Dissolving (In)effective Partnerships

John L. Turner[†]

December 2010

Abstract

This paper studies the problem of partnership dissolution in the context of asymmetric information. Past work shows that ownership share endowments, interdependence of partners' valuations, and asymmetric control all affect the possibility of efficient dissolution. In this paper, I show, in a novel class of "cooperative" partnerships characterized by ex ante interdependence of valuations, that effectiveness is significantly more important than share endowments. Intuitively, as the effectiveness of cooperation between partners (and thus partnership value) increases, the gains from dissolving decrease but the informational rents remain constant, so efficient dissolution is unambiguously more difficult to achieve. For sufficiently high effectiveness, efficient dissolution is Pareto-improving but is impossible for any pattern of share endowments. For sufficiently low effectiveness, however, efficient dissolution is possible for all patterns of shares. The existence of efficient implementation depends on share endowments only for moderately effective partnerships.

JEL Codes: C72, D82, L14
Keywords: Mechanism design, trading, dissolution, partnerships.

[†]Department of Economics, University of Georgia, Brooks Hall 5th Floor, Athens, GA 30602-6254. tel: 706-542-3682, e-mail:jlturner@terry.uga.edu. Thanks to Emanuel Ornelas and seminar participants at IBMEC-Rio de Janeiro for extremely helpful comments.

1. Introduction

The theoretical economics literature on dissolving partnerships in the presence of asymmetric information has helped to explain some important empirical regularities in the ownership patterns of closely-held corporations and joint ventures. Most notably, the work of Cramton, Gibbons and Klemperer (1987), which shows in a symmetric, independent-private-value setting that equal-shares partnerships can always be dissolved efficiently with simple auction mechanisms, suggests that there are organizational economies to equal ownership. This efficiency property is consistent with the empirical findings of Hauswald and Hege (2003) that around two thirds of two-parent US joint ventures formed during 1985-2000 had 50/50 ownership. Recent theoretical work has maintained interest in the way that ownership shares matter for efficient implementation, but it has focused more attention on technical mechanism design issues, such as the impact of interdependence of valuations (Moldovanu 2002; Fieseler, Kittsteiner and Moldovanu 2003; Jehiel and Pauzner 2006).

This has left some important practical puzzles unanswered. First, the results of Cramton et al. (1987) suggest that equal-shares partnerships can and should be efficiently dissolved, so their model cannot explain the prevalence of *persistent* equal-shares partnerships. Additionally, one of the most common dissolution mechanisms in practice, the "Texas Shootout," uses a buy/sell proposal whose narrow application does not yield ex post efficiency.[1] Despite this property, it is considered malpractice among some legal scholars and practitioners for a lawyer supervising a partnership formation not to recommend the simplest version of the "Texas Shootout" (Brooks, Landeo and Spier forthcoming). Contractually-specified auctions, by contrast, are relatively uncommon.

In this paper, I show that modeling an additional feature of partnerships, their ex ante effectiveness in generating value, sheds light on these puzzles. Surprisingly, this has not been studied. Yet, as I show, ex ante effectiveness may be significantly more important for the possibility of efficient implementation than share endowments. Intuitively, individually

[1] Under the "Texas Shootout," one partner proposes a price for the firm. The other partner then can buy or sell at that price, but must choose one of those options. It is inefficient whenever the proposer's price prompts the chooser to buy when his valuation is not highest, or sell when his valuation is not lowest (McAfee 1992). De Frutos and Kittsteiner (2008) show that a more elaborate version of this mechanism can be efficient. Namely, if an auction that determines who proposes the sale price precedes the proposal stage, then the proposal yields efficient trade.

rational participation in a dissolution mechanism is more difficult to obtain when the existing partnership is more effective, because the opportunity cost of dissolving is higher. If this opportunity cost does not affect the informational rents that arise in a dissolution mechanism, then it follows directly that, for any share endowments, there are always some partnerships for which efficient dissolution is both Pareto-improving and, unfortunately, impossible.[2]

I demonstrate these points in a model of two-person "cooperative" partnerships that incorporates effectiveness directly. Firm value under the partnership is a convex combination of the maximum and minimum types of the two partners, while if the partnership dissolves, firm value becomes the type of the partner who obtains the firm. The more heavily weighted is firm value toward the maximum of the partners' types, the more effective is the cooperation and the higher is the value created under the partnership. Ex post efficient dissolution is Pareto improving except in the limiting case of an "efficient" partnership, where firm value is the maximum of the partners' types.

Consistent with Cramton et al (1987), I show that equal-shares cooperative partnerships are the *easiest* to dissolve, in that if there is a non-empty set of ownership shares such that the partnership is efficiently dissolvable, the equal-shares partnership is in the set. For sufficiently high effectiveness, however, there is no pattern of initial ownership shares such that the partnership can be efficiently dissolved. On the other hand, when effectiveness is sufficiently low, efficient implementation is possible for any pattern of shares. The basic results from the independent private values (IPV) model (*e.g.*, Cramton et al 1987), that the possibility of efficient dissolution *depends* on share endowments, obtain only for "moderately" effective partnerships.

Hence, the explanatory power of the IPV model is rather limited. While the equal-shares partnership retains some efficiency properties in the cooperative setting, share endowments themselves are relatively unimportant for implementation. In showing that the first-best is often not achievable for any pattern of ownership, these results strongly suggest that the use of practical mechanisms such as the "Texas Shootout," as well as the persistence of

[2]It is natural that this continuation value is significant for implementation, as it has been shown to be important in related settings. For example, Matouschek (2004) shows, in an incomplete contracts model of bilateral exchange, that the integration decision of two firms influences continuation or "disagreement" payoffs, and that the optimal organizational structure balances a greater likelihood of trade versus worse disagreement payoffs when trade breaks down.

equal-shares partnerships, are often necessary (i.e. constrained-optimal) responses to the impossibility of efficient implementation. They also suggest that restricting attention to equal-shares partnerships in attempts to explain the prevalence of the "Texas Shootout" (Brooks et al. forthcoming; De Frutos and Kittsteiner 2008) is appropriate.

In contrast to models of partnerships in most of the received literature on efficient dissolution, the cooperative class is characterized by key fundamental features of partnerships that own firms. First, it includes the "defining feature" of "redistribution of profits among the partners" (Levin and Tadelis 2005, p. 131), which is clearly lacking in the IPV setting. Second, partners directly benefit (or suffer) from having partners. The total value generated by the firm under a partnership (its "continuation value") is typically different from the expected value of a given partner's valuation for the firm as a sole proprietorship, even under independent and identically distributed private information. This sharply contrasts with both the IPV and interdependent-values settings in the received literature, where continuation value is identical to the expected total value generated using a lottery. Mechanically, a cooperative partnership is a hybrid of the independent and interdependent cases.

This work fits into a growing literature on dissolving partnerships and retains many features of that literature. However, it also integrates key features from a separate literature that focuses on the formation and operation of partnerships. Section 2 shows how my model synthesizes ideas from these two literatures. It offers a detailed discussion of continuation values and the hybrid nature of my specifications of valuations.

