 0$. If $x > x'$ then Partner 1 buys Partner 2's stake and Partner 2's surplus is exactly the same as it was before: $\theta_2 p' - \theta_2 x \; = \; \theta_2 (x' + a) - \theta_2 x \; = \theta_2 a - \theta_2 (x - x')$. This implies that Partner 2's expected payoff from making a buy-sell offer is lower now than it would be making the very same offer when Partner 2 is an equally capable manager as Partner 1. So Partner 2 would never make a buy-sell offer.

In the case of a buy-sell offer, Partner 2 sells the asset to Partner 1 with probability $\pi_1^{1T}(x) = \theta_1 + \theta_2 e^{-(1-x)/a}$, in which case Partner 1 receives the surplus *a*. (If Partner 2 buys the asset for price $p^{1T}(x) = x$ then Partner 1 receives no surplus at all.) In the case of the simple offer to buy, then (as established in the last section) Partner 2 accepts this offer with probability $\pi_1^{1B}(x) = e^{-\theta_2(1-x)/a}$. Partner 1 receives surplus *a* in this case as well. Partner 1's preference hinges on the relative probability of getting the surplus, *a*. Both of these probabilities equal *1* when *x = 1*, giving Partner 1 exactly the same surplus *a*. But for values of *x* below 1, the buy-sell offer yields a higher probability that Partner 1 will ultimately own the assets and a higher corresponding surplus for Partner 1.[1] Q.E.D.

Proof of Proposition 6: First, when Partner 1 makes the offer he will choose to make the buy-sell offer. Making buy-sell offers mandatory when Partner 1 is making the offer has no affect on the outcome.

Making the buy-sell offer mandatory does make a difference when Partner 2 makes the offer. To show that social welfare is higher under the shootout, we need to calculate Partner 2's favorite offer to sell and the associated social surplus.

If Partner 1 has type x and he rejects the offer then Partner 1 receives $\theta_1 x$; if he accepts the offer he receives $x + a - \theta_2 p^{2S} \; = x + a - \theta_2 (x^{2S} + a/\theta_2) = x - \theta_2 x^{2S}$. He will therefore accept the offer if and only if $x > x^{2S}$, where $p^{2S} \; = x^{2S} + a/\theta_2$. Partner 2 will choose the price and cutoff to maximize his surplus:

$$\int_0^{x^{2S}} [\theta_2 x - \theta_2 x] dF(x) + \int_{x^{2S}}^{1} [\theta_2 p^{2S} - \theta_2 x] dF(x) = \int_{x^{2S}}^{1} [\theta_2 (x^{2S} - x) + a] dF(x)$$

Differentiating this payoff function with respect to the cutoff gives:

$$-[\theta_2 (x^{2S} - x^{2S}) + a] f(x^{2S}) + \theta_2 [1 - F(x^{2S})] = 0$$

$$-af(x^{2S}) + \theta_2 [1 - F(x^{2S})] = 0$$

$$\theta_2 F(x^{2S}) + af(x^{2S}) = \theta_2 .$$

Comparing this expression to the first order condition for x^{2T}, the cutoff for the buy-sell offer, establishes that $x^{2S} > x^{2T}$.

---

[1] Differentiating $\pi_1^{1B}(x)$ establishes that this function has a higher slope than $\pi_1^{1T}(x)$. Since they are equal when $x = 1$, $\pi_1^{1B}(x)$ must lie everywhere below $\pi_1^{1T}(x)$.

Let's calculate social welfare. With the buy-sell offer, Partner 1 buys Partner 2's stake when $x > x^{2T}$, and the social surplus a is captured by Partner 1. (If $x < x^{2T}$ then Partner 1 sells his stake to Partner 2 and there is no social value created.) The equilibrium social surplus is therefore:

$$a[1 - F(x^{2T})]$$

Now suppose that Partner 2 makes his favorite simple offer to sell the asset. Again, the social value is created only when Partner 1 accepts this offer, and this happens for $x > x^{2S}$. The equilibrium social surplus is therefore:

$$a[1 - F(x^{2S})]$$

Since $x^{2S} > x^{2T}$, we have that social welfare is higher with the buy-sell offer than it is with the simple offer to sell: $a[1 - F(x^{2T})] > a[1 - F(x^{2S})]$. Q.E.D.

Addendum to the Proof of Proposition 3

Proof of Claim: The first part of the claim (characteristics of intervals with buy-sell offers) was demonstrated in the proof of Proposition 1 and will not be repeated here.

