Conflict and Consensus: A Theory of Control in Organisations

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Abstract

A principal, requiring a team to implement a project by proposing and jointly executing a technique, may benefit from choosing one with internal disharmony. When superior policy proposition by a member is rewarded with unitary executive control, the benefit of control is increasing in the degree of conflict. Hence, the presence of discord can raise incentives to take effort towards technique proposition by inducing competition for control, and thereby enhance average proposal quality. The principal may thus choose a fractious team when the losses from lower consensus in project execution are limited. These effects can be exacerbated in large teams, and lead to teamwork dominating individual production.

1 Introduction

Positional heterogeneity amongst team members is a common feature in many organisations. Members, even while jointly pursuing the common goal of team success, may have differing biases, opinions, interests, divisional objectives, departmental prerogatives, etc. These differences can lead to a diminution of consensus and an exacerbation of conflicts of interest, which can make teamwork difficult and lead to lower team performance.

Such intra-group dissonance seems puzzling. After all, when members of a team have to work together to implement a project, a 'well-knit' or cooperative team where members have closely aligned interests faces limited losses arising from functional incohesion. This suggests that team members should be selected to minimise conflicts of interest between them. Yet fractious teams are commonplace. Do such teams arise because of constraints on the availability of agents with aligned interests, or because of a lack of information on commonality of interests prior to selection? Or can there be strategic reasons for introducing such incongruence?

The problem of team conflict has long been recognised in studies of organisational behaviour and structure, and managerial and political leadership (see, e.g., Drucker (1974), George (1980) and Priem (1990)). Team leaders have often been criticised for permitting excessive conflicts, and been commended for adopting a more consensual approach (see, e.g., Katzenbach and Smith (1993), Kakabadse and Smyllie (1994) and Hambrick (1995)). At the same time, it has also been recognised that there may be benefits to encouraging "productive conflict" (Brown (1983)) or "constructive conflict" (De Janasz, Dowd and Schneider (2001)) in teams.

Indeed, in some organisational contexts, particular conflicts have assumed the status of legend. Consider as an example the cabinet of the United States Federal Government. The history of personality clashes and positional differences between the Secretary of Defence, the Secretary of State, and the National Security Advisor is well-known, especially in the Administrations of Bush II (see, e.g., Mann (2004)), Reagan (see, e.g., USA Today (2002)), Carter and Ford (see, e.g., Newsweek (2002)). Donald (1996) further suggests, when discussing Lincoln's leadership style and the disputatiousness marking the relations between cabinet members, that the President may have deliberately fostered "creative friction" in constituting his cabinet, but in doing so ensured an almost disabling degree of operational disharmony. Do these kinds of clashes arise, in spite of the commonality of interest amongst the parties, because such positions of power necessarily invite mercurial personalities, or are these conflicts part of a deliberate design?

This paper attempts to understand the prevalence of, and interaction between, conflict and consensus within organisations. We argue there is a reason for structuring teams such that member interests are imperfectly aligned, or misaligned. In our incomplete contracting setting, the basic model for which is developed in Section 2, a principal requires a team or an 'empowered committee' with two members to propose and realise a plan or a project. Examples can be thought of in terms of a Managing Director of a firm selecting a team of senior executives to design and implement a plan for firm growth, or a University Vice-Chancellor appointing an empowered committee to propose and execute a strategy for enhancing the institution's long-term research capabilities, or a Prime Minister requiring a group of ministers to conceive and realise a policy on some matter of national importance. He selects a team, knowing its degree of internal conflict. Each member of the team may propose an implementation technique, with greater effort improving the quality of her proposal. The principal then selects the best proposal, and gives control over implementation to its proposer. Team members then work together under the controller to execute the project. At this stage, each member decides whether to put in high or low execution effort, with higher effort increasing the value to any team member.

The allocation of control plays a key role in our analysis, which is presented in Section 3. With interest conflicts, a non-controlling or subordinate member obtains a lower benefit from successful project implementation or execution, and may underinvest at the implementation stage. Thus, conflicts lower 'cooperation' at the execution stage and make everyone worse off. This reduction in payoff consequently lowers any member's incentive to invest towards technique proposition (the conflict effect). At the same time, increased conflict implies a deterioration in the value of being a subordinate relative to being the controller, and hence increases the benefit a member obtains from control, i.e., the value of control is increasing in the degree of conflict. In turn, this implies that greater conflict may induce higher effort towards proposal design (the control effect). Therefore, conflicts reduce subordinate members' project execution effort, but, if the control effect dominates the conflict effect, concomitantly can induce higher effort towards technique proposition because of the competition for control, thereby enhancing the average quality of proposals.

So the optimal team structure, i.e., the optimal degree of intra-team conflict, from the principal's perspective, is determined by the trade-off between lower cooperation in technique implementation and higher competition in technique proposition. We show in Section 3 that if the cost of proposition is low, it is optimal to introduce some conflict, provided the marginal benefit to the principal from cooperation in implementation is low. The value of control in such a setting is endogenously determined by the degree of conflict. In this sense, the principal's problem of choosing the degree of conflict can be reinterpreted as one of determining the optimal value of control.