After introducing the model in section 3, I give conditions characterizing whether cooperative partnerships can be efficiently dissolved with an incentive compatible, individually rational, ex ante budget balanced mechanism. Following recent work by Williams (1999) and Krishna and Perry (2000), it is sufficient to restrict attention to Vickrey-Clarke-Groves (VCG) mechanisms. Section 4 characterizes the set of dissolvable partnerships, gives the paper's main results and compares them to results from the received literature. When a cooperative partnership earns the average of the partners' types, the same total expected continuation value is created as in an IPV partnership. There are similarities between these two cases, but also notable differences. Perhaps most importantly, equal-shares partnerships are not necessarily efficiently dissolvable, even for this *average* cooperative partnership.

In section 5, I highlight these results with an example using uniformly distributed private information. The range of moderately effective partnerships is relatively small and, for the average cooperative partnership, the set of shares for which efficient dissolution is possible is *identical* to that in an IPV partnership. This reinforces the point that effectiveness is a more significant determinant of the possibility of efficient implementation than share endowments. Section 6 concludes with thoughts about the consequences of these findings and about avenues for future research.

2. The Nature of Partnerships

There are essentially two theoretical literatures on partnerships that have developed separately. The first, which focuses on the formation and functioning of partnerships, grew out of the analysis of team production problems by Holmström (1982). It focuses on incentives of partners to contribute to production and the resulting inefficiencies (see also Legros and Matthews 1993), the characteristics of partners who choose to join forces (Farrell and Scotchmer 1988) and the determinants of when people prefer the partnership to the corporate form (Levin and Tadelis 2005). In this literature, partners benefit (or suffer) from their partners in numerous ways. They may cooperate in decision-making, take advantage of specialization of talents, share capital costs, share each other's profits, etc.

The second literature, which uses the tools of mechanism design to study the problem of dissolving partnerships, grew out of the analysis of bilateral exchange by Myerson and Satterthwaite (1983). While private information precludes efficient exchange between a buyer and seller, Cramton et al. (1987) show it does not prevent efficient exchange if the "buyer" and "seller" initially own positive shares in the item to be exchanged. They demonstrate this in a setting that they term a "partnership." It is instructive to revisit the application that inspired their analysis.

In the 1980s, the US Federal Communications Commission (FCC) proposed to allocate licences for cellular telephone franchises by lottery. Motivated, in part, by the question of how efficient this mechanism would be, Cramton et al. instead argued that it would be efficiency enhancing for all possible winners of the FCC lottery to pool their chances, win for sure, then auction off the licenses. In this setting, partnering amounts to the formation of the cartel and the commitment to the rules of the "dissolution" mechanism. Partners' outside options, which form the basis for individually rational participation, reflect payoffs that would occur *under the lottery*, not under a partnership. In effect, the decision to form and dissolve the partnership are one and the same.

The properties of the independent private values model of partnerships, mirror the characteristics of this FCC lottery example. Subsequent work by Moldovanu (2002), Fieseler et al. (2003) and Jehiel and Pauzner (2006) adopts a more general structure for valuations, permitting interdependence. This is shown to strongly affect which partnerships may be efficiently dissolved.[3] However, changes in the functions that determine the nature of interdependence in these papers affect valuations under sole ownership and valuations under the partnership in precisely the same way. Hence, the basis for individually rational participation in these settings could still be generated by a lottery.

As Segal and Whinston (forthcoming, 2010) recently show, efficient bargaining is more easily accomplished when outside options mimic lottery payments. Formally, they prove that, under the conditions of cross-congruence and convexity of both the decision space and the total surplus as a function of the decision, outside options that satisfy the "expected equilibrium allocation" enable efficient bargaining. In the IPV example, where cross-congruence and convexity are always satisfied, the expected equilibrium allocation offers precisely the same expected payoffs as an equal-chance lottery.

Clearly, to use these results to improve understanding of practical problems in restructuring or dissolving partnerships, it is important to explore the extent to which partnerships have characteristics such that it is possible for continuation values to mimic those under a lottery. Clearly, there are some examples that fit. Consider the case of two people who split the cost of a boat to use for recreation. Suppose they use the boat equally often but do not derive any direct benefits from having a partner (i.e. they never use the boat together). It is reasonable to call this an equal-shares partnership. If they later decide to dissolve the partnership, and each partner now has sufficient wealth to buy out the other, then the basis

[3]Jehiel and Pauzner focus on cases where only one partner is informed about the value of the co-owned asset. In such a setting, they identify a wide class of situations where efficient dissolution is not achievable. Fieseler et al. and Moldovanu find that, when information is *ex ante* symmetric, a partnership is more difficult to dissolve if a given partner's valuation is increasing in the types of the other partners, while the opposite is true if the partner's valuation is decreasing in the types of the other partners. In the former case, the equal-shares partnership may not be dissolvable efficiently, while in the latter case even efficient bilateral exchange may be possible. See also Chien (2007), which is discussed more in footnote 22.

for individually rational participation in this endeavor, and the notion of efficiency, is the expected equilibrium allocation. Each person has a one-half ownership share and a private valuation, and efficient allocation demands that the person with the highest private valuation obtain the boat ex post.

However, models that generate these types of payoffs—where one partner's baseline valuation for the asset is the same whether he has partners or not—have one glaring omission that render them poor vehicles for analyzing partnerships that own firms. Neither partner directly benefits (or suffers) from having partners. In more realistic settings, a partner may free ride off of the other partner's ability under a partnership but not under a sole proprietorship. Partners also face costly collective-action problems, in making decisions, that sole proprietors do not. Such problems are particularly striking when partners have equal decision rights. In that case, each partner effectively has full veto power.

Cooperative partnerships assume that each partner's independent private type represents the firm's profit (and his own payoff) under his sole ownership and that both partners' types determine the profit under the partnership (so the partners' payoffs are interdependent). It is appropriate to think of this as a hybrid of the IPV case and the interdependent types cases examined by Moldovanu (2002), Fieseler et al. (2003) and Jehiel and Pauzner (2006). This hybrid case introduces a non-convexity of total surplus in the decision, so that efficient bargaining may not be possible under the expected equilibrium allocation (Segal and Whinston forthcoming, 2010).

This specification captures key surplus-sharing features of partnerships that own firms (Farrell and Scotchmer 1988; Levin and Tadelis 2005). While it is informed by the work in the literature on formation and functioning, partnerships in this paper retain many important features of the literature on dissolution.[4] Namely, it is assumed that a sole proprietor can effectively generate value from the firm. Thus, partners are assumed not to generate profits separately that are added together, such as in a law firm. I also assume that any capital cost economies of scale have already been realized. In addition, the focus of the analysis is the identification of when efficient dissolution is possible.