Suppose there is an interval I where P1 makes a simple offer to buy. In any separating equilibrium it must be the case that $\pi_1^{1B}(x)=1$ for at most one value of *x*. Suppose not: there are two types, *x* and x', and two corresponding prices, *p* and p', where Partner 1 accepts the offer and buys Partner 2's stake with probability 1. In any separating equilibrium the price reveals Partner 1's type, so $p \neq p'$. This outcome violates incentive compatibility because Partner 1 would offer the lower of the two prices, $min\{ p, p' \}$, whether he is of type *x* or type x'. Therefore $\pi_1^{1B}(x)<1$ for (almost) all *x*. It also must be the case that $\pi_1^{1B}(x)>0$ on this range. If $\pi_1^{1B}(x)=0$ (so Partner 2 rejected the offer for sure) then Partner 1 of type *x* is receiving a surplus of zero. This is strictly dominated for Partner 1: he can assure himself a surplus of $\theta_1 a>0$ by offering $p^{1T}(x)=x+a$, regardless of the reaction of Partner 2. Suppose Partner buys Partner 1's stake with probability ρ. Partner 1's payoff is:

$$
\begin{aligned}
&\rho\theta_1(x+a)+[1-\rho][x+a-\theta_2(x+a)] \\
&= (x+a)[\rho\theta_1+(1-\rho)(1-\theta_2)] \\
&=\theta_1(x+a).
\end{aligned}
$$

Therefore $\pi_1^{1B}(x)\in(0,1)$ and Partner 2 is between buying and selling on this range. Partner 2's indifference between accepting the offer and rejecting it and staying with the status quo implies that $p^{1B}(x)=x$.

Suppose Partner 1 is of type *x*. Partner 1's payoff from making an offer $p^{1B}(\hat{x})=\hat{x}$ is:

$$\pi_1^{1B}(\hat{x})(x+a-\theta_2 p^{1B}(\hat{x})]+[1-\pi_1^{1B}(\hat{x})][\theta_1 x]$$

The first term reflects Partner 1's payoff if the offer is accepted and Partner 1 purchases Partner 2's stake for $\theta_2 p^{1B}(\hat{x})$. The second term reflects Partner 1's payoff when Partner 2 rejects the offer, since they stay with the status quo of joint ownership. Substituting $p^{1B}(\hat{x})=\hat{x}$ gives

$$
\begin{aligned}
&= \pi_1^{1B}(\hat{x})(x+a-\theta_2\hat{x}]+[1-\pi_1^{1B}(\hat{x})][\theta_1 x] \\
&=\pi_1^{1B}(\hat{x})[x+a-\theta_2\hat{x}-\theta_1 x]+\theta_1 x \\
&=\pi_1^{1B}(\hat{x})[\theta_2(x-\hat{x})+a]+\theta_1 x.
\end{aligned}
$$

Incentive compatibility implies that Partner 1 weakly prefers to offer $p^{1B}(x)=x$ to any other price, so

$$
\begin{aligned}
&\pi_1^{1B}(\hat{x})[\theta_2(x-\hat{x})+a]+\theta_1 x \le \pi_1^{1B}(x)[\theta_2(x-x)+a]+\theta_1 x \\
&\pi_1^{1B}(\hat{x})[\theta_2(x-\hat{x})+a] \le \pi_1^{1B}(x)a \\
&\pi_1^{1B}(\hat{x})\theta_2(x-\hat{x})-a[\pi_1^{1B}(x)-\pi_1^{1B}(\hat{x})] \le 0
\end{aligned}
$$

Suppose that $x>\hat{x}$. Dividing this expression by $x-\hat{x}$ and taking the limit as $\hat{x}$ approaches x gives us $\pi_1^{1B}(x)\theta_2 - a\frac{\partial\pi_1^{1B}(x)}{\partial x}\le 0$. Similarly, if $x<\hat{x}$ then we find that $\pi_1^{1B}(x)\theta_2 - a\frac{\partial\pi_1^{1B}(x)}{\partial x}\ge 0$. Therefore $\pi_1^{1B}(x)$ is the solution to the first-order linear differential equation $\theta_2\pi_1^{1B}(x) - a\frac{\partial\pi_1^{1B}(x)}{\partial x} = 0$. The general solution is $\pi_1^{1B}(x) = ce^{\theta_2 x/a}$ where c is an arbitrary constant.

Now suppose instead that there is an interval where P1 makes a simple offer to sell. As in the previous claim, it must be the case that $\pi_1^{1S}(x) \in (0,1)$ on this range. Partner 2 must be indifferent between accepting and rejecting the offer. Partner 2's payoff if he buys Partner 1's stake is $x + a - \theta_1 p^{1S}(x)$ and his payoff if he rejects the offer and remains with the status quo of joint ownership is $\theta_2 x$. Partner 2 is indifferent when $p^{1S}(x) = x + a/\theta_1$.

