

GOING ALONE TOGETHER: JOINT OUTSIDE OPTIONS IN BILATERAL NEGOTIATIONS*

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Several contractual situations are such that the parties may ‘step out’ of negotiations and take up outside opportunities only if there is mutual consent to do so. Examples include employer – employee negotiations, divorce and inheritance procedures, and arbitration. To analyse such cases we develop the general concept of a ‘joint outside option’ and study its effect in the standard bargaining game. Examples from the international trade and theory of the firm are considered in some depth.

In many types of negotiation the parties can ‘agree to disagree’. That is, there are opportunities to exit the current negotiations and switch, by common accord, to a different type of relationship. Consider the following example. Two businessmen are equal partners in an enterprise and are discussing what use to make of their profits. One option is to buy new premises in a prime location. Before doing so, however, they have to agree on the terms of the deal (e.g. who gets the office with the best view). At any moment, during negotiations, some other prospective buyer could snatch the opportunity and the desired new building would ‘disappear’ (which they consider the worst possible outcome). Alternatively, rather than reinvesting profits, the partners may simply agree on the less productive option to share them 50-50. That is, they may decide to step out of current negotiations into an altogether different settlement, which requires mutual consent.

Several other instances exemplify this point:

- Employer and employee are locked in a long-term contract and are arguing over working conditions. ‘Early retirement’, requiring the consent of both parties, offers an alternative resolution of the conflict.
- Landlord and tenant are involved in a dispute. In case of a deadlock, they can at any time agree to have their argument resolved by an arbitrator.
- After marrying, both partners learn of attractive outside alternatives. Unilaterally filing for divorce is not viewed as a practicable (or even legal) option but a less costly consensual decision to split is.
- Two siblings argue over how to share the use of their inherited country house. Should they fail to reach an agreement on this issue, they may agree to sell the house and share the proceeds.

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In these very diverse situations – and others, some of which we discuss later – *exit is feasible only when agreed upon by both sides*.

To be more precise about why this may be the case, consensuality of the will to divorce is or was until recently legally required in several countries. In essence, this is the case with fault divorce.¹ No-fault divorce itself does not necessarily rule out mutual consent. This is explicitly the case, for instance, in some states in the US, like Arkansas and Delaware; see for instance Friedberg (1998) and Gray (1998). Also, unilateral divorce can be legal but very costly compared to an agreed upon divorce: for instance the Scotland Divorce Act of 1976 requires proof of at least two years of separation if both partners consent, and five years separation in case of unilateral divorce.

Early retirement has been widely used, for example, in UK academic institutions as a strategy to increase research productivity.² Conceptually similar consensual ways of terminating negotiations are relevant in several other employer – employee negotiations (e.g. switching from full time to part-time employment). Again, the crucial point here is that although unilateral actions to terminate negotiations (through firing or quitting) may not be legally impossible, they are sometimes less viable/relevant than consensual decisions because of their cost.

In several countries, going into arbitration to resolve disputes is a decision that parties must agree upon. Examples include procedures in UK labour disputes, in which final offer arbitration can be triggered only with the consent of both sides; and common civil law disputes in Italy.³

Finally, the sale of a jointly owned asset is an almost universal procedure to overcome difficulties in reaching an agreement over its use.⁴

How could these situations be modelled? We propose an approach based on non-cooperative bargaining theory, as started by Rubinstein, (1982) and Stahl (1972). The standard theory admits essentially only two kinds of alternatives to agreement:

- (i) there is perpetual disagreement (either because of an exogenous break-down or because negotiations never end); or
- (ii) a *unilateral* action is taken by one of the players to terminate the negotiations.

The unilateral action in (ii) results in the players taking their ‘outside options’, namely payoffs that can be obtained in another activity. The literature has explored many interesting variations of the exact meaning of ‘taking a unilateral action’, which depend on answering questions such as: When can a player opt out? (Bester, 1988; Shaked, 1994; Shaked and Sutton, 1984; Sutton, 1986). How does the outside option arise? (Muthoo, 1995). Do both players have this opportunity? (Ponsati and Sàkovics, 1998). But common examples such as those we have

¹ See e.g. Clark (1999) and Fella *et al.* (2002).

² See the Annex for specific evidence.

³ For instance, in the UK, ‘[Arbitration] is method of resolving disputes between parties without recourse to the law. It is voluntary, and the procedures have to be agreed by both parties beforehand’, see (Kennerley, 1994). Manzini and Mariotti (2001) presents a specific model of arbitration.

⁴ See e.g. Young (1994).

mentioned, where the effective power of ‘unlocking’ bargaining is a *joint* prerogative of both players, simply cannot be framed in any of these variations.⁵

In this paper we introduce and analyse the concept of a *Joint Outside Option*’ (henceforth, a JOO). Formally, a JOO is just like a standard outside option⁶ (that is, an alternative that can be obtained by the players if they exit the bargaining process), with the single difference that it can only be obtained if *both* players consent to take it.⁷ More precisely, with a standard outside option, a responder can immediately take up his outside opportunity after rejecting an offer. With a JOO a responder can immediately take up the (joint) outside opportunity *provided* his opponent agrees to do so.

A crucial feature of a JOO is that it *need not* be Pareto efficient, in the sense that there may be negotiable alternatives which both parties would prefer to the JOO: switching out of the current type of relationship in favour of a different one may be costly.

How do JOOs affect bargaining? Suppose the JOO is efficient (that is, it takes the parties on the frontier of the feasible set). Then exactly one party stands to lose from terminating the negotiations (with respect to the ‘normal’ bargaining outcome). But in our examples that party could simply ‘veto’ this possibility. On the other hand, the JOO, like a ‘standard’ outside option, can be obtained immediately. At the outset, it is not clear how these two contrasting effects play out one another. Similar considerations apply when the JOO is not efficient.