This hybrid case has already been shown to yield results quite distinct from the received

[4]Another paper that blends these literatures is Li and Wolfstetter (forthcoming), who examine partners' incentives to form, invest and dissolve.

literature.[5] For instance, Ornelas and Turner (2007) show that strongly asymmetric control structures make efficient dissolution impossible, for any pattern of ownership, when the number of partners is sufficiently small. Specifically, when a single controlling partner's private information determines the continuation value of the firm (we term this arrangement a "silent partnership"), efficient dissolution is impossible if there are only two partners. On the other hand, implementation is possible with a sufficiently large number of partners as long as the non-controlling partners initially own positive shares. If the controlling partner initially owns all shares, the Myerson-Satterthwaite impossibility result obtains for any finite number of non-controlling partners.

Finally, it is important to distinguish the model in the present paper from the models in the two most closely related papers, Fieseler et al (2003) and Ornelas and Turner (2007). All three papers show that partnership dissolution may be impossible for any pattern of share ownership. However, the present paper is unique in showing how partnership effectiveness matters for the possibility of efficient implementation. The continuation value of the partnership is different from *all* expected sole-proprietor valuations here, but not in Fiesler et al. (2003) or Ornelas and Turner (2007). In Fieseler et al. (2003), the expected continuation value of the partnership equals any partner's expected sole-proprietor valuation. In Ornelas and Turner (2007), the controlling partner's sole-proprietor valuation is the same as the continuation value of the partnership, while the silent partner's valuation is different.

3. The Model

3.1. Preliminaries

Consider a partnership, of two risk-neutral people facing no wealth constraints, that owns a firm. Partner 1 is endowed with share $r_1 \in [0,1]$ and partner 2 owns share $r_2 = 1 - r_1$.

[5] Related work studies the properties of specific mechanisms. Several authors study the revenue properties of particular auction mechanisms in the IPV setting (Engelbrecht-Wiggans 1994, Singh 1998, Goeree et al. 2005, Lengwiler and Wolfstetter 2005 and Engers and McManus 2007), as revenue equivalence does not generally hold. Auctions are generally efficient when ownership shares are symmetric, however. McAfee (1992) studies auctions, buy/sell agreements and sequential choice mechanisms as practical ways for two partners to "amicably divorce." He shows that buy/sell agreements are generally inefficient, suggesting that they should not be used to dissolve partnerships. De Frutos and Kittsteiner (2008), however, show that buy/sell clauses may be efficient if the proposer is chosen endogenously with an initial auction.

Let $\mathbf{r} \equiv (r_1, r_2)$. Let π_0 be the net return resulting from actions that (from experience) both partners agree should be taken. Each partner i has private information $v_i \in [\underline{v}, \overline{v}]$, drawn independently from distribution F, which is common knowledge and has positive continuous density f. Each v_i gives the net returns to partner i's ideas about the best *new* plans to implement going forward. The firm's profit under his full ownership and control is given by $v_i + \pi_0$. I denote $\mathbf{v} \equiv (v_1, v_2)$.

Under the status quo partnership, profit depends on both partners. Let $\alpha \in [0, 1]$ be the probability that the best ideas would be implemented if the partnership were to remain intact. Then the effectiveness of the partnership is modeled with a single parameter, α.[6]

Definition 1. *In a* ***Cooperative Partnership*** $\langle \mathbf{r}, \alpha, F \rangle$*, the firm earns a profit of*

$$\pi(\mathbf{v}) = \pi_0 + \alpha max\{v_1, v_2\} + (1 - \alpha) min\{v_1, v_2\}.$$

Note that α can also be seen as measuring the negative effects of team coordination problems and moral hazard (i.e., low-α partnerships suffer more). When $\alpha = 1$, the partnership achieves the highest possible profit of $\pi(\mathbf{v}) = \pi_0 + \tilde{v}$, where $\tilde{v} \equiv max\{v_1, v_2\}$. Note that the model assumes that partners know exactly how well they would work together but that each partner is incompletely informed about the value of the other partner's ideas for the future. Since the common knowledge part of profit is realized regardless of whether the partnership remains intact, its level is irrelevant to the analysis and we henceforth set $\pi_0 = 0$.[7]

In this paper, I restrict attention to the problem of dissolving cooperative partnerships, *i.e.* reducing them to a single, fully-controlling owner. It is obvious that, for $\alpha < 1$, maintaining the partnership is inefficient.[8] These cases and the limiting case of $\alpha = 1$ are important, however, for three reasons: (1) the need to dissolve a partnership is often

[6] We restrict attention to two partners to fix ideas around our main points about the importance of effectiveness. Fully extending the analysis to the n-partner case introduces a wide array of possible modeling structures that could capture effectiveness. For example, one could justify making expected profit a convex combination of the highest and lowest valuations or a combination of the highest and second-highest valuations. For $n > 2$, these two structures coincide only for the case $\alpha = 1$, which we consider directly in Proposition 4.

[7] Implicitly, we assume that the partnership was, at some point in the past, necessary to realize π_0. Thus, for the initial formation of the partnership to be efficient, one would need $\pi_0 > 0$. For simplicity, our model treats the partnership's initial formation as a fait accompli and sets $\pi_0 = 0$ to economize on notation.

[8] Note that I rule out cases where the partnership yields strictly greater value than a sole proprietorship, i.e. where there is *synergy.* In such a case, dissolving would introduce negative gains from trade and is inefficient. In the case where $\alpha > 1$ but dissolution is exogenously required, individual rationality constraints would be

exogenous to features of the business and/or assets owned and operated by the partnership, (2) dissolution is frequently difficult to implement in practice, and (3) partners' incentives to seek dissolution may be asymmetric.[9] This approach has also the obvious virtue of yielding results that directly contribute to, and can be compared with, the growing literature on partnership dissolution.

Appealing to the revelation principle, I study a direct revelation game where partners report types simultaneously, then a mechanism allocates shares $\mathbf{s}(\mathbf{v}) = \{s_1, s_2\}$ and determines transfer payments $\mathbf{t}(\mathbf{v}) = \{t_1, t_2\}$ to the partners. I refer to $\langle \mathbf{s}, \mathbf{t} \rangle$ as a *trading mechanism.* If truthful revelation is a Bayesian-Nash equilibrium under mechanism $\langle \mathbf{s}, \mathbf{t} \rangle$, then it is *incentive compatible.* A mechanism is (ex post) *efficient* if the firm is allocated to the partner with the highest type with probability 1. A mechanism is (ex ante) *budget balanced* if the mechanism designer does not expect to pay a positive subsidy to the partners, *i.e.* $E\{\sum t_i(v)\} \leq 0$.