Suppose Partner 1 is of type *x*. Partner 1's payoff from making an offer $p^{1S}(\hat{x}) = \hat{x} + a/\theta_1$ is:

$$\pi_2^{1S}(\hat{x})(\theta_1 p^{1S}(\hat{x})] + [1 - \pi_2^{1S}(\hat{x})][\theta_1 x]$$
$$= \pi_2^{1S}(\hat{x})[\theta_1\hat{x} + a] + [1 - \pi_2^{1S}(\hat{x})][\theta_1 x]$$
$$= \pi_2^{1S}(\hat{x})[\theta_1(\hat{x} - x) + a] + \theta_1 x$$

Incentive compatibility for Partner 1 implies:

$$\pi_2^{1S}(\hat{x})[\theta_1(\hat{x} - x) + a] + \theta_1 x \le \pi_2^{1S}(x)[\theta_1(x - x) + a] + \theta_1 x$$
$$\pi_2^{1S}(\hat{x})[\theta_1(\hat{x} - x) + a] \le \pi_2^{1S}(x)a$$
$$\pi_2^{1S}(\hat{x})\theta_1(\hat{x} - x) + a[\pi_1^{1S}(\hat{x}) - \pi_1^{1S}(x)] \le 0 .$$

As in the proof of the last claim, this gives us the differential equation $\theta_1\pi_1^{1S}(x) + a\frac{\partial\pi_1^{1S}(x)}{\partial x} = 0$.

The general solution is $\pi_1^{1S}(x) = ce^{-\theta_1 x/a}$. Q.E.D.

Additional Appendices

This document encompasses Appendix B (binary version of the model) and Appendix C (instructions for the A/IO condition).

Appendix B: Binary Version of the Model

This appendix presents a two-type version of the model (low and high asset values). The notation used in this section is as follows. If the partners stay together, the total value is x; if they break up, the total value is $x+a$; two values for x, $x \in \{x_L, x_H\}$, with probabilities $\{\beta_L, \beta_H\}$ where $\beta_L + \beta_H = 1$ and $\bar{x} = \beta_L x_L + \beta_H x_H$.

Mandatory Texas Shootouts

In this section, we will assume that one partner is designated the "offeror" and the other partner is the designated "offeree."

Claim: Suppose A2 (the uninformed partner) makes the buy-sell offer.

- *i.* *If $\beta_L > 1/2$, then A2 offers $p = x_L + a$. A1 gets $(x_L/2)(\beta_L - \beta_H) + \beta_H x_H + a/2$ and A2 gets $(1/2)(x_L + a)$. A2 prefers the buy-sell offer to remaining with the status quo when $a > \beta_H (x_H - x_L)$.*
- *ii.* *If $\beta_L < 1/2$, then A2 offers $p = x_H + a$. A1 gets $(1/2)(x_H + a)$ and A2 gets a payoff of $(x_H/2)(\beta_H - \beta_L) + \beta_L x_L + a/2$. A2 prefers the buy-sell offer to remaining with the status quo when $a > \beta_L (x_H - x_L)$.*
- *iii.* *If $\theta_L = 1/2$, then A2 is indifferent about the precise value of his offer and any $p \in [x_L + a, x_H + a]$ is an equilibrium. A1 receives $\beta_H (x_H + a)$ and A2 receives $\beta_L (x_L + a)$. A2 prefers a buy-sell offer to remaining with the status quo when $a > (1/2)(x_H - x_L)$.*

Proof: Suppose that A2 makes a buy-sell offer. First, it must be the case that $p \in [x_L + a, x_H + a]$. If $p < x_L + a$ then both types will buy and A2's profits would be $p/2$. He should clearly raise the offer. Similarly, if $p > x_H + a$ then both types would prefer to sell and A2 should lower the offer.

Suppose that $p \in (x_L + a, x_H + a)$. A1, knowing x, will buy when $p < x + a$ and sell when $p > x + a$. So A2's expected profits are $\beta_L (x_L + a - p/2) + \beta_H (p/2)$ = $\beta_L (x_L + a) + (\beta_H - \beta_L)(p/2)$. Notice that if $\beta_H = \beta_L = 1/2$ then A2 is indifferent as to the value of p. If $\beta_H > 1/2 > \beta_L$, then A2 wants to make p as high as possible, $p = x_H + a$ (minus $\varepsilon > 0$). If $\beta_H < 1/2 < \beta_L$ then A2 wants to make p as low as possible, $p = x_L + a$ (plus $\varepsilon > 0$).

A2 prefers to make a buy-sell offer $p \in (x_L + a, x_H + a)$ when:

$$\beta_L (x_L + a) + (\beta_H - \beta_L)(p/2) > \beta_L (x_L/2) + \beta_H (x_H/2)$$
$$\beta_L a + (\beta_H - \beta_L)(p/2) > \beta_H (x_H/2) - \beta_L (x_L/2)$$
$$2\beta_L a + (\beta_H - \beta_L)(p) > \beta_H x_H - \beta_L x_L$$

$\beta_H(x_H - p) - \beta_L(x_L - p) < 2\beta_L a$.