We will demonstrate that JOOs do affect the bargaining outcome,⁸ and the basic facts we find are:

- (a) The presence of a JOO *always* affects the equilibrium set of outcomes of bargaining, provided its inefficiency is not too high relative to bargaining frictions. This proves to be relevant in several economic applications such as the theory of the firm.
- (b) If the JOO is ‘not too distant’ from the standard bargaining outcome (but possibly inefficient), then the equilibrium is *unique*, and is determined in the following way: the JOO payoff acts as a lower bound for one of the parties,⁹ while the other obtains the ‘residual’. Note that in this case the bargaining outcome is efficient, even if the JOO is not. The veto power of each party to block unfavourable outside options proves to be completely

⁵ There have also been interesting explorations on what exactly happens in case of disagreement: How ‘bad’ is disagreement? (Manzini and Mariotti, 2002). Does disagreement mean a breakdown of negotiations or a continued failure to agree? (Binmore *et al.*, 1986). Can a player harm the other? If so when? (Avery and Zemsky, 1994; Busch *et al.*, 1998; Fernandez and Glazer, 1991; Haller and Holden, 1990; Manzini, 1999). Is the disagreement payoff determined by the equilibrium of some other game? (Busch and Wen, 1995). Again, we find that such variations do not capture the kind of situation we are interested in in this paper. For a general reference see Muthoo (1999), chapters 5–6.

⁶ To be precise, of the ‘bazaar’ type (Shaked, 1994).

⁷ An interesting conceptual analogy, in a very different setting, is with the ‘AND’ game by Brams *et al.* (1993).

⁸ Technically, this is due to the fact that they are taken, in equilibrium, at out-of-equilibrium decision nodes.

⁹ This is analogous to the celebrated ‘Outside Option Principle’, OOP, (Binmore *et al.*, 1989): in the case in which only one party has an outside option, and can (unilaterally) take it when rejecting an offer, if the outside option has an effect, it always acts as a lower bound for the player’s payoff.

empty; the other party will always be able, in equilibrium, to force an outcome whose value is bounded below by his outside option. Again, this is relevant for judging the practical effectiveness of institutions such as consensual divorce or arbitration.

- (c) If the JOO is not in the region for which (b) applies, then a continuum of equilibria may exist, reminiscent of those determined by double-sided outside options.¹⁰ This opens the door to inefficiency in the bargaining outcome.

A final introductory note concerns the *interpretation* of a JOO. Some readers may feel that our model oversimplifies the situations we have mentioned at the outset. For example, the outcome of ‘agreeing to split’ in a marriage can hardly be viewed as a ‘parameter’: it is itself a strategic situation. However, there is no analytical difficulty in this respect in interpreting the JOO as an *equilibrium* outcome of another game the players may decide to play. Our simplified model can deal in principle with very complex extensive forms, such that at any time while bargaining within a given extensive form game, the players can *jointly change the contractual situation they are involved in*, thus generating a new extensive form.

This also clarifies an important feature of a JOO, in that it is *not* just another agreement. The JOO summarises the outcome of some specific (institutional or contractual) framework which exists *outside* and *independently* of the negotiations in which the parties are involved. In the opening example, sharing profits according to a pre-specified rule is an *alternative* to negotiating the terms under which to reinvest them, and not one of the possible negotiated agreements. So simply enlarging the set of possible agreements in the standard bargaining framework would not address the situations discussed in this paper. Furthermore, there is no reason why the JOO should be subjected to the same costs to which the other alternatives are subjected. In our opening example, any disagreement on the terms of the re-investment triggers the risk that the building ‘disappears’, yielding the worst outcome. On the contrary, the 50-50 split is a ‘safe’ (although less profitable) option.

1. The Model

Two players must reach an agreement on an outcome in a set Ω . A breakdown of negotiations is a distinct outcome denoted b . Players may also agree to terminate the negotiations (with the rules described below): this outcome is denoted t , and is interpreted as the situation in which a JOO is taken. To simplify notation, we will work directly in utility space and assume that the set Ω maps onto a compact convex feasible set of utility pairs, $S \subset \mathcal{R}^2$. Utilities are viewed as von Neumann-Morgenstern representations of players’ risk preferences. Players prefer any agreement in Ω to b . From now on, we call S the set of *alternatives*. It is convenient to assume that S can be described in the following way. Normalise the utilities of b at 0 and normalise the maximum feasible utility for each player to 1. The utility

¹⁰ Ponsati and Sàkovics (1998) have pointed out that when *both* players can (unilaterally) take outside options after a rejection, there is typically a continuum of equilibria.

pair obtained if players agree to trigger outcome t is denoted $m \in S$. Suppose that, for each player, 0 is the utility of the worst alternative in S , and that the worst outcome for i corresponds to the best outcome for j . Let the continuous strictly decreasing concave function $f_i : [0,1] \rightarrow [0,1]$ denote the maximum utility that player i can get for any given level of player j 's utility, $i, j = 1, 2$. That is, $f_i(x) = \{\max_{s_i} \{s_i, s_j\} \in S \text{ and } s_j = x\}$. So $S = \{s | 0 \leq s_i \leq 1 \text{ and } 0 \leq s_j \leq f_j(s_i)\} = \{s | 0 \leq s_j \leq 1 \text{ and } 0 \leq s_i \leq f_i(s_j)\}$. For future reference note that obviously we have the identity $f_i[f_j(x)] = x, x \in [0, 1], i, j = 1, 2$.

There is an unbounded number of potential rounds, $r = 0, 1, \dots$, and at any round r there is an exogenous probability $p \in (0, 1)$ that negotiations continue to round $r + 1$ and a probability $1 - p$ that they break down. Thus, at round 0, the expected value of an agreement yielding x in round r is xp^r . As in the standard alternating offers model, players alternate in proposing an alternative (in utility space), which can be either accepted, ending the game, or rejected. In addition, when rejecting a proposal at round r the responding player, say i , can either follow with a counter-offer in round $r + 1$; or propose to take the JOO. In this latter case player j has to decide whether to accept, in which case the game terminates with the players receiving (m_1, m_2) ; or to decline and propose an alternative in round $r + 1$. The game continues in this way until a proposal is accepted.