Under mechanism $\langle \mathbf{s}, \mathbf{t} \rangle$, partner i obtains utility $v_i s_i + t_i$ and, conditional on v_i, expects to receive shares and transfers $S_i(v_i) \equiv E_{-i}\{s_i(\mathbf{v})\}$ and $T_i(v_i) \equiv E_{-i}\{t_i(\mathbf{v})\}$, respectively, where $E_{-i}\{\cdot\}$ denotes the expectation operator with respect to the other partner's type v_{-i}. His interim expected utility from the mechanism is therefore $M_i(v_i) = v_i S_i(v_i) + T_i(v_i)$. By contrast, partner i's expected utility under the partnership is his share r_i times

$$\begin{aligned} \Pi_i(v_i) &= E\left[\alpha max\{v_1, v_2\} + (1-\alpha) min\{v_1, v_2\} | v_i\right] \\ &= \alpha \left(v_i F(v_i) + \textstyle\int_{v_i}^{\overline{v}} u dF(u) \right) + (1-\alpha) \left(v_i (1 - F(v_i)) + \textstyle\int_{\underline{v}}^{v_i} u dF(u) \right). \end{aligned}$$

I define the *interim expected net utility* from dissolving instead of maintaining the partnership as $U_i(v_i) \equiv M_i(v_i) - r_i \Pi_i(v_i)$. The *worst-off type* of partner i in $\langle \mathbf{s}, \mathbf{t} \rangle$ earns the least expected net utility, *i.e.*

$$U_i(v_i^*) \leq U_i(v_i) \text{ for all } v_i.$$

Formally, I call a mechanism *interim individually rational* if expected net utility is non-negative, *i.e.* $U_i(v_i^*) \geq 0$, for all types of both partners.[10]

impossible to meet. The incentive compatible mechanisms analyzed here would then be the best that could be hoped for.

[9] Dissolution is precipitated, for example, when one or more of the partners needs liquidity for alternative investments, personal circumstances such as divorce, etc. In practice, partnership agreements specify dissolution mechanisms for precisely this reason.

[10] Where there is no confusion, we drop the modifier "interim."

3.2. Efficient Dissolution

The technical features of this problem fall within the general class analyzed Makowski and Mezzetti (1994) and Williams (1999).[11] Hence, without loss of generality, I restrict attention to Vickrey-Clarke-Groves (VCG) mechanisms. The efficient allocation rule assigns shares

$$s_i(v) = \begin{cases} 1 & \text{if } v_i = \widetilde{v} \\ 0 & \text{if } v_i < \widetilde{v} \,. \end{cases} \tag{1}$$

This implies that the expected share function satisfies $S_i(v_i) = F(v_i)$.

The VCG class of mechanisms specifies the following transfers:

$$t_i(v) = \begin{cases} -k_i & \text{if } s_i(v_i) = 1 \\ \widetilde{v} - k_i & \text{if } s_i(v_i) = 0 \,, \end{cases} \tag{2}$$

where k_i is a real number.[12] VCG mechanisms are incentive compatible, and any two of them yield, up to a constant, the same expected transfers. Given that we include the status-quo payoff $r_i \Pi_i(v_i)$ in $U_i(v_i)$,[13] we can write

$$U_i(v_i) = U_i(v_i^*) + \int_{v_i^*}^{v_i} \left[S_i(u) - r_i \left(\frac{d\Pi_i(t)}{dt} \right)_{t=u} \right] du \text{ for all } i. \tag{3}$$

We now identify the worst-off types of partners. The first-order condition for (3) is

$$S_i(v_i^*) = r_i \left(\frac{d\Pi_i(t)}{dt} \right)_{t=v_i^*} . \tag{4}$$

In a cooperative partnership, this reduces to

$$F(v_i^*) = \frac{r_i(1-\alpha)}{1 + r_i(1-2\alpha)}, \tag{5}$$

and fully characterizes v_i^*, as net utility is convex in v_i.[14]

---

[11] Krishna and Perry (2000) prove results similar to Williams for this class.

[12] This need not be a constant term. Rather, its expectation conditional on agent $i's$ reported type is constant.

[13] Fieseler, Kittsteiner and Moldovanu (2003) also define utility in this way. See their Proof of Theorem 1 (p. 231) for further details.

[14] Net utility is strictly convex except for the uninteresting boundary cases of $\alpha = 1, r_i \in \{0, 1\}$, in which one partner's worst-off type is indeterminate. This is seen by noting that the derivative of net utility, $F(v_i)(1 - r_i(2\alpha - 1)) - r_i(1 - \alpha)$, is increasing in v_i except when $\alpha = 1$ and $r_i = 1$. This case may be safely ignored, as the worst-off types are indeterminate precisely because payoffs, gains from trade, informational rents, etc., do not depend on v_i.

A partnership can be *dissolved efficiently* if there exists an ex post efficient mechanism $\langle \mathbf{s}, \mathbf{t} \rangle$ that is incentive compatible, individually rational and ex ante budget balanced. The following proposition gives the conditions governing whether a partnership can be dissolved efficiently.[15] See the appendix for a proof.[16]

Proposition 1. *A partnership* $\langle \mathbf{r}, \alpha, F \rangle$ *can be dissolved efficiently if and only if*

$$\sum_{i=1}^{2} \left[\int_{v_i^*}^{\overline{v}} u dF(u) - \int_{\underline{v}}^{\overline{v}} F(u) u dF(u) \right] \geq \sum_{i=1}^{2} \left[r_i \Pi_i(v_i^*) - v_i^* F(v_i^*) \right], \tag{6}$$

where v_i^* *satisfies condition* (5) *for* $i \in \{1, 2\}$.

The left-hand side of the inequality gives the sum of the expected transfers to the worst-off types of partners (net of total expected informational rents), while the right-hand side gives the sum of the participation constraints for the worst-off types.

4. Characterization

In this section, I give propositions that characterize the set of cooperative partnerships that can be efficiently dissolved. To simplify the exposition, I first note that it is without loss of generality to call partner 1's share r, partner 2's share $1-r$, and define the *net surplus* from dissolving,

$$V(r, \alpha) = \sum_{i=1}^{2} \left\{ \int_{v_i^*}^{\overline{v}} u dF(u) - \int_{\underline{v}}^{\overline{v}} F(u) u dF(u) - \left[r_i \Pi_i(v_i^*) - v_i^* F(v_i^*) \right] \right\},$$

where the worst-off types $\{v_i^*\}$ and the expected profit functions $\{\Pi_i\}$ depend on r and α.

This represents the amount of money a risk-neutral broker would be willing to pay for the right to administer a mechanism that implements efficient dissolution. Hence, the condition

[15] Makowski and Mezzetti (1994) also allow for a continuation value for the partnership that depends on all types, so this proposition can be viewed as an application of their Theorem 3.1. Note that this is the same condition that would emerge if *ex post* budget balance were required. Using a technique similar to that in the "If" part of the proof of Lemma 4 from Cramton et al. (p. 628), it would be straightforward to specify the constant terms in (2) so that ex post budget balance is satisfied.

[16] All proofs are in the appendix.

for the possibility of efficient dissolution in Proposition 1 is equivalent to $V(r, \alpha) \geq 0$, i.e. the broker is willing to pay a non-negative amount of money for this right. Since I frequently compare the results here with those from the IPV case, first studied by Cramton et al., it is important to recall its corresponding net surplus for two partners:

$$V^{IPV}(r) = \sum_{i=1}^{2} \left\{ \int_{v_i^*}^{\overline{v}} u dF(u) - \int_{\underline{v}}^{\overline{v}} F(u) u dF(u) \right\}, \tag{7}$$

where $v_i^* = F^{-1}(r_i)$ for both i.