Suppose that $\beta_H = \beta_L = 1/2$. This expression becomes $(1/2)x_H - (1/2)x_L < a$. When $\beta_H > 1/2 > \beta_L$ then $p = x_H + a$. The expression becomes $\beta_H(-a) - \beta_L(x_L - x_H - a) < 2\beta_L a$, or $\beta_L(x_H - x_L) < a$. Similary for $\beta_H < 1/2 < \beta_L$. Q.E.D.

Claim: Suppose A1 (the informed partner) makes the buy-sell offer. There exists a fully-separating equilibrium where:

- *i.* *If* $x = x_H$ *then A1 offers* $p = x_H + a$ *and A2 sells. A1 and A2 both receive payoffs of* $(1/2)(x_H + a)$. *A1 prefers this outcome to the status quo of* $\bar{x}/2$.
- *ii.* *If* $x = x_L$ *then A1 offers* $p = x_L + a$ *and A2 buys. A1 and A2 both receive payoffs of* $(1/2)(x_L + a)$. *A1 prefers this outcome to the status quo of* $\bar{x}/2$.

When A2 sees an off the equilibrium path offer $p \in (x_L + a, x_H + a)$ *he believes that A1 is of type* $x = x_L$ *with probability* $\tilde{\beta}_L(p) = (x_H + a - p)/(x_H - x_L)$ *and type* $x = x_H$ *with probability* $\tilde{\beta}_H(p) = [p - (x_L + a)]/(x_H - x_L)$ *, and mixes with probability 50/50 between buying and selling.*

Proof: First, it is incentive compatible for A2. When $p = x_H + a$ then A2 believes that $x = x_H$ so he is indifferent between buying and selling. Therefore it is (weakly) optimal for him to sell. When $p = x_L + a$ then A2 believes that $x = x_L$ so he is indifferent between buying and selling. Therefore it is (weakly) optimal for him to buy.

These offers are also incentive compatible for A1. When $x = x_H$ then A1 gets $(1/2)(x_H + a)$ when he offers $p = x_H + a$. If he offered $p = x_L + a$ then A2 would buy at the low price and A1 would only get $(1/2)(x_L + a)$. So A2 will stick to the high offer. Similarly, it is incentive compatible for A1 to offer $p = x_L + a$ instead of $p = x_H + a$ when $x = x_L$. If he offers $p = x_L + a$ he gets $(1/2)(x_L + a)$ (since A2 buys out A1 when $p = x_L + a$). If he offered $p = x_H + a$ instead then A2 would sell his stake to A1 and A1 would get $x_L + a - (1/2)(x_H + a) = x_L - (x_H/2) + (a/2) < (1/2)(x_L + a)$.

It remains to check that A1 cannot do better by deviating to another offer. Given the beliefs of A2 and the mixing with probability 50/50, one can see that Partner A1 is indifferent between all of the offers in $p \in (x_L + a, x_H + a)$, regardless of his type. Q.E. D.

Non-Mandatory Texas Shootouts

Claim: Suppose A2 (the uninformed partner) makes an offer to buy A1's (the informed partner's) share.

- *i.* *If* $2a < (\beta_L/\beta_H)(x_H - x_L)$ *then A2 offers to buy for* $p = x_L$ *and only type* x_L *accepts. A1 gets* $\bar{x}/2$ *and A2 gets* $\bar{x}/2 + \beta_L a$ *. Note that A2 receives a higher payoff than in the status quo of* $\bar{x}/2$.
- *ii.* *If* $2a > (\beta_L/\beta_H)(x_H - x_L)$ *then A2 offers to buy for* $p = x_H$ *and both types accept. A1 gets* $x_H/2$ *and A2 gets* $\bar{x}/2 + a + (\beta_L/2)(x_H - x_L)$ *. Note that A2 receives a higher payoff than in the status quo.*

Proof: In equilibrium, A2 will choose to offer either $p = x_L$ and purchase from just type x_L or $p = x_H$ and purchase from both types. If A2 offered less than $p = x_L$ then both types would reject the offer. A2 does strictly better raising his offer to (just above) $p = x_L$. A1 accepts if $x = x_L$ and A2 gets the surplus a. Similarly, if $p > x_H$ then A2 should lower the offer. Etc. If A2 offers $p = x_L$ then A2 gets $\beta_L[(x_L/2) + a] + \beta_H(x_H/2) = \bar{x}/2 + \beta_L a$. If he offers $p = x_H$ then A2 gets $\beta_L[x_L + a - (x_H/2)] + \beta_H[(x_H/2) + a] = \bar{x}/2 + a + (\beta_L/2)(x_H - x_L)$. Comparing these two expressions gives the result. Q.E.D.