Note carefully how taking the JOO is not subject to the risk of breakdown $1 - p$, although it may well suffer from other inefficiencies. This modelling choice identifies the fact that the JOO outcome is not simply another agreement (that is, $t \notin \Omega$). Our discussion at the end of the previous section illustrates this point.¹¹

We denote by G^i any subgame starting with the proposal of an alternative by player i . The game begins at round $r = 0$ with a subgame G^1 : player 1 proposes the alternative $g^1 = (g_1^1, g_2^1)$, which player 2 can either accept – ending the game – reject and make a counteroffer, or reject and propose to take the joint outside option.

We denote by D^i any subgame in which player i has to decide whether to agree on taking the JOO. If player 2 rejects an alternative and proposes to take the JOO, the game moves to a subgame D^1 . If the JOO is accepted, players' payoff pair is (m_1, m_2) ; if it is declined, play moves to a subgame of type G^1 , in round $r = 1$. Alternatively, if player 2 rejects an alternative to make a counteroffer to player 1, the game moves to the following round $r = 1$, entering a subgame of type G^2 . Symmetrically, player 1 can either accept – ending the game – reject and make a counteroffer (entering a subgame of type G^1 in the following round), or reject and propose to take the JOO, in which case the game moves to a subgame of type D^2 . Now player 2 can either accept taking the JOO, yielding (m_1, m_2) ; or decline and make a counteroffer in the following round, so that play moves to a subgame of type G^2 , and so on.

¹¹ As an additional example, the law may prescribe two siblings inheriting an estate either to reach an agreement on the shared use of the estate, or to split the proceeds of a market sale fifty-fifty. As an institution, the property market functions without risk of breakdown. Any eventual inefficiency will rather arise from the fact that the total surplus generated by the sale falls short of the original one. This and other applications are discussed in more detail in Section 3.

Furthermore, define the ‘Rubinstein’ alternatives $\rho^i = (\rho_1^i, \rho_2^i) \in S, i = 1, 2$, as the (unique¹² solution pair to $f_i(\rho_j^i) = p\rho_i^i, i, j = 1, 2$, and $\rho_j^i = f_j(\rho_i^i)$, so that:

$$\rho_i^i = f_i[pf_j(p\rho_i^i)].$$

Note that $\rho_j^i = p\rho_j^j, i, j = 1, 2$ and that ρ^i and ρ^j lie on the same hyperbola. In Section 2 we completely characterise the solution to this game.

2. Results

Observe that the ratios $m_i/f_i(m_j) \in [0, 1]$ provide a measure of how efficient (close to the boundary) the JOO is, so that $1 - m_i/f_i(m_j) \in [0, 1]$ provides an inefficiency measure. It is the comparison between the latter with the bargaining frictions, as measured by the probability of breakdown $(1 - p)$, which will prove crucial in determining the structure of the equilibrium set in the game.

In order to help the reader with the analysis that follows, we visualise in Figure 1 the link between (m_1, m_2) and the equilibria that the model with the JOO equal to (m_1, m_2) generates. We highlight the regions of existence of the equilibria characterised in Propositions 1–5. Notice that in the portion of the set of

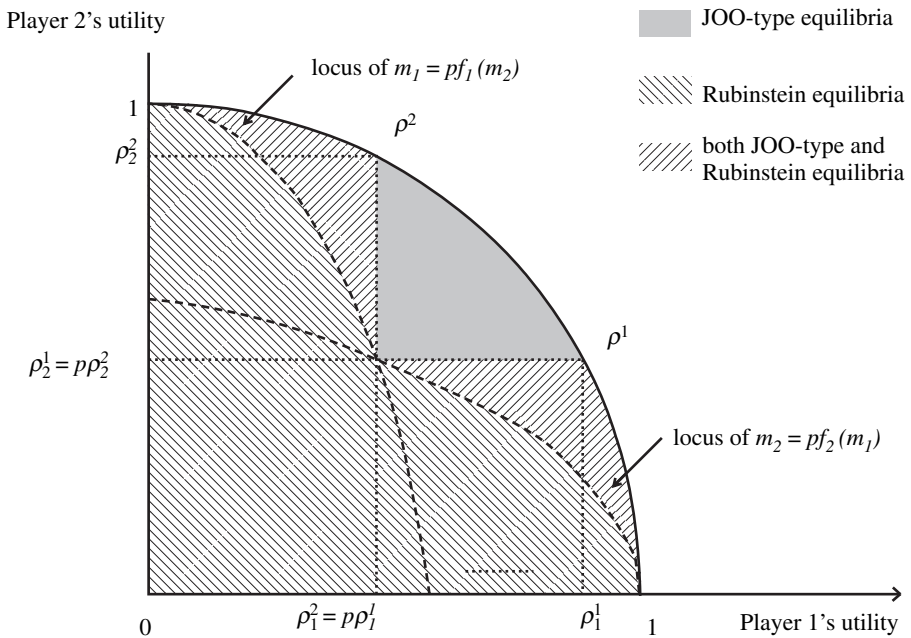


Fig. 1. Parameters Values and Equilibria

¹² This is verified by standard arguments. A fixed point of $F(x) \equiv f_i[pf_j(px)], x \in [0, 1]$ exists by continuity of f_i and f_j . To show that it is unique, check first that F is increasing and convex. Then, it suffices to show that neither $x = 0$ nor $x = 1$ are fixed points. We have $0 < F(0)$, since $f_j(0) = 1$ and therefore $F(0) = f_i(p) > 0 (p < 1)$. Similarly, $1 > F(1)$, since $f_j(1) > 0 (p < 1)$ and $F(1) = f_i[pf_j(p)] < 1 (p > 0)$.

alternatives delimited by the frontier and the locus of points $m_i = pf_i(m_j)$ it is true that $m_i > pf_i(m_j)$.