The assumption that conflicts are present only between the members is unproblematic in our environment, given the passivity of the principal's role. With a more active principal, other issues may arise, such as the effect of conflicts between the principal and a member (Dessein (2002), Li and Suen (2004), Dur and Swank (2005), Mello and Ruckes (2006)), the impact of the principal's ability to exercise, cede, revoke and transfer control or authority (Aghion and Tirole (1997), Burkart, Gromb and Panunzi (1997), Aghion, Dewatripont and Rey (2002, 2004), Banerjee (2008)), the ramifications of a divergence of interest between the principal and the organisation (Dewatripont and Tirole (1999)) etc.[1] We eschew such considerations and restrict attention to studying the conflicts of interest between the members and the competition it induces for control, the key concern of this study.[2]

Dewatripont and Tirole (1999) also explore the benefits of inducing divergence amongst parties within organisations, and hence competition between them. In their model, "enfranchised advocates of special interests" compete in promoting "causes". This competition, as in our environment, can lead to greater information acquisition. In their analysis, agents' incentives to compete against each other stem not from the principal's structural choices, but rather from the contractual specification of decision-based rewards. The other principal difference between our article and theirs arises from a consideration of the cost of advocacy. In their paper, the disadvantage of creating conflict is that advocates have an incentive to suppress unfavourable information. By contrast, our main focus is on reduced cooperation in project execution, an issue of some importance when parties within organisations not only propose plans, but also jointly implement them.[3] In such situations, a cost

[1] Some of these issues are discussed further below, in Section 3.5.

[2] Issues of information aggregation and manipulation may also arise when team members have imperfectly aligned interests: see Li, Rosen and Suen (2001) and Li and Suen (2004).

[3] The importance of studying the relationship between competition and cooperation between members of an organisation has also been stressed, though from a somewhat different perspective, by Dewatripont and Tirole (1999, p. 32).

of conflict arises as unitary assignment of control as a structural reward for superior policy proposition can impair appropriate execution when parties have differential agenda.[4]

Rajan and Zingales (1998) propose a theory of the firm where power is associated with "access" to critical resources. Access allows a member to make specific investments which enhance her power and organisational rents. When output is additive in specific investments, they show that dispersal of access rights may be optimal if it increases competition between members, and expands total investment. In their analysis, the allocation of access influences the nature of competition, and hence total investment. By contrast, in our paper, conflict determines the value of control, and hence the degree of competition, which in turn influences the profile of investments and the allocation of control.

Creation of conflict in our environment may be beneficial if it induces competition for control and therefore better proposals ex ante.[5] Such conflict is however ex post inefficient as it reduces cooperation at the execution stage. In an analysis of group decision-making, a similar point is made by Li (2001), who shows that committees may be able to improve the quality of their decisions by committing ex ante to an ex post inefficient decision standard, as such a commitment can increase the information acquisition incentive of individual committee members.[6] He does not consider conflicts of interest between members, or the ex post moral hazard problem, but rather focusses on the relationship between information acquisition, and the continuation versus rejection of a status quo.

In Section 4, we allow the principal to choose between team and individual production. Individual production and team production with misaligned member interests have similar advantages over perfectly consensual teams. In either case, a member's incentive to free-ride on another's effort towards technique proposition may be reduced, thereby enhancing average proposal quality. We show that the principal may prefer team over individual production even when, and especially because, member interests are imperfectly aligned, with a team organisation being superior if the benefit of joint production is sufficiently

[4] Heterogeneity in teams has also been investigated, although in a very different setting, by Prat (2002), who studies teams where members have common interests. Suboptimal actions may be chosen because members possess private information which cannot be shared. He shows that if members' tasks are complements, team homogeneity (all members possessing the same information structure) may be optimal, while heterogeneity may be optimal if tasks are substitutes.

[5] The terms ex ante and ex post respectively refer to the technique proposition stage and the technique execution stage.

[6] See also Szalay (2005) and Banerjee (2007).

high. Conflicts of interest across members can therefore be a basis for the institution of teamwork.[7] In other words, the competition for control induced by such conflicts may more easily mitigate the free-riding problems than individual production.

In Section 5, we study teams with many members, where the ex ante free-rider problem can become more severe. We show that the principal would like to introduce some internal conflicts whenever the number of members is sufficiently large. Thus, tensions common within large groups may serve a useful purpose: by inducing competition for control, they help reduce the adverse impact of diminished effort incentives inherent in larger teams.

The paper is organised as follows. The basic model with two members is constructed in Section 2, and analysed and discussed in Section 3. Section 4 studies the choice between team and individual production, while Section 5 examines teams with more than two members. Section 6 concludes.

2 The basic model

A Principal ($\mathcal{P}$) needs a team to design a policy and implement it. For now, we assume that a team has two members, and that individual production is not possible..

The principal selects the team at date 0. Any team is indexed by a commonly known parameter $x \in [0, 1]$, measuring the conflict of interest between the members. A team with perfectly aligned member interests has $x = 0$, and the degree of internal discord increases in x. We assume that there are a large number of teams, so $\mathcal{P}$ has unrestricted choice, and can choose x optimally to maximise ex ante expected payoff. A team is selected once and for all, i.e., $\mathcal{P}$ cannot change his team at any point once it has been chosen.

At date 1, each member decides how much effort to put in towards technique proposition. A proposal can be of low or high quality (q), with $q = 0$ for a low quality proposal, and $q = 1$ for a high quality proposal.[8] Higher effort by a member raises the probability that her proposal is of high quality. A member can choose any effort level e from an interval $[0, \bar{e}]$. For any such e, $p(e)$ is the probability her proposal is of high quality, and $\alpha c(e)$

[7] Many other authors have asked, though from very different perspectives, when team production, or joint task assignment, is part of an optimal job design (see, e.g., Che and Yoo (2001) for an interesting recent contribution). To our knowledge, the study of teamwork in relation to endogenous interest conflicts between members is novel.