The following definition also proves useful.

Definition 2. *Partnership $\langle \mathbf{r}, \alpha, F \rangle$ is **easier** to efficiently dissolve than partnership $\langle \mathbf{r}^*, \alpha^*, F \rangle$ if and only if $V(r, \alpha) > V(r^*, \alpha^*)$.*

Intuitively, a partnership is easier to dissolve if the amount a broker is willing to pay to design the mechanism is higher. If $V(r, \alpha) > V(r^*, \alpha^*)$, then it is never the case that $\langle \mathbf{r}^*, \alpha^*, F \rangle$ can be efficiently dissolved while $\langle \mathbf{r}, \alpha, F \rangle$ cannot. If neither can be efficiently dissolved, then a lower outside subsidy is needed to dissolve $\langle \mathbf{r}, \alpha, F \rangle$.

4.1. Main Results

I now state the key characterization results.

Proposition 2. *For any α, net surplus is maximized at the equal-shares partnership, $r = \frac{1}{2}$. The set of ownership shares for which a partnership can be dissolved efficiently is either empty or is a symmetric subset of the unit interval, centered around the equal shares partnership.*

Thus, the equal-shares partnership is the easiest to dissolve. Intuitively, the gains from trade for the worst-off types of partners are smaller under more extreme initial ownership. In contrast to the IPV case, however, the equal-shares partnership is not always dissolvable and the extreme-ownership partnership may be dissolvable. The key determining factor is α, the effectiveness of the partnership.

Proposition 3. *If $\alpha = 1$, the partnership cannot be dissolved efficiently for any r. Partner-*

ship $\langle \mathbf{r}, \alpha, F \rangle$ *is easier to dissolve than partnership* $\langle \mathbf{r}, \alpha^*, F \rangle$ *if and only if* $\alpha < \alpha^*$. *If* $\alpha = 0$, *the partnership can be dissolved efficiently for all* r.

Taken together, Propositions 2 and 3 characterize three different categories of partnerships based on their values of α. Define α_H as the highest level of effectiveness such that the equal-shares cooperative partnership can be efficiently dissolved and α_L as the highest level of effectiveness such that the extreme-ownership cooperative partnership can be efficiently dissolved.

Propositions 2 and 3 prove that $0 < \alpha_L < \alpha_H < 1$, which yields an intuitive partition. For *high* effectiveness $\alpha \in (\alpha_H, 1]$, there is no ownership endowment for which efficient dissolution is possible. For *moderate* effectiveness $\alpha \in (\alpha_L, \alpha_H]$, the equal-shares partnership can be dissolved, but the extreme-ownership partnership cannot be, as in the IPV case. For *low* effectiveness $\alpha \in [0, \alpha_L]$, efficient implementation is possible for all share endowments.[17]

The intuition for the first part of this result is that when the partnership itself is efficient, dissolving introduces zero gains from trade. Since dissolving always introduces strictly positive informational rents, efficient dissolution is impossible when the status quo partnership is itself efficient. Hence, although efficient dissolution of an $\alpha = 1$ partnership is neutral with respect to efficiency, it is not implementable without some positive outside subsidy. This holds for all patterns of ownership.

Note that one can write

$$V(r, 1) = \int_{\underline{v}}^{\overline{v}} F(u)[F(u) - 1]du$$

The absolute value of this term is the minimum outside subsidy required for efficient dissolution. It is interesting to note that this is the same as the subsidy needed to implement efficient bilateral exchange for symmetric distributions of types (see Myerson and Satterthwaite 1983, p. 272). The worst-off types in the $\alpha = 1$ case equal $\underline{v}$ regardless of r, so these types do not expect any surplus from the mechanism. Since the VCG mechanism is the same here as under bilateral exchange (except for constant terms), expected informational rents

[17] When efficient dissolution is possible, it can often be achieved using a mechanism combining an efficient auction with up front fixed payments and revenue sharing. See Ornelas and Turner (2007, pp. 194-95) for the basic intuition. See also Krishna (2002, pp. 80-81) for an informative example of efficient implementation using VCG mechanisms.

are the same. Hence, the mechanism designer faces the same budget deficit under efficient implementation.

Note also that the first part of Proposition 3 extends straightforwardly to the case of n partners.

Proposition 4. *Suppose there are n partners and that $\pi(\mathbf{v}) = max\{v_1, ..., v_n\}$. Then it cannot be dissolved efficiently.*

The minimum subsidy required for n partners equals

$$V_n(r, 1) = (n-1)\int_{\underline{v}}^{\overline{v}} F(u)^{n-1}[F(u) - 1]du,$$

whose absolute value is the necessary subsidy to dissolve an n-person, extreme-ownership partnership in the IPV case (Cramton et al., 1987). Hence, this result is quite general.

Now consider the second part of Proposition 3. As α falls, the continuation value of the partnership falls, so the worst-off types' expected gains from trade from dissolving increase. A risk neutral broker can charge the partners more to participate in the mechanism, while still obtaining full participation. The informational rents from the mechanism are unchanged, however, because α does not affect incentive compatibility.[18] Hence, V increases.

For $\alpha = 0$, the most difficult cooperative partnership to dissolve, extreme ownership,[19] yields the same net surplus as the equal-shares partnership in the IPV setting (which can always be efficiently dissolved). For $r = 1, \alpha = 0$, we have

$$V(1, 0) = 2\left\{\int_{F^{-1}(\frac{1}{2})}^{\overline{v}} udF(u) - \int_{\underline{v}}^{\overline{v}} F(u)udF(u)\right\} > 0.$$

Propositions 2 and 3 also imply that, for any r, there exists some $\widetilde{\alpha}(r) \in [\alpha_L, \alpha_H]$ such that $V(r, \alpha) < 0$ if and only if $\alpha \geq \widetilde{\alpha}(r)$, and that $\widetilde{\alpha}(r)$ is smaller for more extreme r.

[18] This is seen by noting that incentive compatibility requires that the shape of partner i's utility under the mechanism be $\frac{dM_i(v_i)}{v_i} = S_i(v_i)$, independent of α. While it is true that α affects the identity of the worst-off types, which determines the expected informational rents for the worst-off types, the proof of Proposition 3 shows that any change in these expected informational rents with α does not offset the expected lost gains from trade.

[19] This comes out of the proof of Proposition 2. $V(r, 0)$ is minimized at $r = 1$, so $V(r, 0) \geq V(1, 0) > 0$ for all r.

4.2. Comparison with Other Cases

The main distinction between our specification and other cases is the partnership's *continuation value*, defined as the sum of payoffs that would be realized were the partnership to remain intact. When partners' valuations are independent and private, it is easy to see that the expected total continuation value is $E\{\sum_{i=1}^{n} r_i v_i\} = E\{v_i\}$, the expected value of a single partner's type. However, this expected continuation value also obtains in the case of interdependent valuations where valuations are additively separable functions of independent signals.[20] In both cases, the continuation value is essentially that of a lottery.