Our first Proposition establishes that for any probability of breakdown there exists a subgame perfect equilibrium (henceforth s.p.e.) where the negotiated agreement is entirely determined by the JOO, provided it is not too inefficient relative to bargaining frictions.

PROPOSITION 1 *For any probability of breakdown $(1 - p)$, and for any joint outside option pair of utilities $m \in S$ such that*

$$m_i \geq pf_i(m_j), i, j = 1, 2, i \neq j \tag{1}$$

there exists an s.p.e. in which agreement is reached immediately on the alternative $[f_1(m_2), m_2]$. In particular, if m is efficient $[f_1(m_2) = m_1]$ then for any value of p there exists an s.p.e. in which agreement is reached immediately on the alternative (m_1, m_2) .

Proof. See Appendix.

REMARK. *The necessary condition 1 is equivalent to $1 - m_i/f_i(m_j) \leq 1 - p$, and can therefore be interpreted as stating that the inefficiency must be less than the bargaining frictions.*

In the equilibrium described in Proposition 1 there is no waste even when the JOO is not efficient. The first proposer appropriates all the benefit obtained by not resorting to an inefficient JOO.

The next Proposition will show that the type of equilibrium analysed above is unique when the JOO is not exceedingly favourable to one of the bargainers, where the definition of ‘favourable’ depends on the probability of continuation. We say that a JOO is *balanced* if

$$m_i \in (p\rho_i^i, \rho_i^i) \forall i.$$

A balanced JOO is ‘intermediate’ between the equilibrium payoffs of a proposer and a responder in the standard model without the JOO. This we interpret as being not exceedingly favourable to either bargainer.

For later proofs, it is useful to note the following fact about balancedness: if m is balanced, then

$$m_i > pf_i(m_j) \forall i, j$$

which in turn ensures that a JOO-type equilibrium exists by Proposition 1.

To check this statement, note that since f_i is monotonically decreasing, $m_j > p\rho_j^j \Leftrightarrow f_i(m_j) < f_i(p\rho_j^j) = \rho_i^i$, where the equality derives from the definition of ρ^i and ρ^j as the solution of $f_j(\rho_i^i) = p\rho_j^j$ for $i, j = 1, 2$, by applying $f_i(\cdot)$ on both sides. Thus, multiplying both sides of $\rho_i^i > f_i(m_j)$ by p and coupling with $m_i > p\rho_i^i$ yields $m_i > p\rho_i^i > pf_i(m_j)$.

Our next result establishes that when the JOO is balanced only the ‘JOO-type’ equilibrium can obtain:

PROPOSITION 2 *If the JOO is balanced, then if $m_1 < f_1(m_2)$ the unique s.p.e. is immediate agreement on the alternative $(f_1(m_2), m_2)$.*

Proof. See Appendix.

COROLLARY 3 *If $m_1 = f_1(m_2)$, then the unique s.p.e. payoff pair is (m_1, m_2) . This can be obtained either in an equilibrium identical to the previous case, or by jointly agreeing to take the JOO at the first occasion in which this is possible.*

In the next Proposition we complete the results in Proposition 2 by establishing that lack of balance for the JOO is both necessary and sufficient for the existence of standard Rubinstein equilibria.

PROPOSITION 4 *If and only if the JOO is not balanced, there exists an s.p.e. in which agreement is reached immediately on the alternative ρ^1 .*

Proof. See Appendix.

When the inefficiency associated with the JOO is large relative to the probability of breakdown, the presence of a JOO will be irrelevant, and the Rubinstein equilibrium is unique:

PROPOSITION 5 *If $m_i \leq p\rho_i^i$ for some i and $p > p_m \equiv \min[m_1/(f_1(m_2), m_2/(f_2(m_1))]$, then in the unique s.p.e. agreement is reached immediately on the alternative ρ^1 .*

Proof. See Appendix.

Figure 2 is helpful in clarifying the differences between the unilateral and joint outside option models.

In the Figure three regions corresponding to three different equilibrium outcomes are visualised. In the dark grey region the outside option is non-binding for both agents, so that the unique equilibrium outcome is with immediate agreement on the Rubinstein alternative. In the region coloured in intermediate grey, the outside option is binding either for player 2 only (area I) or for both (area II), so that the equilibrium outcome is with immediate agreement on a partition which gives player 2 a payoff equal to his outside option. Finally, in the light grey region the outside option is binding for player 1 only. Note that player 1 can obtain his outside option payoff only in the next round, where player 2's payoff is worth $pf_2(m_1)$. Consequently the equilibrium outcome is with immediate agreement on an 'outside option' driven settlement, whereby player 1 obtains $f_1[pf_2(m_1)]$. By comparing Figures 1 and 2 it is easy to see where the two models yield different predictions:

- *same unique prediction:* Both models predict the same, unique equilibrium agreement only if m is either balanced or it lies in region IV (see Figure 2).