[8] All qualitative results readily extend to situations where the quality variable is not binary.

is the cost she bears, where $\alpha \in (0, \infty)$. We make the following standard assumptions. $p(.)$ is twice continuously differentiable, strictly increasing and strictly concave on $[0, \overline{e}]$, with $p(0) = 0$, $p(\overline{e}) = 1$, and $\lim_{e \uparrow \overline{e}} p'(e) = 0$. $c(.)$ is twice continuously differentiable, strictly increasing and strictly convex on $[0, \overline{e}]$, with $c(0) = 0$, $\lim_{e \downarrow 0} c'(e) = 0$, and $\lim_{e \uparrow \overline{e}} c(e) > M$, for any positive M.[9]

Proposal qualities are realised at date 2. $\mathcal{P}$ selects one of the proposals, and the member whose proposal is selected is given 'control' of the project. She therefore acts as the Controller ($\mathcal{C}$), and the other member works as the Subordinate ($\mathcal{S}$).[10]

Let the quality of the selected proposal be q. At date 3, each member has to decide whether to put in high ($a = 1$) or low ($a = 0$) effort in project implementation. Low effort is costless, while high effort costs any member k. Suppose implementation effort choices of members i and j are a_i and a_j respectively. Define a function $g(a_i, a_j) = g(a_i + a_j)$ which takes the following values: $g(0) = 0$, $g(1) = 1$, $g(2) = 1 + A_T$, where $A_T \geq 0$.

Gross payoffs are realised at date 4. The principal's payoff is $qg(a_i + a_j)$. A_T is therefore a measure of the benefit to the principal from 'cooperation' between the members at the implementation stage. The members' gross payoffs are given below.[11]

$$\mathcal{C} : q(a_i + a_j)$$

$$\mathcal{S} : (1 - x)q(a_i + a_j)$$

Gross member payoff, for $q > 0$, (and, for the subordinate, for $x < 1$), is increasing in own implementation effort. Moreover, each member is worse off when her partner executes the project than when she herself does, ceteris paribus, with the extent depending on the value of x. Thus, x is also a measure of the benefit a member gets from control.[12]

[9] These assumptions are stronger than necessary for our results, and are made for analytical simplicity.

[10] Implicitly, we assume that only the proposer of the selected technique is able to implement the project using that technique, or at least that the proposer is a more effective executor. See Section 3.5 for a discussion of this assumption.

[11] Qualitative results are unchanged if the controller's payoff is instead an increasing function of x, as long as it is not too sharply increasing. See Assumption 2 below, and the discussion in Section 3.5.

[12] The assumption that the principal's payoff is driven by the function g, while member payoffs are linear in total effort, is made largely for simplicity, and is discussed further below in Section 3.5.

We assume that k, the cost of high implementation effort, is the realisation of a random variable which is distributed over [0, 1] according to a distribution function F, which is continuous and strictly increasing. The realisation occurs at the beginning of date 3.[13]

We suppose that the principal has no access to contractual remedies to the free-riding problems. In other words, key variables (degree of conflict, proposal qualities, control assignment, and final payoffs) are unverifiable by those outside the organisation.[14,15] This assumption is examined below in Section 3.5.

We now analyse this model to determine effort choices at the project implementation stage (date 3), and also at the technique proposition stage (date 1). Our interest is to determine $\mathcal{P}$'s date 0 team selection decision: does he prefer a harmonious team with a consensual style of operation ($x = 0$), or does he prefer one with internal conflict ($x > 0$)?

The timeline is given in Figure 1.

[Figure 1 about here]

3 Analysis

We use backward induction to analyse the model. We first study member effort choices at the proposal implementation stage and then consider the principal's proposal selection problem. Following that, we examine the investment choices of the members at the technique proposition stage and, finally, we investigate the principal's team selection decision.

3.1 Implementation effort choices by the members

Consider a team with the level of internal conflict given by x. Suppose at the beginning of date 3 the quality of the selected proposal is $q_s \in \{0, 1\}$, and the cost of high implementation effort for any member is $k \in [0, 1]$.

[13]The assumption that the costs of implementation effort for different members are perfectly correlated simplifies the analysis, but is otherwise unnecessary. With ex ante member symmetry, our results hold as long as these costs are independent of the profile of proposition qualities.

[14]Additionally, monetary transfers may not feasible because of credit constraints, or because member choices are insensitive to transfers due to infinite risk-aversion.

[15]We also rule out any possibility of such problems being mitigated through reputational mechanisms.

If $q_s = 0$, clearly no member takes high effort. The principal then earns 0 payoff, as do the members, excluding any cost borne while exerting effort at date 1. Suppose therefore $q_s = 1$. Consider first the effort choice problem of the controlling member. $\mathcal{C}$ takes high effort if and only if $k \leq 1$, which is always true.

Now consider the effort choice problem of the subordinate member. $\mathcal{S}$ takes high effort if and only if $k \leq 1 - x$. Thus, $\mathcal{S}$ takes high effort only when the cost is sufficiently low. Moreover, the cut-off level of the cost below which $\mathcal{S}$ takes high effort is decreasing in x. In other words, higher is the conflict of interest between the members, less likely is $\mathcal{S}$ to take high effort. Hence, a team with higher internal conflict produces a lower level of total implementation effort in expected terms. In essence, increased conflicts of interest lowers team cooperation at the project implementation stage.