Claim: Suppose A2 (the uninformed partner) makes an offer to sell his own shares to A1 (the informed partner).

i. *If* $2a < (\beta_L/\beta_H)(x_H - x_L)$ *then A2 offers to sell for* $p = x_H + 2a$ *and only type* x_H *accepts. A1 gets* $\bar{x}/2$ *and A2 gets* $\bar{x}/2 + \beta_H a$. *A2's payoff is higher than the status quo of* $\bar{x}/2$.

ii. *If* $2a > (\beta_L/\beta_H)(x_H - x_L)$ *then A2 offers to sell for* $p = x_L + 2a$ *and both types accept. A1 gets* $\bar{x}/2 + (\beta_H/2)(x_H - x_L)$ *and A2 gets* $x_L/2 + a$. *A2's payoff is higher than the status quo of* $\bar{x}/2$.

Proof: If A2 offers to sell for $p = x_H + 2a$ then only type x_H accepts. A2 gets $\beta_L(x_L/2) + \beta_H[(x_H/2) + a] = \bar{x}/2 + \beta_H a$. If he offers $p = x_L + 2a$ then both types accept and A2 gets $x_L/2 + a$. Comparing these two expressions gives the result. Q.E. D.

Proposition: Suppose that A2 (the uninformed partner) can make a single offer to A1 (the informed partner).

1. *Suppose* $2a < (x_H - x_L)$.

   i. *If* $\beta_L < \beta_H$, *then A2 offers to sell for* $p = x_H + 2a$. *Only type* $\bar{x}/2$ x_H *accepts. A1 gets* $\bar{x}/2$ *and A2 gets* $(\bar{x}/2) + \beta_H a$.

   ii. $\beta_L > \beta_H$, *then A2 offers to buy for* $p = x_L$. *Only type* x_L *accepts. A1 gets* $\bar{x}/2$ *and A2 gets* $(\bar{x}/2) + \beta_L a$.

2. *Suppose* $2a > (x_H - x_L)$.

   i. *If* $\beta_L < \beta_H$, *then A2 offers to buy for* $p = x_H$. *Both types accept. A1 gets* $(x_H/2)$ *and A2 gets* $\bar{x}/2 + a - (\beta_L/2)(x_H - x_L)$.

   ii. $\beta_L > \beta_H$, *then A2 offers to sell for* $p = x_L + 2a$. *Both types accept. A1 gets* $\bar{x}/2 + (\beta_H/2)(x_H - x_L)$ *and A2 gets* $x_L/2 + a$.

Proof: Suppose that $\beta_L > \beta_H$. Then, $(\beta_H/\beta_L)(x_H - x_L) < (x_H - x_L) < (\beta_L/\beta_H)(x_H - x_L)$.

i. If $2a < (\beta_H/\beta_L)(x_H - x_L)$, then from the previous claims, A2 chooses between an offer to buy for $p = x_L$ where he receives $(\bar{x}/2) + \beta_L a$ and an offer to sell for $p = x_H + 2a$ where he receives $(\bar{x}/2) + \beta_H a$. He clearly prefers the offer to buy for $p = x_L$.

ii. If $(\beta_H/\beta_L)(x_H - x_L) < 2a < (\beta_L/\beta_H)(x_H - x_L)$, from the previous claims, A2 chooses between an offer to buy for $p = x_L$ where he receives $(\bar{x}/2) + \beta_L a$ and an offer to sell for $p = x_L + 2a$ where he receives $x_L/2 + a$. He prefers the offer to buy for $p = x_L$ when $2a < (x_H - x_L)$ and the offer to sell when $2a > (x_H - x_L)$.

iii. If $(\beta_L/\beta_H)(x_H - x_L) < 2a$, from the previous claims, A2 chooses between an offer to buy for $p = x_H$ where A2 gets $\bar{x}/2 + a - (\beta_L/2)(x_H - x_L)$ and an offer to sell for offer to sell for $p = x_L + 2a$ where he receives $x_L/2 + a$. $x_L/2 + a > \bar{x}/2 + a - (\beta_L/2)(x_H - x_L)$ if and only if $x_L > \bar{x} - \beta_L(x_H - x_L)$ which is true if and only if $x_L > \beta_L x_L + \beta_H x_H - \beta_L(x_H - x_L)$ or $(\beta_L - \beta_H)x_H > (\beta_L - \beta_H)x_L$ which is always true under the assumption that $\beta_L > \beta_H$.