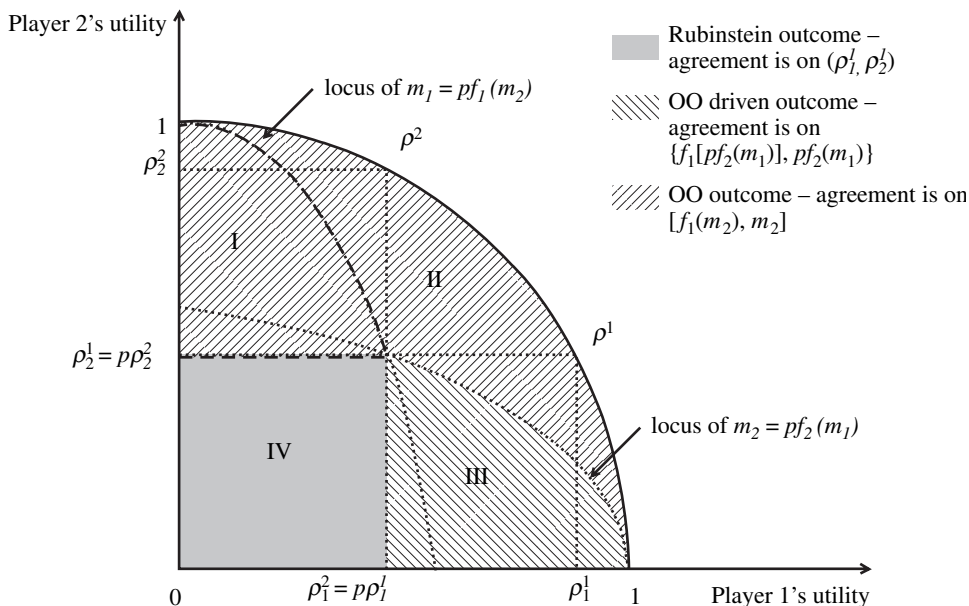


Fig. 2. Equilibrium Outcomes in the Model with Unilateral Outside Option

- ‘nested’ prediction: If m lies in area II of Figure 2 but it is *not* balanced, the unilateral outside option model predicts a unique equilibrium. To the contrary, in the JOO model a continuum of equilibria can obtain.
- *opposite unique prediction*: If m lies in either area I or III of Figure 2 the standard outside option model predicts that the outside option principle will drive agreement, while in the model with the JOO players settle for the Rubinstein alternative.

Furthermore note that the unilateral and joint outside option models may differ in the limiting cases for the probability of breakdown tending to zero. In that case, if the JOO is inefficient, it effectively disappears and the problem becomes a standard one without any outside option. In contrast, a unilateral outside option still matters in the limit.¹³ However, as stated in Proposition 1, if the JOO is efficient, the JOO-type equilibria survive even in the limit.

We can conclude this Section by completing the description of the efficient equilibria of our model. When the equilibria are not unique, so that both Rubinstein and JOO-type equilibria exist, the set of efficient equilibrium payoffs is simply obtained by adding all the intermediate alternatives on the boundary of S to the two ‘extreme’ equilibrium payoffs.

PROPOSITION 6 *If $m_i > pf_i(m_j)$, $i, j = 1, 2$, and $m_j < p\rho_j^j$ for some j , only and all those alternatives which yield player i a payoff $x^* \in [\rho_i^i, f_i(m_j)]$ if he is the proposer, or $f_i(y^*) \in [p\rho_i^i, m_i]$ if he is the responder can be supported in any efficient equilibrium.*

¹³ We thank one referee for drawing our attention to this point.

Proof. See Appendix.

As is standard in this type of literature,¹⁴ the existence of the two extreme equilibrium payoffs guarantees the existence of equilibria with delayed agreement. Here we characterise them for the case $m_2 < p\rho_2^2$; it is straightforward (thus omitted) to rephrase the proposition in order to obtain analogous results in the symmetric case for $m_1 < p\rho_1^1$.

PROPOSITION 7 *For any round R there exists a pair (m_2, p) such that every alternative which yields player 1 a payoff $z^* \in [\rho_1^1/p^R, f_1(m_2/p^R)]$ can be supported in an equilibrium in which negotiated agreement is reached in round R . Furthermore, (m_2, p) can be chosen such that p is arbitrarily close to 1.*

Proof. See Appendix.

3. Applications

3.1. Joint Ownership I: Incentives to Invest in a Theory of the Firm

So far we have analysed equilibria for a given set of alternatives. However interesting conclusions can be drawn when our model is used to study comparative statics when the set of alternatives changes. An important area where *enlargements* of the set of alternatives are relevant is the theory of the firm developed by Grossman, Hart and Moore (Grossman and Hart, 1986; Hart, 1995; Hart and Moore, 1990), henceforth GHM. The central role in that theory is played by the incentives to invest on the part of owners of different assets, who then bargain over how to share the gains from trading with each other (in which case the parties have access to all assets). At the analytical level, the effect of investments is simply to enlarge the set of available alternatives.

Asset ownership determines the value of no-trade payoffs. Therefore, asset ownership affects investment incentives to the extent that no-trade payoffs determine agreement payoffs. However, it has been pointed out that the exact interpretation of no-trade payoffs can make a crucial difference. In the original GHM theory they are considered as *inside options*, that is payoffs obtained in case of 'temporary' disagreement (one which does not preclude resuming of negotiations). More recently, de Meza and Lockwood (1998)¹⁵ have instead proposed to interpret no-trade payoffs as *outside options*, that is payoffs which accrue to the bargainers due to them abandoning negotiations in favour of other activities.

The implications of these alternative interpretations are substantially different. While the details are complex, the basic intuition is clear. If the bargaining outcome is driven by a (binding) outside option, an enlargement of the set of alternatives bears no advantage to the player with the (favourable) outside option, provided of course that the outside option remains binding; in this case the incentive to invest is

¹⁴ See e.g. Muthoo (1999).

¹⁵ See also Chiu (1998) and Rajan and Zingales (1998).

absent for that player. On the contrary, in the presence of an inside option enlargements of the set of alternatives will normally benefit both players.

The concept of a JOO allows some elaboration on these issues. A natural interpretation in this setting is joint ownership of an asset: both managers have veto power on its use.¹⁶ It is generally assumed that joint ownership does not provide optimal incentives to invest even with asset complementarity. The argument is basically that it coincides with a fifty-fifty split of the asset value in case of breakdown, which is inferior to integration (one manager owns both assets). In fact, we argue that joint ownership enriches the incentive structure in a non-trivial way and that further study is needed.