In the cooperative partnership, by contrast, the lottery continuation value obtains only if profit is the average of the two partners' types, $\alpha = \frac{1}{2}$. It is instructive to compare and contrast our case and the IPV case. When $\alpha = \frac{1}{2}$, $V(r, \alpha)$ simplifies:

$$V\left(r, \frac{1}{2}\right) = \sum_{i=1}^{2} \left\{ \int_{v_i^*}^{\overline{v}} udF(u) - \int_{\underline{v}}^{\overline{v}} F(u)udF(u) - \frac{1}{2} \int_{\underline{v}}^{\overline{v}} udF(u) \right\}, \tag{8}$$

where $v_i^* = F^{-1}(\frac{r_i}{2})$. There are two key differences between this expression and $V^{IPV}(r)$. First, the worst-off types in ($\alpha = \frac{1}{2}$) cooperative partnerships are lower than in the IPV case, and at least one worst-off type is always an interior type. In extreme-ownership IPV partnerships, the worst-off types are both boundary types. Since interior types expect positive gains from trade in any VCG mechanism (as such mechanisms offer their most preferred price for any shares they trade), while boundary types expect zero gains from trade, a risk neutral broker could raise more revenue under the cooperative partnership. Hence, cooperative partnerships generate a smaller budget deficit under extreme initial ownership.

Second, the participation constraints are different. This is represented by the (additional) final term in braces in (8). For very low types, participation constraints are relatively high, because a low type of partner can "free ride" off of his partner's ability. This may lower expected gains from trade, making efficient dissolution more difficult to obtain. Overall, dissolution may be easier or more difficult, depending on share endowments and the type distribution. I now turn to the most natural example to illustrate my results.

[20]The partnership dissolution results produced by Fieseler et al. (2003, section 4) use this specification, i.e. $v_i(\theta_1, ..., \theta_n) = g(\theta_i) + \sum_{j \neq i} h(\theta_j)$ with $\theta_i \perp \theta_j$.

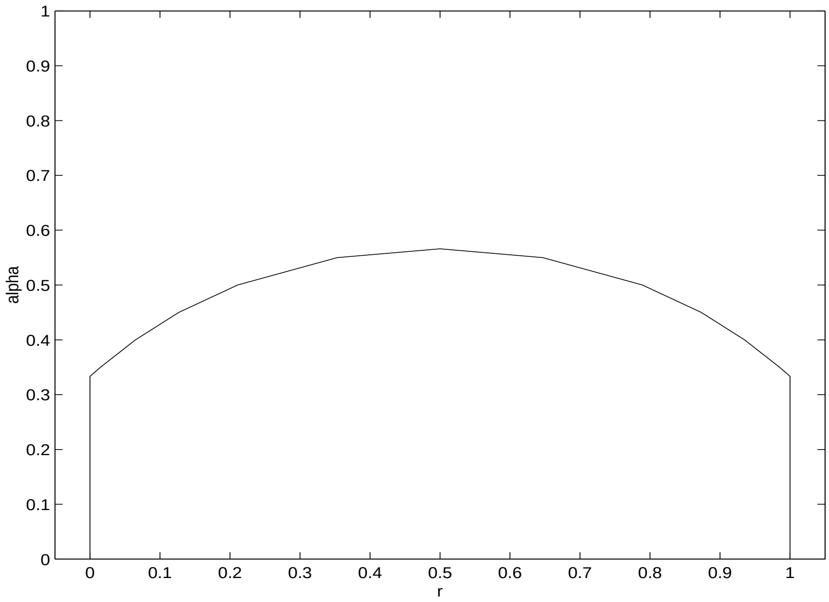

Figure 1: *Efficient Dissolution with Uniform Distributions.*

5. An Example

Let the partners' types be distributed uniformly on $[0,1]$. Then the worst-off types are

$$v_i^* = \frac{r_i(1-\alpha)}{1+r_i(1-2\alpha)},$$

and, letting $r_1 = r$, the condition for efficient dissolution is

$$\frac{2-3((v_1^*)^2+(v_2^*)^2)}{6} \geq \frac{\alpha}{2} + (2\alpha-1)(r\frac{(v_1^*)^2}{2} + (1-r)\frac{(v_2^*)^2}{2})$$

$$+(1-\alpha)(r(v_1^*)+(1-r)(v_2^*)) - (v_1^*)^2 - (v_2^*)^2. \qquad (9)$$

The set of efficiently dissolvable partnerships are those under the curve in Figure 1. For high effectiveness $\alpha \in (.567, 1]$ (approximately), no partnerships are dissolvable. The moderate levels of effectiveness are $\alpha \in (\frac{1}{3}, .567]$, and it is easily seen that the set of ownership endowments for which efficient implementation is possible is symmetric about the equal-shares partnership. The low range is $\alpha \in [0, \frac{1}{3}]$. Hence, for the uniform case, the moderate range, where ownership endowments matter, is relatively small.

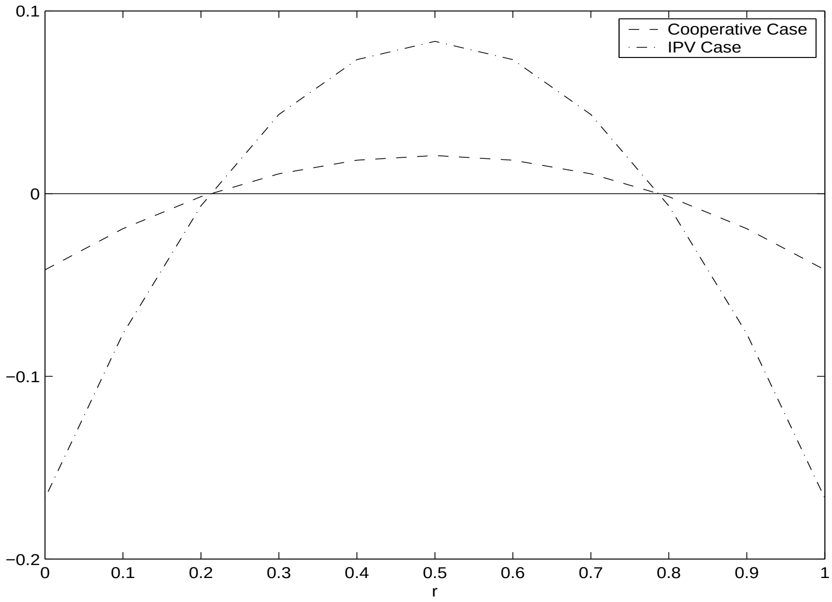

Figure 2: *Comparing* $V(r, \frac{1}{2})$ *to* $V^{IPV}(r)$.