We summarise these results below.

Conclusion 1 *For any $x \in [0, 1]$, if q_s, the quality of the selected project execution technique, is 0, no member takes high implementation effort. If $q_s = 1$, then if $k \leq (1 - x)$, both members take high effort. Otherwise, if $k \in ((1 - x), 1]$, only the controlling member takes high effort.*

$\mathcal{P}$ of course prefers that both members take high effort. But when $x > 0$, if k sufficiently high, both members will not take high effort. So when $q_s = 1$, if $k > 1 - x$, $\mathcal{P}$'s payoff is 1, while if $k \leq 1 - x$, $\mathcal{P}$'s payoff is $(1 + A_T)$. Given these effort choices, we now study $\mathcal{P}$'s selection problem.

3.2 Proposal selection by the principal

Suppose, given the two members' proposals, $\mathcal{P}$ selects member i's proposal with quality q_i. We use Conclusion 1 to derive the payoffs.

If $q_i = 0$, $\mathcal{P}$ earns 0 payoff, as do the members, excluding date 1 effort costs. If $q_i = 1$, expected payoffs at the end of date 2 are

$$\mathcal{C} \text{ (member } i\text{)}: \; C(x) = [1 + F(1 - x)] - \overline{k}, \text{ where } \overline{k} = E(k). \tag{1}$$

$$\mathcal{S} \text{ (member } j\text{)}: \; S(x) = (1 - x)[1 + F(1 - x)] - \overline{k}^x, \text{ where } \overline{k}^x = \int_0^{1-x} y dF(y). \tag{2}$$

$$\mathcal{P}\colon\ \widehat{P}(x) = 1 + A_T F(1-x) \tag{3}$$

Therefore, if $q_i = q_j$, $\mathcal{P}$ is indifferent between the two proposals, and we assume he chooses one by uniform randomisation. On the other hand, if $q_i \neq q_j$, then $\mathcal{P}$ chooses the higher quality proposal, irrespective of the extent of internal conflict in the team.

3.3 Member investment decisions at the technique proposition stage

At date 1, each member chooses an effort level $e \in [0, \bar{e}]$, with higher effort raising the probability of generating a high quality proposal. Since the members are symmetric at this stage, we study the symmetric equilibrium of this effort choice game, given the payoffs induced by the profile of realised qualities of the members' proposals.

Higher effort by a member, while costly, increases the probability that a high quality proposal is available for implementation by the team, and also the probability that she is the controlling member at the implementation stage. The former effect is always beneficial, as the member's payoff from date 2 onwards is 0 if all proposals are of low quality. The latter effect is beneficial provided members prefer being the controller. Define the function $B(x) \equiv C(x) - S(x)$, where $C(x)$ and $S(x)$ are respectively given by (1) and (2). $B(x)$ is the benefit of being the controller.

Using (1), we see that $C(x') - C(x) = F(1-x') - F(1-x) > 0 \Leftrightarrow x > x'$

So, the controller's payoff is strictly decreasing in x. This is because the total expected team implementation effort decreases as conflicts of interest rise, while the controller always puts in high effort. Further, using (1) and (2), we have

$$S(0) = C(0) = 2 - \bar{k}, \text{ so } B(0) = 0, \text{ and } B(1) = C(1) = 1 - \bar{k} > S(1) = 0$$

Given a high quality proposal, the payoffs of the subordinate and the controller are the same at the implementation stage, if $x = 0$. On the other hand, if $x = 1$, the subordinate gets 0 payoff at the implementation stage, while the controller gets a positive payoff. Thus, since $F(.)$ is continuous, there is always an open interval of x such that $B(x)$ is positive and increasing on that interval. But does a member always prefer being the controller, for any x? As the following example shows, $B(x)$ is not necessarily always positive.

Example 1 *Suppose $x = 0.5$. Let C and S respectively denote the expected payoffs of the controller and the subordinate at date 3. Define $F(y)$ as follows:*

$$F(y) = \{ \begin{array}{c} \frac{y}{b}, \text{ if } y \leq \frac{b}{b+1} \\ by - (b-1), \text{ if } y \geq \frac{b}{b+1} \end{array}, \text{ with } b > 1, \text{ and } b \text{ finite}$$

Then, $\overline{k} = \frac{b}{b+1}$, and $\overline{k}^x(x = 0.5) = \frac{1}{8b}$. We thus have, at $x = 0.5$, $C < S \Leftrightarrow 4b^2 - 7b$ $-3 > 0$, which is always true for large enough b.

We shall assume that $B(x)$ is positive whenever x is positive. We have *Assumption* 1:

$$x[1 + F(1-x)] > (\overline{k} - \overline{k}^x), \text{ for all } x > 0.$$

Hence, for any $x > 0$, $B(x) > 0$, and so any member always prefers to be the controller. Now, given x, what effort level does a member choose at date 1?