As shown in the previous Section, the existence of an efficient and unbalanced JOO ensures that all alternatives included between this JOO and the Rubinstein alternative can be supported as equilibrium agreements. Consider the case where the JOO payoffs obtain in equilibrium, which in this case coincides with the outside option equilibrium described above. At this point, an enlargement of the set of alternatives which did not make the JOO too inefficient would still result in a JOO type equilibrium, so that the player with the (favourable) JOO appropriates the entire extra surplus from investment. This is a diametrically opposed result to the outside option model outlined above, as depicted in Figure 3.

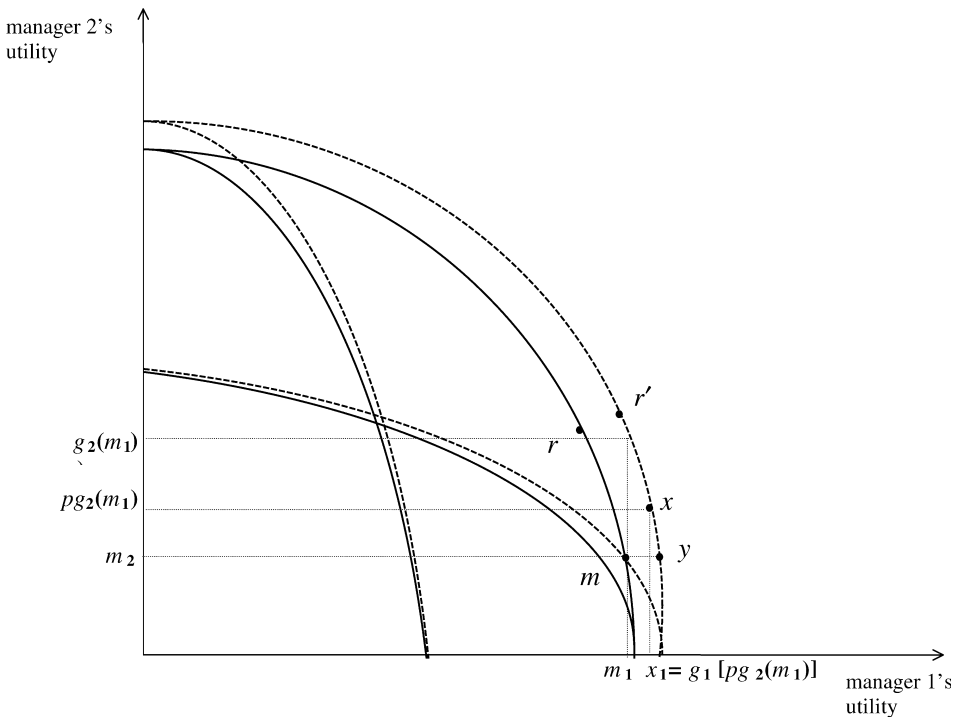


Fig. 3. *JOO and Outside Option in the Asset Ownership Theory of the Firm*

¹⁶ See e.g. Hart (1995), footnote 32, p. 53.

Here the original bargaining set is delimited by the solid line, whereas the dashed line delimits the after-investment set of alternatives; m (with coordinates m_1 and m_2) identifies both the original outside option and JOO; r and r' denote the Rubinstein alternative before and after the investment, respectively; and x and y refer to the after-investment outside option and JOO-type equilibrium payoffs, respectively.

To see this, start from the case of unilateral outside option. Assuming that manager 1 moves first, he can obtain his binding outside option payoff m_1 only when responding, leaving $g_2(m_1)$ to his opponent, where g_i denotes the after-investment frontier. As a consequence, when proposing manager 1 has to concede to his opponent his continuation payoff, with expected value $pg_2(m_1)$, thereby obtaining $g_1[pg_2(m_1)]$. This payoff pair is denoted by x in Figure 3. Consider now the case where m is a JOO. Because after investment the JOO is not 'too' inefficient, the JOO-type equilibrium obtains, so that the equilibrium payoff pair is represented by point y in Figure 3.

If instead the enlargement of the set of alternatives makes the original JOO 'too' inefficient, the *unique* after-investment equilibrium outcome is the Rubinstein alternative for the new bargaining set, r' (see Figure 4). In the case depicted our model implies that the returns to investment for player 2 are higher than in the outside option model. Note also that, although the after-investment equilibrium outcome is the same as in the inside option model, the incentives to investment are very different in the two situations.

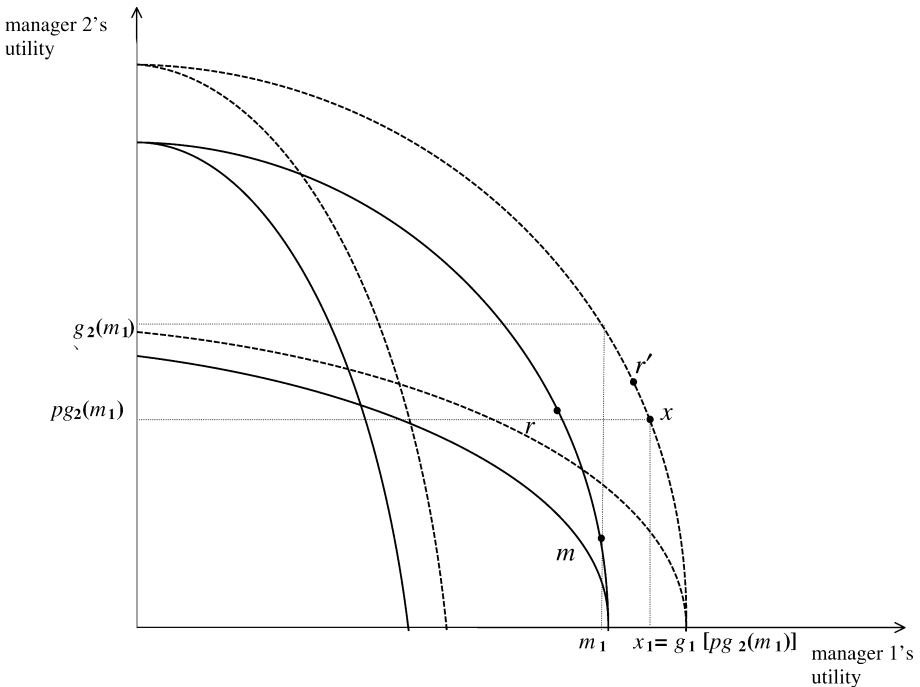


Fig. 4. Different Predictions When the JOO is too Inefficient

Without pursuing this application of our model in further detail, it should be clear how joint ownership creates a rich set of new possibilities in the analysis of investments when asset ownership matters.