Easily the most interesting case is $\alpha = \frac{1}{2}$. The firm's expected continuation value, just the average of the maximum and minimum types, equals $\frac{1}{2}$, the same as the expected continuation value of a two-person IPV partnership with uniform types ($rE\{v_1\} + (1-r)E\{v_2\} = \frac{1}{2}$). Both $V(r, \frac{1}{2})$ and $V^{IPV}(r)$ are plotted in Figure 2.

Clearly, net surplus may be higher or lower in the cooperative partnership. It is higher under extreme ownership, consistent with the discussion in the previous section. Interestingly, the set of dissolvable partnerships is the same in both cases under uniform types. This set, defined by

$$r^2 + (1-r)^2 \leq \frac{2}{3},$$

covers all $r \in [.211, .789]$ (approximately). The moderately effective partnership $\alpha = \frac{1}{2}$ is, essentially, equivalent to an IPV partnership from a dissolvability standpoint. Thus, the results of Cramton et al. (1987) clearly hinge on the inherent inefficiency of the ex ante partnership structure.

The set of dissolvable partnerships is not generally the same in these two cases. For distributions of the form $F(v) = v^\beta, \beta > 0$, I find that the range of share endowments, for which efficient dissolution is possible, is larger in the cooperative ($\alpha = \frac{1}{2}$) case than in the IPV case when $\beta > 1$, and smaller otherwise. The equal-shares partnership is not dissolvable in the cooperative case when $\beta < .62$ (approximately).

6. Conclusion

In spirit, I view this article as being somewhat analogous, for the partnership dissolution literature, to the work of Whinston (2003) on the property rights literature. In that paper, Whinston used a simple linear-quadratic property rights model to exemplify the shortcomings of the theory's empirical explanatory power and to guide future research. In this paper, I add a straightforward feature to models of partnerships to exemplify the narrow explanatory power of both the IPV case and the interdependent-valuation cases previously studied and to shed light on existing puzzles.

My results suggest that settings where the first-best allocation is not achievable are far more prevalent than originally thought. This may help to explain why inefficient mechanisms such as buy/sell clauses are nonetheless popular in partnership agreements. Most importantly, however, it reinforces the view of Moldovanu (2002) that the construction of (second-best) "incentive efficient" mechanisms and the identification of well-performing mechanisms whose rules do not depend on valuation functions and distributions are crucially important tasks for the mechanism design literature. Kittsteiner (2003) and Chien (2007), for example, show that the efficiency of an auction differs from the (much more complicated) second-best mechanism in an environment where the first best is not possible.[21]

[21] Chien (2007) studies the case where interdependence of valuations follows additively-separable functions of private single-dimensional signals [previously studied by Fieseler et al. (2003)], and shows that when there are two partners and symmetric distributions, second-best mechanisms allocate the partnership to the partner with the highest ex ante ownership more often. Jehiel and Pauzner (2006) also study second-best mechanisms.

Appendix

Proof of Proposition 1. Williams (1999, Theorem 3, p. 166) shows that an interim individually rational, ex ante budget balanced mechanism exists if and only if $(n-1)$ times the expected total value under efficient implementation is no greater than the sum of expected net utilities of the worst-off types in the *basic Groves mechanism,* where $k_i = 0$ for all i for the transfers defined in (2). This yields the condition

$$E(\widetilde{v}) \leq \sum_{i=1}^{2} \{v_i^* F(v_i^*) + E_{-i}\{\widetilde{v}1(v_i^* < \widetilde{v})\} - r_i \Pi_i(v_i^*)\},$$

where $1(\cdot)$ is the indicator function. This expression can be rewritten as

$$2\int_{\underline{v}}^{\overline{v}} uF(u)dF(u) \leq \sum_{i=1}^{2} \{v_i^* F(v_i^*) - r_i \Pi_i(v_i^*)\} + \sum_{i=1}^{2} \int_{v_i^*}^{\overline{v}} udF(u).$$

Rearranging of terms yields condition (6). ***QED***

Proof of Proposition 2 It is clear that $V(r,\alpha) = V(1-r,\alpha)$, as partners 1 and 2 are ex ante identical except for their shares. It remains to show that $V(r,\alpha)$ is maximized at $r = \frac{1}{2}$.

Referring, for convenience, to the terms on the left-hand side and right-hand side of (6) as X_1 and X_2, respectively, and differentiating the first term, we have:

$$\frac{dX_1}{dr} = \sum_{i=1}^{2} -\left[v_i^*(r,\alpha) f(v_i^*(r,\alpha)) \frac{dv_i^*}{dr}\right],$$

where $v_i^*(r,\alpha)$ is the worst-off type as a function of both ownership r and effectiveness α [recall equation (5)]

Differentiating the second term, and doing some simple algebra, we have

$$\frac{dX_2}{dr} = \Pi_1(v_1^*) - \Pi_2(v_2^*) - \sum_{i=1}^{2}\left[v_i^*(r,\alpha) f(v_i^*(r,\alpha)) \frac{dv_i^*}{dr}\right],$$

where the algebra is greatly simplified by the envelope theorem (using the definition of v_i^*).

Thus, we have

$$\frac{dV}{dr} = \Pi_2(v_2^*) - \Pi_1(v_1^*).$$

Clearly, this is positive if $v_2^* > v_1^*$, zero if $v_2^* = v_1^*$, and negative if $v_2^* < v_1^*$. These three cases correspond, respectively, to the cases of $r < \frac{1}{2}$, $r = \frac{1}{2}$, and $r > \frac{1}{2}$. Hence, V is maximized at $r = \frac{1}{2}$. If $V(\frac{1}{2}, \alpha) < 0$, then the set of dissolvable partnerships is empty. If $V(\frac{1}{2}, \alpha) > 0$, this set is clearly a symmetric interval about $r = \frac{1}{2}$. ***QED***

Proof of Proposition 3 For the first sentence, see the Proof of Proposition 4 (subsequent page) and apply it to the $n = 2$ case.

For the second sentence of the proposition, it suffices to show that V is strictly decreasing in α. Analogous to the previous proof, note :

$$\frac{dX_1}{d\alpha} = \sum_{i=1}^{2} - \left[v_i^*(r,\alpha) f(v_i^*(r,\alpha)) \frac{dv_i^*}{d\alpha} \right]$$

and

$$\frac{dX_2}{d\alpha} = \sum_{i=1}^{2} \left\{ r_i \left[\int_{\underline{v}}^{v_i^*} (v_i^* - u) dF(u) + \int_{v_i^*}^{\overline{v}} (u - v_i^*) dF(u) \right] - \left[v_i^*(r,\alpha) f(v_i^*(r,\alpha)) \frac{dv_i^*}{d\alpha} \right] \right\}.$$

Thus, we have

$$\frac{dV}{d\alpha} = \sum_{i=1}^{2} -r_i \left[\int_{\underline{v}}^{v_i^*} (v_i^* - u) dF(u) + \int_{v_i^*}^{\overline{v}} (u - v_i^*) dF(u) \right] < 0.$$