Suppose member j chooses effort e_j. Then, member i chooses effort e_i to maximise

$$U_T(e_i, e_j; x) = p(e_i)p(e_j)[\frac{C(x) + S(x)}{2}] + p(e_i)[1-p(e_j)]C(x) + [1-p(e_i)]p(e_j)S(x) - \alpha c(e_i)$$

If both member proposals are of low quality, gross payoff is 0. If both members generate high quality proposals, then $\mathcal{P}$ chooses one of them randomly to be the controller. Hence, with probability $p(e_i)p(e_j)$, i obtains expected payoff $\frac{C(x)+S(x)}{2}$. If only i generates a high quality proposal, she becomes the controller, and gets expected payoff $C(x)$, while she becomes the subordinate with expected payoff $S(x)$ if only j generates a high quality proposal. Rewriting the above, we have

$$U_T(e_i, e_j; x) = p(e_j)S(x) + p(e_i)[p(e_j)\frac{B(x)}{2} + \{1 - p(e_j)\}C(x)] - \alpha c(e_i)$$

Since $B(x) > 0$, by Assumption 1, and $C(x) > 0$, an interior solution to i's maximisation problem exists for all e_j and x, under the assumptions imposed on $p(.)$ and $c(.)$ earlier. The first order condition is

$$p'(e_i)[p(e_j)\frac{B(x)}{2} + \{1 - p(e_j)\}C(x)] = \alpha c'(e_i) \tag{4}$$

The second order conditions are easily seen to be satisfied. Let $\widehat{e}(x)$ be the symmetric equilibrium effort choice by the members at date 1. Using (4), and imposing symmetry, we find that $\widehat{e}(x)$ is the solution to the following equation.

$$p'(e)[p(e)\frac{B(x)}{2} + \{1 - p(e)\}C(x)] = \alpha c'(e) \tag{5}$$

The right hand side of (5) is strictly increasing in e. For the left hand side, recall, whenever $x < 1$, $C(x) > B(x)$. Thus, $C(x) > \frac{B(x)}{2}$, for all x. Hence, for given x, $p(e)\frac{B(x)}{2}$ + $\{1 - p(e)\}C(x)$ is strictly decreasing in e. Since $p(.)$ is strictly concave, the left hand side is strictly decreasing in e. $\widehat{e}$ is therefore unique.

We summarise the above results.

Conclusion 2 *Given Assumption 1, a unique interior symmetric equilibrium exists in the technique proposition game. Given x, equilibrium effort $\widehat{e}(x)$ solves (5).*

3.4 Team selection

We first investigate the principal's expected payoff at the beginning of date 1. At this stage, the team has already been selected, so the value of x is given. Suppose the probability that at least one member proposal is of high quality is denoted as $\Phi(x)$. Clearly

$$\Phi(x) = 1 - [1 - p(\widehat{e}(x))]^2 \tag{6}$$

Let $\mathcal{P}$'s expected payoff, given x, be $P(x)$. Then, using (3) and (6),

$$P(x) = \Phi(x)\widehat{P}(x) = [1 - \{1 - p(\widehat{e}(x))\}^2][1 + A_T F(1 - x)] \tag{7}$$

We now study the principal's choice of optimal team structure. Our interest is in understanding whether $\mathcal{P}$ wants a consensual team with $x = 0$, or whether he may prefer one with some degree of internal tension. With a high quality project, raising x causes losses ex post at the implementation stage, because of lower expected implementation effort by the subordinate. Hence, a higher x tends to lower the principal's payoff.

At the implementation stage however, a higher x, while it lowers the benefit accruing to the controller conditional on the project being of high quality, can raise the benefit to a member from being the controller relative to being the subordinate. This will happen if the decline in the value of being the controller, $C(x)$, resulting from a higher x, is lower than the decline in the value of being the subordinate, $S(x)$. If so, a higher x can increase the competition between members for control at date 1, when members choose effort towards generating proposals. Since the probability of obtaining control is increasing in a member's own effort towards technique proposition, a higher x may raise effort levels at date 1. Thus, a higher x can raise ex ante effort, while reducing ex post effort. This trade-off then helps determine $\mathcal{P}$'s optimal choice of x.

To study this problem, we first investigate whether raising x can in fact raise ex ante equilibrium effort $\widehat{e}$. For simplicity, we shall assume henceforth that $F(.)$, in addition to being continuous and strictly increasing, is differentiable on [0, 1], with the density denoted by $f(.)$. Using Conclusion 2, we have from (5)

$$\widehat{e}'(x) = \frac{p'(\widehat{e})[p(\widehat{e})\frac{B'(x)}{2} + \{1 - p(\widehat{e})\}C'(x)]}{\alpha[c''(\widehat{e}) - \frac{c'(\widehat{e})p''(\widehat{e})}{p'(\widehat{e})} + \frac{\{p'(\widehat{e})\}^2}{\alpha}\{C(x) - \frac{B(x)}{2}\}]} \tag{8}$$

The denominator of the fraction above is strictly positive. Therefore,

$$\widehat{e}'(x) > 0 \Longleftrightarrow p(\widehat{e})\frac{B'(x)}{2} + \{1 - p(\widehat{e})\}C'(x) > 0$$

Since $C'(x) < 0$, raising x has a tendency to reduce ex ante effort of a member, because of a conflict effect: greater conflict lowers the payoff to a member, and diminishes the incentive to generate high quality proposals. Indeed, we see that if $B'(x) < 0$, $\widehat{e}'(x) < 0$, i.e., if at some x the benefit of control to a member is decreasing in x, equilibrium ex ante member effort is also decreasing in x. When $B'(x) < 0$, an increase in x raises the value to a member of being the subordinate relative to being the controller, and hence leads the member to choosing a lower effort at date 1. Now, since $B(0) = 0$, and $B(1) > 0$, there is always an open interval of x such that $B'(x) > 0$ on that interval. But is the benefit of being the controller always increasing in x? As the following example shows, $B(x)$ is not always monotone on [0, 1]. Recall, using (1) and (2), we have

$$B(x) = x[1 + F(1 - x)] - \int_{1-x}^{1} y dF(y)$$

The first term is the expected total effort multiplied by the conflict parameter, while the second is the extra expected effort cost incurred by the controller. Thus

$$B'(x) = 1 + F(1-x) - f(1-x) \tag{9}$$

Example 2 *Let $z \in [0,\ 1]$, and suppose $F(z) = (1-\beta)z^2 + \beta z$, so $f(z) = F'(z) = 2(1 - \beta)z + \beta$. $F(0) = 0$, and $F(1) = 1$. For $\beta \in [0,\ 2]$, we see that $f(z) \geq 0$, $\forall z \in [0,\ 1]$. Assume then $\beta \in [0,\ 2]$, and suppose k, the cost of implementation effort, is distributed according to F.*