3.2. *Joint Ownership II: Who Gets Auntie's Villa?*

Aside from the theory of the firm, our model allows one to study, in general, the implications of bargaining over the use of a jointly owned asset. Consider, to fix ideas, the division of a dwelling inherited by two siblings. One obvious possibility is some rota in the use of the property. If its sale is not practicable, the standard non-cooperative model of bargaining predicts a unique equilibrium agreement.

Alternatively, suppose that the property can be sold and the proceeds split between the parties. In this case there is an outside option in the negotiations over use, which is joint since the siblings have equal rights upon the property, hence veto power on its sale. Here the JOO is configured as the result of an agreement to step out of the negotiations on the rota in order to liquidate the asset, and step into another bargain to share the revenues from the sale. This is in turn a division problem, which admits a unique equilibrium outcome in the standard model. This procedure thus identifies a well-defined JOO for the original problem of estate division. If the JOO turns out to be balanced, our theory predicts that it will uniquely determine the equilibrium outcome. Let us focus on this case for definiteness. The interesting aspect is that in the bargaining over sale proceeds, the shape of the feasible set – and therefore the equilibrium – is determined by the individuals' utilities for *money*. On the contrary, the outcome of negotiations over the rota without the JOO is determined by utilities for the *physical* use of the asset. Consequently, the two equilibrium outcomes will normally be different. And, if the 'main' negotiation were to be over how to split the sale proceeds, with shared use viewed as a fallback alternative, the outcome would be yet a different one.

These considerations highlight the fact that the precise availability and sequencing of methods used to render divisible an indivisible object (rota, randomisation, sale)¹⁷ is crucial for the outcome of negotiations, even when both players can object to the use of a particular method. This aspect has been somewhat downplayed in the fair division literature and it creates the possibility of new procedures of fair division. For example, randomisation in the assignment of the property is usually dismissed because it does not guarantee Pareto optimality. However, according to our model, allowing the parties to consensually randomise on ownership – should they fail to reach an agreement over the use of the property – leads (in the balanced case) to an efficient bargaining outcome!

3.3. *International Trade Agreements: 'Rules-Based' vs. 'Power-Based' Approaches*

In international trade negotiations a distinction has been made (Bagwell and Staiger, 1999; Jackson, 1989) between two types of framework. In 'power-based'

¹⁷ For a lucid explanation of fair division procedures see for instance Brams and Taylor (1996) or Young (1994).

negotiations an eventual agreement is driven by the relative bargaining powers of the countries involved. By contrast, in 'rules-based' negotiations governments refer to a set of internationally agreed common principles. A leading example of the latter type of framework is the World Trade Organisation, with its twin principles of *reciprocity* and *nondiscrimination*. Reciprocity means that countries reciprocate concessions on protective measures. Non-discrimination means that any tariff levied by a government on a tradeable good is the same regardless of the identity of the member country of origin.

Consider two non-WTO countries involved in negotiations over a tariff. Negotiations will thus be power-based. If they were modelled as a standard alternating-offers bargain, theory predicts that they would agree on the unique tariff corresponding to the Rubinstein alternative.¹⁸ In this way, however, one is ignoring the possibility that countries decide to join the WTO. If only one of them joins, the other country would not be bound by the principles. But if *both* do, the bargain turns into a principle-based one. This naturally requires that negotiations between non-WTO member countries be modelled allowing for the presence of a JOO, represented by the *joint* opportunity they have to change the nature of their trade relation.¹⁹

This suggests that the sheer presence of an institution such as the WTO not only regulates trade among members, but also changes the environment in which the non-members operate. Even for countries involved in power-based negotiations, agreements driven by WTO principles can obtain in equilibrium. In fact, either the equilibrium agreement *coincides* with a principle-based one (balanced JOO) or any of the possible agreements, ranging from the purely power-based one to the purely principle-based one, can be struck.

3.4. *Strikes in the Public Sector*

An area where the theory of JOOs has a natural application is industrial relations in sector of public interest. In that type of sectors the government, though not directly involved in wage negotiations, generally have a direct interest in them because of the negative fallout in case of stalemate or worse still breakdown of negotiations. This may determine the government to provide an 'outside' proposal (e.g. a recommendation from an advisory body) as a reference point for the two contending sides.

A case in point is the firefighters dispute in the UK, which culminated in a series of strikes begun in 2002. In the UK firefighters are employed by local government and negotiate wages and work conditions directly with them. However, not least because of the negative impact on the public at large in case of a strike, the central government has an interest that the dispute is resolved quickly. In this case an independent report²⁰ detailing a fundamental overhaul of working practices and

¹⁸ So that, in the limit as the exogenous probability of breakdown tends to 0, the Nash Bargaining Solution (NBS) outcome obtains. In the literature it is in fact common to use directly the NBS as a modelling tool.

¹⁹ For simplicity, we are assuming that principles lead to a unique outcome. In the more realistic case where principles do not determine the outcome uniquely, one would need a model with multiple JOOs.

²⁰ The 'Independent Review of the Fire Service', chaired by Sir George Bain, is available online at the following address: <http://www.irfs.org.uk/>.

conditions was provided, requiring the consent of both parties to be implemented.