In each of these cases, A2's payoff is higher from the simple offers than from the buy-sell offer (where he gets $(\bar{x}/2) + (a/2)$). An analogous proof exists for the case where $\beta_L < \beta_H$. Q.E.D.

Proposition: Suppose that A1 (the informed partner) can make a single offer to A2 (the uninformed partner). Partner A1 can extract the whole surplus in the following way:

i. When $x = x_H$, then A1 makes a simple offer to buy for $p = x_H$. A2 accepts. A1 gets a payoff of $x_H/2 + a$ and A2 gets $x_H/2$.

ii. When $x = x_L$, then A1 makes a simple offer to sell for $p = x_L + 2a$. A2 accepts and buys A1's stake. A1 gets a payoff of $x_L/2 + a$ and A2 gets $x_L/2$.

Appendix C: Instructions for the A/IO Condition

<u>PLEASE GIVE THIS MATERIAL TO THE EXPERIMENTER AT THE END OF THE SESSION</u>

INSTRUCTIONS

This is an experiment in the economics of decision-making. The University of Alberta, Harvard University and Yale University have provided the funds for this research.

In this experiment you will be asked to play an economic decision-making computer game. The experiment currency is the "token." The instructions are simple. If you follow them closely and make appropriate decisions, you may make an appreciable amount of money. At the end of the experiment you will be paid your total game earnings in CASH along with your participation fee. If you have any questions at any time, please raise your hand and the experimenter will go to your desk.

SESSION AND PLAYERS

The session is made up of 24 rounds. The first 8 rounds are practice rounds and will not be counted in the determination of your final earnings.

1) Before the beginning of each practice round, the computer will randomly form pairs of two people: one **Player 1** and one **Player 2**. The roles will be randomly assigned. During the practice rounds, each person will play 4 times the roles of **Player 1** and **Player 2**.

2) After the last practice round, 16 rounds will be played. Every participant will be randomly assigned a role. This role will remain until the end of the session. At the beginning of each round, new pairs, one **Player 1** and one **Player 2**, will be randomly formed.

You will not know the identity of your partner in any round.

ROUND STAGES

STAGE 1

1) **Player 1** and **Player 2** jointly own a business. Each business partner owns 50% of the initial value of the business assets.

2) **The computer** randomly decides the initial value of the business assets and reveals this information only to **Player 1**. **Player 2** will NOT know the initial value of the business assets until the end of the round.

   There are two possible initial values of the business assets: **150 tokens** and **400 tokens**. The Players have no choice over whether the initial value of the business assets is 150 tokens or 400 tokens. There is a **75%** chance that the initial value of the business assets will be **150 tokens** and a **25%** chance it will be **400 tokens**. In other words, on average, 3 out of 4 times the players will confront a value of the business assets equal to 150 tokens, and on average, 1 out of 4 times the players will confront a value of the business assets equal to 400 tokens.

STAGE 2

1) **Player 1** and **Player 2** play a partnership-dissolution game.

1.1) If the business partnership is dissolved, the value of the business assets **increases** by 100 tokens.

- In case the initial value of the business assets is **150 tokens**, it **increases** to **250 tokens.**
- In case the initial value of the business assets is **400 tokens**, it **increases** to **500 tokens.**

1.2) If the business partnership is not dissolved, the value of business assets remains at its initial value.

<u>STAGE 2</u> (cont.)

PLAYER 1'S OFFER

2) **Player 1 makes an offer** to **Player 2**. The possible offers are as follows.

2.1) **Player 1** makes an offer **to buy Player 2**'s share of the business assets, at a price equal to **105 tokens, 125 tokens, 145 tokens, 230 tokens, 250 tokens, or 270 tokens.**

2.2) **Player 1** makes an offer **to sell** his/her share of the business assets to **Player 2**, at a price equal to **105 tokens, 125 tokens, 145 tokens, 230 tokens, 250 tokens, or 270 tokens.**

.

2.3) **Player 1** makes a **buy/sell** offer that **Player 2** can use **to buy Player 1**'s share of the business assets **or to sell** his/her share of the business assets to **Player 1**, at a price equal to **105 tokens, 125 tokens, 145 tokens, 230 tokens, 250 tokens, or 270 tokens.**

PLAYER 2'S RESPONSE

3) After observing the offer, **Player 2 makes a decision**. The possible choices are as follows.

3.1) In case **Player 1 OFFERS TO BUY Player 2**'s share of his/her business assets, **Player 2** should decide whether to **accept** or **reject** the offer.

- If the offer is **ACCEPTED**, **Player 1** transfers to **Player 2** an amount of tokens equal to the price proposed. The business partnership is dissolved. **Player 1** is now the sole owner of the business. The GAME ENDS.