We have from (9)

$$B'(x) \geq 0 \Leftrightarrow (1-\beta)x^2 + \beta(1-x) \geq 0$$

Hence, if $\beta \in [0,\ 1]$, $B'(x) \geq 0$, for all $x \in [0,\ 1]$, with strict equality if $x \in (0,\ 1)$. But suppose $\beta \in (1,\ 2]$. Then at $x = 1$, using (9),

$$B'(x) = 1 - \beta < 0$$

So with $\beta \in (1,\ 2]$, $B'(x) < 0$, for x sufficiently close to 1.

Suppose at some $x > 0$, $B'(x) < 0$. Such a value of x cannot be optimal for the principal, as, by reducing x, he can increase $\widehat{e}(x)$, and therefore $\Phi(x)$ (from (6)), and also increase $\widehat{P}(x)$ (from (3)). At the same time, $B'(x)$ must be strictly increasing on some open interval. We shall assume therefore that $B(x)$ is always increasing in x. We have

Assumption 2:

$$1 + F(1-x) \geq f(1-x), \text{ for all } x.$$

Observe that Assumption 2 implies Assumption 1. We find now from (8) that with $B'(x) > 0$, $\widehat{e}(x)$ can increase with x, because of a control effect: greater conflict raises the value of being the controller relative to being the subordinate, and hence has a tendency to increase ex ante member effort. Such an increase will take place only if $p(\widehat{e}(x))$, and hence $\widehat{e}(x)$, is sufficiently large, since $C'(x) < 0$, i.e., if the control effect dominates the conflict effect. When is $\widehat{e}(x)$ 'sufficiently large'? Now, we know from (8) that, given Assumption 2, for $p(\widehat{e})$ sufficiently close to 1, $\widehat{e}'(x) > 0$, and that for $p(\widehat{e})$ sufficiently close to 0, $\widehat{e}'(x)$

< 0. But we see from (5) that $\widehat{e}(x;\,\alpha)$ is decreasing in α, which is positive by assumption. Further, as $\alpha \to 0$, $\widehat{e}(x;\,\alpha)$ becomes arbitrarily close to $\overline{e}$, for any x, since $c(.)$ is strictly convex and increasing, with $c(\overline{e})$ large. Hence, as $\alpha \to 0$, $p(\widehat{e}(x))$ approaches 1. Conversely, as $\alpha \to \infty$, $\widehat{e}(x;\,\alpha)$ approaches 0, for any x, since $c(.)$ is strictly convex and increasing, with $c(0) = 0$. Hence, as $\alpha \to \infty$, $p(\widehat{e}(x))$ becomes close to 0. We have shown

Lemma 1 *Given Assumption 2, for sufficiently small* α, $\widehat{e}'(x) > 0$*, for all* x*.*

We shall assume henceforth that equilibrium date 1 member effort is increasing in x. *Assumption* 3:

$$\alpha \text{ is sufficiently small, so that } \widehat{e}'(x) > 0, \text{ for all } x^{16}.$$

When the cost of technique proposition is high (α is large) then, if $\widehat{e}'(x) < 0$, for some $x > 0$, such an x cannot be an optimal choice for the principal, as discussed earlier. Why is $\widehat{e}'(x) < 0$ when α is large? With high α, member net payoff is low, and the marginal cost of date 1 effort is high. Moreover, $C(x)$ and $S(x)$ are both declining in x. Hence ex ante competition for control between members is weakened by an increase in x, as the lower overall benefit makes higher effort at such a high cost unattractive to a member, i.e., the conflict effect dominates.

We now examine $\mathcal{P}$'s choice problem, which can be written using (7) as

$$\max_x P(x) = [1 - \{1 - p(\widehat{e}(x))\}^2][1 + A_T F(1-x)]$$

Let the principal's optimal x be denoted as x^*. We have

Proposition 1 *Given Assumptions 2 and 3,* $x^* > 0$ *if* A_T *is sufficiently small. If* $\widehat{e}'(x)$ *is everywhere negative,* $x^* = 0$*.*

Proof. Since $P(.)$ is differentiable on [0, 1], a solution exists to $\mathcal{P}$'s maximisation problem. Also, $P(0)$ is positive. The first order condition is

$$P'(x) = 2[1 - p(\widehat{e}(x))][1 + A_T F(1-x)]p'(\widehat{e}(x))\widehat{e}'(x) - A_T[1 - \{1 - p(\widehat{e}(x))\}^2]f(1-x)$$

Since Assumptions 2 and 3 are satisfied, $\widehat{e}'(0) > 0$. Further, as $A_T \to 0$,

$$P'(0) \to 2[1 - p(\widehat{e}(0))]p'(\widehat{e}(0))\widehat{e}'(0) > 0$$

Hence, given Assumptions 2 and 3, $x^* > 0$ if A_T is sufficiently small.