Our model suggests that the presence of the JOO increases the strategic complexity of negotiations in such a way that it can generate inefficient outcomes, in the sense that agreement may be delayed. By Proposition 4, a balanced JOO/external recommendation guarantees that the parties to the negotiations will agree immediately to the recommendation (if the JOO is efficient) or a 'close relative' (i.e. its 'efficient projection' if the JOO is not efficient, see Proposition 4 for details). On the other hand if the JOO/external recommendation is *not* balanced, by Proposition 7 even a stalemate (i.e. strikes) can occur in equilibrium. Note that this explanation for impasse in bargaining differs from the more usual ones based on incomplete information and reputation building: our model is one of perfect and complete information. Indeed in the firefighters example it might be argued that the bargaining stances of both sides had been amply clarified, and there was therefore little scope for reputation building.

4. Concluding Remarks

In this paper we have considered situations where two negotiating parties can agree to disagree. To this aim we have introduced a new concept in the theory of bilateral bargaining, that of a joint outside option. We hope to have shown that it is a relevant concept, in that several economic situations present a broad structure where this notion is useful to draw interesting conclusions. In particular, *the voluntary nature of the act of taking a JOO does not make it uninfluential on the bargaining outcome*, as one might believe it to be at first blush. For the case we have called 'balanced', the implication is that a version of the 'Outside Option Principle' holds independently of whether one of the players has veto power on taking an outside option which is unfavourable to him. For the general case, the distinction between standard and joint outside options sheds light, for example, on the incentives to invest in the Grossman-Hart-Moore theory of the firm – and in general in situations where an asset (e.g. estates, factors of production, goodwill) is jointly owned by two parties – in the theory of international trade agreements and in industrial relations.

Of course, what we have provided is merely a broad framework, which is stripped of many details and which may be useful as a 'canonical form'. Investigations of specific economic problems will benefit from enriching this basic structure with the relevant details. In our opinion, an interesting step to take even in the abstract is to consider the case in which the parties are not fully informed, or have differing expectations, regarding the JOO. To some extent, our analysis can already accommodate some degree of uncertainty over the JOO. If such an uncertainty is modelled as a probability distribution over a set of potential JOOs, all one has to do is to compute the corresponding expected utilities: even if the two players have different expectations, provided the pair of expected utilities falls within the feasible set, our analysis carries through unchanged, with the role of point *m* replaced by this new payoff vector. On the other hand, if the 'expected' JOO is outside the feasible set, then there will be equilibria where the JOO is accessed due

to the conviction of both parties that they can do better outside the negotiations than inside. As an extreme case, suppose for both agents the expected JOO payoff is the maximum achievable. Then one subgame perfect equilibrium is with player 1 making a 'ridiculous' offer (zero, say), which player 2 rejects in order to propose the JOO to mutual advantage. Presumably this is the basis for litigation. However in order to address this issue properly, one would need a sound theory of how expectations are formed, which lies beyond the scope of this paper.

More interesting still would be to consider the case where agents are asymmetrically informed about the JOO and use this knowledge strategically. This addition would significantly complicate the analysis but seems worth pursuing in another paper.

Annex²¹

To: All non-SMD Academic Staff

From: Director of Personnel

Date: 16 February 1999

Policy and Resources Committee Contingency Fund for Voluntary Severance/
Early Retirement for Academic Staff

The Policy and Resources Committee has agreed a contingency fund for individual voluntary severance/early retirement offers, to be administered:

- (a) in the interests of achieving an appropriate balance in the College's profile, in terms of its research and teaching activity;
- (b) as an entirely voluntary scheme.

The attached sheet provides indicative details of the financial offer available to fully HEFCE-funded academic staff on indefinite contracts.

Individuals interested in exploring such an offer should make an appointment to see the Senior Vice-Principal. An appointment will normally be arranged shortly after an initial enquiry to allow time for the Senior Vice-Principal to obtain from Payroll and Pensions details of the scheme as it applies to the individual concerned.

An initial, strictly confidential, interview will then be arranged with the Senior Vice-Principal. Following confirmation of a wish to accept the offer, the College will commit to giving a decision with the minimum of delay.

It would be helpful if initial enquiries to the Senior Vice-Principal could be made before Wednesday, 31 March.

Policy and Resources Committee Contingency Fund for Voluntary Severance/
Early Retirement

Terms for fully HEFCE-funded Academic Staff on indefinite contracts of employment

A Staff below 40 years of age at the termination of employment date With exceptions given below, staff who are granted voluntary severance will receive

²¹ The name of the University has been omitted for obvious reasons.

12 months gross pay in compensation for loss of their employment. The exceptions are as follows:

1. Staff with two years' service or less at the date of termination of employment will receive no compensation.
 2. Staff with between two and five years' service will receive 1/36th of one year's pay for each month of service beyond two complete years' service at the date of termination of employment.
- B Staff aged from 40 and below 60 years of age at the termination of employment date With exceptions given below, staff who are granted voluntary severance (and early retirement pensions for staff of 50 and over who are members of USS or NHSSS and where they qualify) will receive 24 months gross pay in compensation for loss of their employment. The exceptions are as follows:
1. Staff with two years' service or less at the date of termination of employment will receive no compensation.
 2. Staff with between two and five years' service will receive 1/36th of two years' pay for each month of service beyond two complete years' service at the date of termination of employment.
- C Staff aged from 60 and below 63 years of age at the termination of employment date With the same rules as for Section B above, this group will have a reduction of compensation of 1/36th for each month of service between the ages of 60 and 63 years.
- D Staff aged from 63 years of age and beyond No compensation is payable for loss of office under this Scheme.

Notes

1. Under current tax rules, lump sums as above are normally tax-free up to £30,000 and taxable at the highest marginal rate thereafter.
2. Staff can ask for all or part of their compensation to be paid by the College directly to USS to buy additional years serves in USS. Such payments made directly by the College to USS are tax-free. Members of the NHSSS do not have this option as it is not offered by the Scheme.

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Technical Appendix is available for this paper: www.res.org.uk/economic/ta/tahome.asp

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