For the third sentence of the proposition, suppose that $r = 1$ and $\alpha = 0$, so that $v_1^* = F^{-1}(\frac{1}{2})$ and $v_2^* = \underline{v}$. Then, we have

$$V(1,0) = \left\{ \int_{F^{-1}(\frac{1}{2})}^{\overline{v}} u dF(u) - \int_{\underline{v}}^{\overline{v}} F(u) u dF(u) + \int_{\underline{v}}^{\overline{v}} u[1 - F(u)] dF(u) - \int_{\underline{v}}^{F^{-1}(\frac{1}{2})} u dF(u) \right\}.$$

Simplifying, we have

$$V(1,0) = 2 \left\{ \int_{F^{-1}(\frac{1}{2})}^{\overline{v}} u dF(u) - \int_{\underline{v}}^{\overline{v}} F(u) u dF(u) \right\}$$

Noting that $V(1,0) = V^{IPV}(\frac{1}{2})$, the result $V(1,0) > 0$ follows from the Proof of Proposition 1 by Cramton et al. (1987), applied to the case of 2 partners. By Proposition 2, we have $V(r,0) \geq V(1,0) > 0$, completing the proof. ***QED***

Proof of Proposition 4. When there are n partners, one can use the techniques from earlier in the paper to show that

$$V^n(r,1) = \sum_{i=1}^{n} \left[\int_{v_i^*}^{\overline{v}} ud[F(u)^{n-1}] - \int_{\underline{v}}^{\overline{v}} F(u)ud[F(u)^{n-1}] \right] - \sum_{i=1}^{n} \left[r_i \Pi_i(v_i^*) - v_i^* F(v_i^*)^{n-1} \right].$$

The worst-off types are the lowest possible types: $v_i^* = \underline{v}$. Thus, we have

$$V^n(r,1) = \sum_{i=1}^{n} \int_{\underline{v}}^{\overline{v}} u[1-F(u)]d[F(u)^{n-1}] - \sum_{i=1}^{n} r_i \int_{\underline{v}}^{\overline{v}} ud[F(u)^{n-1}].$$

This can be rewritten

$$V^n(r,1) = n \int_{\underline{v}}^{\overline{v}} u[1-F(u)]d[F(u)^{n-1}] - \int_{\underline{v}}^{\overline{v}} ud[F(u)^{n-1}].$$

Simple algebra and integration by parts then yields

$$V^n(r,1) = (n-1) \int_{\underline{v}}^{\overline{v}} F(u)^{n-1}[F(u)-1]du < 0.$$

QED

References

Brooks, Richard, Claudia Landeo and Kathryn Spier. "Trigger Happy or Gun Shy? Dissolving Common-Value Partnerships with Texas Shootouts," *RAND Journal of Economics*, forthcoming.

Chien, Hung-Ken. "Incentive Efficient Mechanisms for Partnership Dissolution," manuscript, 2007.

Cramton, Peter, Robert Gibbons and Paul Klemperer. "Dissolving a Partnership Efficiently," *Econometrica* 55, 1987, 615-32.

De Frutos, Maria Angeles and Thomas Kittsteiner. "Efficient Partnership Dissolution under Buy/Sell Clauses," *RAND Journal of Economics* 39, 2008, 184-99.

Engers, Maxim and Brian McManus. "Charity Auctions," *International Economic Review* 48, 2007, 953-94.

Englebrecht-Wiggans, Richard. "Auctions with Price-Proportional Benefits to Bidders," *Games and Economic Behavior* 6, 1994, 339-46.

Farrell, Joseph and Suzanne Scotchmer. "Partnerships," *The Quarterly Journal of Economics* 103, 1988, 279-97.

Fieseler, Karsten, Thomas Kittsteiner and Benny Moldovanu. "Partnerships, Lemons and Efficient Trade," *Journal of Economic Theory* 113, 2003, 223-34.

Goeree, Jacob, Emiel Maasland, Sander Onderstal and John L. Turner. "How (Not) to Raise Money," *Journal of Political Economy* 113, 2005, 897-918.

Hauswald, R., Hege, U. "Ownership and Control in Joint Ventures: Theory and Evidence," Discussion Paper 4056, C.E.P.R., 2003.

Holmström, Bengt. "Moral Hazard in Teams," *Bell Journal of Economics* 13, 1982, 324-40.

Jehiel, Philippe and Ady Pauzner. "Partnership Dissolution with Interdependent Values," *RAND Journal of Economics* 37, 2006.

Krishna, Vijay. *Auction Theory.* Academic Press: San Diego, CA, 2002.

Krishna, Vijay and Motty Perry. "Efficient Mechanism Design," mimeo, 2000.

Legros, Patrick and Steven A. Matthews. "Efficient and Nearly-Efficient Partnerships" *Review of Economic Studies* 60 (3), 1993, 599-611.

Lengwiler, Yvan and Elmar Wolfstetter. "On Some Auction Rules for Amicable Divorce in Equal Shares Partnerships," in: Beschorner, T. and Eger, T. (eds.), Das Ethische in der konomie, Festschrift fr Hans Nutzinger, Metropolis Verlag, 2005, 199-212.

Levin, Steven and John Tadelis. "Profit-Sharing and the Role of Professional Partnerships," *Quarterly Journal of Economics* 120, 2005, 131-71.

Li, Jianpei and Elmar Wolfstetter. "Partnership Dissolution, Complementarity, and Investment Incentives," *Oxford Economic Papers*, forthcoming.

Makowski, Louis and Claudio Mezzetti. "Bayesian and Weakly Robust First Best Mechanisms: Characterizations," *Journal of Economic Theory* 64, 1994, 500-19.

Matouschek, Niko. "Ex Post Inefficiencies in a Property Rights Theory of the Firm," *Journal of Law, Economics and Organization* 20, 2004, 125-47.

McAfee, R. Preston. "Amicable Divorce," *Journal of Economic Theory* 56, 1992, 266-93.

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

Morgan, John. "Dissolving a Partnership (Un)fairly," *Economic Theory* 23, 2004, 909-23.

Myerson, Roger B. and Mark Satterthwaite. "Efficient Mechanisms for Bilateral Trading," *Journal of Economic Theory* 29, 1983, 265-81.

Ornelas, Emanuel and John L. Turner. "Efficient Dissolution of Partnerships and the Structure of Control," *Games and Economic Behavior* 60, 2007, 187-99.

Segal, Ilya and Michael Whinston. "A Simple Status Quo that Assures Participation (with Application to Efficient Bargaining)," *Theoretical Economics* forthcoming.

Segal, Ilya and Michael Whinston. "Property Rights," working paper, 2010, prepared for *Handbook of Industrial Organization.*

Singh, Rajdeep. "Takeover Bids with Toeholds: The Case of the Owner's Curse," *Review of Financial Studies* 11, 1998, 679-704.

Whinston, Michael D. "On the Transaction Cost Determinants of Vertical Integration," *Journal of Law, Economics and Organization* 19, 2003, 1-23.

Williams, Steven R. "A Characterization of Efficient, Bayesian Incentive Compatible Mechanisms, *Economic Theory* 14, 1999, 155-80.