The second part follows as when $\widehat{e}'(x) < 0$, $P'(x) < 0$. ■

Recall, A_T is a measure of the gain to the principal when both members take high effort at the implementation stage relative to when only one member does, conditional on the implemented project being of high quality. So A_T is a measure of the benefit to $\mathcal{P}$ from ex post cooperation by the members. An increase in x reduces total expected effort from the subordinate at the implementation stage, and hence causes a loss to $\mathcal{P}$, with $\widehat{P}'(x) = -A_T f(1-x)$. If A_T is small, this loss is small as well.

The proposition shows therefore that it may be optimal for a leader to introduce conflicts of interest within his organisation to generate competition between members for control over jointly implemented projects. In introducing such conflicts, he has to trade off the benefit from the increased effort, if any, invested by members towards generating higher quality proposals with the loss stemming from lower cooperation between them at the implementation stage.

We end this subsection with an example.

Example 3 *Suppose $p(e) = e$, $\overline{e} = 1$ and $c(e) = \frac{e^2}{2}$. Although these functions violate some of the assumption made earlier, they are adequate for illustrative purposes. Suppose also $F(.)$ is the c.d.f of the uniform distribution, which is a special case of the class of distributions discussed in Example 2, with $\beta = 1$.*

We have, using (1), (2) and (9)

$$C(x) = \frac{3}{2} - x, C'(x) = -1, B(x) = \frac{x(2-x)}{2}, B'(x) = 1 - x$$

Using (5), we find

$$\widehat{e}(x; \alpha) = \frac{\frac{3}{2} - x}{\alpha + \frac{1}{4}(x^2 - 6x + 6)}$$

while using (8), we know

$$\widehat{e}'(x) > 0 \Leftrightarrow \widehat{e}(x)(\frac{1-x}{2}) - [1 - \widehat{e}(x)] > 0$$

So,

$$\widehat{e}(0) = \frac{\frac{3}{2}}{\alpha + \frac{3}{2}} \in (0,1) \textit{ and } \widehat{e}'(0) > 0 \Leftrightarrow \frac{\frac{3}{2}}{\alpha + \frac{3}{2}} > \frac{2}{3} \Leftrightarrow \alpha < \frac{3}{4}$$

Hence, whenever $\alpha \in (0, \frac{3}{4})$*, if* A_T *is sufficiently small,* $x^* > 0$*.*

3.5 Discussion

We now discuss some of the assumptions, as well as related literature. It should be noted that Assumptions 2 and 3 are stronger than necessary. To see that, observe that the main result, that $\mathcal{P}$ may choose $x > 0$, holds whenever $P'(0) > 0$. As long as A_T is sufficiently small, this obtains if $\widehat{e}'(0) > 0$, a necessary condition for which is $B'(0) > 0$. Hence, Proposition 1 will continue to hold if Assumptions 2 and 3 are weakened, as long as $B'(0) > 0$, i.e., whenever the additional benefit of control is increasing in the degree of conflict at low conflict levels.

In deriving our results, we used some simplifying assumptions with relation to gross payoffs at the implementation stage. Recall that conditional on the quality of the selected proposal being high, the controller's payoff is $(a_C + a_S)$, and the subordinate's payoff is $(1 - x)(a_C + a_S)$, where a_C and a_S are respectively the implementation effort choices of $\mathcal{C}$ and $\mathcal{S}$. It is easy to show that all qualitative results hold even if $\mathcal{S}$'s payoff is not linear in x, as long as it is strictly decreasing in x. Further recall that the principal's payoff at this stage is $g(a_C + a_S)$. Assuming 'linearity' of member payoff functions simplifies the analysis, but is not necessary. Indeed, suppose instead that the respective payoffs of $\mathcal{C}$ and $\mathcal{S}$ at this stage are $g(a_C + a_S)$ and $(1 - x)g(a_C + a_S)$. We can show then that, as long as $B'(0) > 0$, and α is sufficiently small, $x^* > 0$ whenever A_T is small, provided k never exceeds A_T.[17,18]

[17] If k is allowed to exceed A_T, our results may still hold, but the analysis is complicated by the potential non-uniqueness of equilibrium in the implementation effort choice game.

[18] Any member's ex ante net expected payoff may increase in the degree of conflict at $x = 0$ due to the mitigation of the free-riding problem in spite of the decline in payoffs at the implementation stage. If not, and if the ex ante reservation payoff is substantially greater than 0, i.e., if the relationship holds very little surplus for the members, then the principal may choose not to introduce conflict if the gain from doing so is outweighed by the loss from having to give the agents a higher fixed transfer.

The basic model assumed for simplicity that the controller's effort (at the implementation stage) is unaffected by the degree of conflict. The qualitative results continue to hold however in the absence of such a restriction. To see that, consider a simple generalisation of the basic model. Let the controller's and the subordinate's payoffs be

$$\mathcal{C} : h_C(x)q(a_i + a_j); \mathcal{S} : h_S(x)q(a_i + a_j)$$

Let $h_S^{'}(x) < 0$, $h_C^{'}(x) > 0$, $h_S(0) = h_C(0) = \underline{h} > 0$, $h_S(1) = 0$, $h_C(1) = \overline{h}$. In the basic model, $h_C(x) = 1$, $h_S(x) = 1 - x$. We find after some algebra that the expected total implementation effort, which we denote by $E(x)$, is

$$E(x) = F(h_C(x)) + F(h_S(x))$$

$$\text{so } E'(x) < 0 \Leftrightarrow f(h_C(x))h_C^{'}(x) + f(h_S(x))h_S^{'}(x) < 0$$

The above condition always holds if $h_C^{'}(x) = 0$, as in the basic model, but certainly can quite easily continue to be true even if $h_C^{'}(x) > 0$. If we specialise this further and impose $h_C(x) + h_S(x) = 1$, we find

$$E'(x) < 0 \Leftrightarrow f(h_C(x)) < f(h_S(x))$$

Again, we find that the conflict effect can certainly continue to be present, though a condition is required on the distribution function. Essentially, all we need for the results is that $B'(0) > 0$, which is guaranteed by Assumption 2.