Player 1's payoff = initial value of the business assets + 100 tokens – price proposed by **Player 1** **Player 2**'s payoff = price proposed by **Player 1**

- If the offer is **REJECTED**, the business partnership is not dissolved. Both players remain with their share of the initial business partnership assets. The GAME ENDS.

Player 1's payoff = ½ (initial value of the business assets) **Player 2**'s payoff = ½ (initial value of the business assets)

PLAYER 2'S RESPONSE (cont.)

3.2) In case **Player 1 OFFERS TO SELL** his/her share of the business assets**, Player 2** should decide whether to **accept** or **reject** the offer.

- If the offer is **ACCEPTED, Player 2** transfers to **Player 1** an amount of tokens equal to the price proposed. The business partnership is dissolved. **Player 2** is now the sole owner of the business. The GAME ENDS.

Player 1's payoff = price proposed by **Player 1**

Player 2's payoff = initial value of the business assets + 100 tokens **–** price proposed by **Player 1**

- If the offer is **REJECTED**, the business partnership is not dissolved. Both players remain with their shares of the initial value of the business assets. The GAME ENDS.

Player 1's payoff = ½ (initial value of the business assets)

Player 2's payoff = ½ (initial value of the business assets)

3.3) In case **Player 1 makes a BUY/SELL OFFER, Player 2** should decide whether **to buy Player 1**'s share of the business assets at the proposed price, or **to sell** his/her share of the business assets to **Player 1** at the proposed price.

- If **Player 2** decides to **BUY** Player 1's share of the business assets, **Player 2** transfers to **Player 1** an amount of tokens equal to the price proposed. The business partnership is dissolved. **Player 2** is now the sole owner of the business. The GAME ENDS.

Player 1's payoff = price proposed by **Player 1**

Player 2's payoff = initial value of the business assets + 100 tokens **–** price proposed by **Player 1**

- If **Player 2** decides to **SELL** his/her share of the business assets to **Player 1**, **Player 1** transfers to **Player 2** an amount of tokens equal to the price proposed. The business partnership is dissolved. **Player 1** is now the sole owner of the business. The GAME ENDS.

Player 1's payoff = initial value of the business assets + 100 tokens – price proposed by **Player 1**

Player 2's payoff = price proposed by **Player 1**

ROUND PAYOFF

The Payoff Tables show the round payoffs for **Player 1** and **Player 2**, under the possible outcomes of the partnership-dissolution game.

Payoff Table 1: PLAYER 1 MAKES AN OFFER TO BUY HIS/HER PARTNER'S SHARE OF THE BUSINESS ASSETS

	PAYOFFS IF PLAYER 2 ACCEPTS THE OFFER TO BUY	**PAYOFFS IF PLAYER 2 REJECTS THE OFFER TO BUY**
PLAYER 1	initial value of the business assets + 100 tokens – price proposed by Player 1	½(initial value of the business assets)
PLAYER 2	price proposed by Player 1	½(initial value of the business assets)

Payoff Table 2: PLAYER 1 MAKES AN OFFER TO SELL HIS/HER SHARE OF THE BUSINESS ASSETS TO HIS/HER PARTNER

	PAYOFFS IF PLAYER 2 ACCEPTS THE OFFER TO SELL	**PAYOFFS IF PLAYER 2 REJECTS THE OFFER TO SELL**
PLAYER 1	price proposed by Player 1	½(initial value of the business assets)
PLAYER 2	initial value of the business assets + 100 tokens – price proposed by Player 1	½(initial value of the business assets)

Payoff Table 3: PLAYER 1 MAKES A BUY/SELL OFFER

	PAYOFFS IF PLAYER 2 DECIDES TO BUY HIS/HER PARTNER'S SHARE OF THE BUSINESS ASSETS
PLAYER 1	price proposed by Player 1
PLAYER 2	initial value of the business assets + 100 tokens – price proposed by Player 1
	PAYOFFS IF PLAYER 2 DECIDES TO SELL HIS/HER SHARE OF THE BUSINESS ASSETS TO HIS/HER PARTNER
PLAYER 1	initial value of the business assets + 100 tokens – price proposed by Player 1
PLAYER 2	price proposed by Player 1

EXERCISES

Eleven exercises related to the Payoff Tables are presented below. Please fill the blanks.

Exercise 1. Payoff Table 2

Suppose that the **initial value of the business assets** is **400 tokens**, **Player 1** proposes to **sell** his/her share of the business assets to his/her partner at a **price equal to M tokens**, and **Player 2 rejects** the offer. Then, **Player 1**'s payoff is equal to **_________________________** tokens, and the **Player 2**'s payoff is equal to **______________________________** tokens.

Exercise 2. Payoff Table 3

Suppose that the **initial value of the business assets is 150 tokens**, the **Player 1** proposes a **buy/sell offer equal to U tokens**, and **Player 2** decides to **sell** his/her share of the business assets. Then, **Player 1**'s payoff is equal to **_________________________** tokens, and **Player 2**'s payoff is equal to **______________________________** tokens.

Exercise 3. Payoff Table 1

Suppose that the **initial value of the business assets is 150 tokens**, **Player 1** proposes to **buy** his/her partner's share of the business assets at a **price equal to X tokens**, and **Player 2 accepts** the offer. Then, **Player 1**'s payoff is equal to **_________________________** tokens, and **Player 2**'s payoff is equal to **______________________________** tokens.

EXERCISES (cont.)

Exercise 4. Payoff Table 2

Suppose that the **initial value of the business assets is 400 tokens**, **Player 1** proposes to **sell** his/her share of the business assets to his/her partner at a **price equal to Z tokens**, and **Player 2 accepts** the offer. Then, **Player 1**'s payoff is equal to ________________________ tokens, and **Player 2**'s payoff is equal to _____________________________ tokens.

Exercise 5. Payoff Table 1

Suppose that the **initial value of the business assets is 150 tokens**, **Player 1** proposes to **buy** his/her partner's share of the business assets at a **price equal to T tokens**, and **Player 2 rejects** the offer. Then, **Player 1**'s payoff is equal to ________________________ tokens, and **Player 2**'s payoff is equal to _____________________________ tokens.

Exercise 6. Payoff Table 3

Suppose that the **initial value of the business assets is 400 tokens**, **Player 1** proposes a **buy/sell offer equal to Y tokens**, and **Player 2** decides **to sell** his/her share of the business assets to his/her partner. Then, **Player 1**'s payoff is equal to ________________________________ tokens, and **Player 2**'s payoff is equal to _____________________________ tokens.

Exercise 7. Payoff Table 2

Suppose that the **initial value of the business assets is 150 tokens**, **Player 1** proposes to **sell** his/her share of the business assets to his/her partner at a **price equal to V tokens**, and **Player 2 accepts** the offer. Then, **Player 1**'s payoff is equal to ________________________ tokens, and **Player 2**'s payoff is equal to _____________________________ tokens.

EXERCISES (cont.)

Exercise 8. Payoff Table 1

Suppose that the **initial value of the business assets is 150 tokens**, **Player 1** proposes to **buy** his/her partner's share of the business assets at a **price equal to J tokens**, and **Player 2 rejects** the offer. Then, **Player 1**'s payoff is equal to ________________________ tokens, and **Player 2**'s payoff is equal to _____________________________ tokens.

Exercise 9. Payoff Table 3

Suppose that the **initial value of the business assets is 150 tokens**, **Player 1** proposes a **buy/sell offer equal to Q tokens**, and **Player 2** decides **to buy** his/her partner's share of the business assets. Then, **Player 1**'s payoff is equal to ________________________ tokens, and **Player 2**'s payoff is equal to _____________________________ tokens.

Exercise 10. Payoff Table 2

Suppose that the **initial value of the business assets is 150 tokens**, **Player 1** proposes to **sell** his/her share of the business assets to his/her partner at a **price equal to H tokens**, and **Player 2 rejects** the offer. Then, **Player 1's payoff** is equal to ________________________ tokens, and **Player 2's payoff** is equal to _____________________________ tokens.

Exercise 11. Payoff Table 1

Suppose that the **initial value of the business assets is 400 tokens**, **Player 1** proposes to **buy** his/her partner's share of the business assets at a **price equal to R tokens**, and **Player 2 accepts** the offer. Then, **Player 1**'s payoff is equal to ________________________ tokens, and **Player 2**'s payoff is equal to _____________________________ tokens.

SESSION PAYOFF

The session earnings in tokens will be equal to the sum of payoffs for the 16 rounds. The session earnings in dollars will be equal to (session earnings in tokens)/147 (147 tokens = 1 dollar). The total earnings in dollars will be equal to the participation fee plus the session earning in dollars.

GAME SOFTWARE

The game will be played using a computer terminal. You will need to enter your decisions by using the mouse. In some instances, you will need to wait until the other players make their decisions before moving to the next screen. Please **be patient**. There will be two boxes, displayed in the upper right-hand side of your screen, that indicate the "Round Number" and "Your Role."

Press the NEXT >> button to move to the next screen. Please, **do not try to go back** to the previous screen and **do not close the browser**: the software will stop working and you will lose all the accumulated tokens.

Next, the **8 PRACTICE ROUNDS** will begin. After that, 16 rounds will be played. **You can consult these instructions at any time during the session**.

THANKS FOR YOUR PARTICIPATION IN THIS STUDY!!

PLEASE GIVE THIS MATERIAL TO THE EXPERIMENTER AT THE END OF THE SESSION`