The idea behind our structural theory of control is that greater conflict can raise the marginal value of control. In our model, control is assigned unitarily, and can act as a reward for superior policy proposition. Although this is a reasonable assumption in many settings, one can think of organisational situations where ex post control is structurally dispersed amongst different members. It can be shown in our environment that such structural dispersion can dampen effort towards technique proposition by increasing members' free-riding incentives. Similar issues also arise when any member is capable of acting as the controller for another member's proposal, or when members can learn from each others' proposals: weakening the link between proposal quality and control assignment can diminish ex ante effort incentives, and thereby harm the principal. Similarly, it is important that $\mathcal{P}$ be able to commit to not changing the team after the proposition stage, as any potential incentive benefit resulting from internal conflict can arise only in such a setting. The organisation's capacity to guarantee adherence to such an ex post inefficient rule may be higher if there is a history of coherent existence and an established concern for future continuance, enabling it to establish and maintain reputation. Frequency of decision episodes, internal information flow and transparency of organisational decision-making, presence of other organisations providing similar services, outside options for organisational members, processes generating ingress and egress of participants, internal structures affecting the cohesion of the organisation, etc. may be some of the other factors influencing the ability of the organisation to provide firm commitments.

The theory of control in organisations developed above was situated in an environment which ruled out contractual remedies to the free-riding problems. The assumption that key variables like the degree of conflict, proposal qualities, control assignment, and final payoffs are unverifiable by outsiders may be reasonable when organisations are repositories of privileged information, making it quite difficult to write contracts conditioned on such variables.[19] In addition, in certain contexts, even if these variables were contractible, it is not clear that the principal would want to disclose information to third parties which would make contracts enforceable. Such considerations may arise from a government's unwillingness to reveal what it regards as state secrets or administrative privilege, a firm's desire to prevent details of internal strategies from potentially leaking to competitors, etc.

The relationship between conflict and control has also been examined by Aghion and Tirole (1997) and Banerjee (2007, 2008). These papers show that a principal may choose to cede control to a subordinate with whom he has a conflict of interest, in situations with bilateral moral hazard. These articles make similar contractability assumptions as ours, but do not share our focus on the competition for control between members.[20] While the complete noncontractability assumption is extreme, the notion of control may in general be

[19] Clearly, such a noncontractability assumption is not permissible in all contexts. For example, in the model constructed by Dewatripont and Tirole (1999), decisions internal to the organisation are verifiable, leading to the possibility of using decision-based rewards in order to induce advocacy. Such considerations are important in many settings, such as the justice system. There is no role, however, for the provision of control in their scenario.

[20] In somewhat different environments, Dessein (2002), Li and Suen (2004) and Dur and Swank (2005) also analyse, using similar contractability assumptions, a principal's decision to delegate authority to a single agent.

vacuous with full contractability, as Rajan and Zingales (1998) and Aghion, Dewatripont and Rey (2004) point out. A potentially interesting question for further research is the issue of control allocation among multiple members in the presence of partial contractability, in the sense of Aghion, Dewatripont and Rey (2002).

The possibility of control, as modelled above, has been visualised as a technological datum. In these situations, the assignment of control can be used as a reward for superior policy design, and hence for effort. This reward is valuable only when there are conflicts of interest between members. In settings where unitary assignment of control is technologically impermissible, team composition, of the form discussed in this essay, may not be of much help in resolving incentive problems. However, in more accommodating environments, there may be an incentive to create opportunities for control allocation through, for example, modification of job or authority structure. We leave an examination of the endogenous creation of structural control for future work.

4 Teams versus individual projects

The previous section showed that introducing conflicts could be beneficial when the project is jointly executed. In some situations however, there may be avenues for uncoupling different elements of the project, or disaggregating it into smaller projects. If a single member is capable of performing such a smaller project by designing and implementing a proposal, $\mathcal{P}$ has to decide between team and individual production.

To study this problem, we augment the model as follows. At date 0, $\mathcal{P}$ selects a two member team, but then decides whether to keep them as a team, or to use them as individual operators. If he decides on team production, the problem is as analysed before.

Suppose however $\mathcal{P}$ chooses individual production. Each member then chooses effort towards technique proposition at date 1. Since members perform individually, each member has control of her own project, irrespective of the profile of proposal qualities. Members choose implementation effort at date 3, after observing the cost of effort, and gross payoffs are realised at date 4. Let the realised quality of member i's proposal be q_i. Then, each member's gross payoff is $q_i a_i + q_j a_j$, as earlier.

When the cost of effort is k, member i takes high effort if and only if $q_i \geq k$, i.e., a member takes high effort if and only if her proposal is of high quality. The payoffs at the end of date 2 for $\mathcal{P}$ and members i and j, as functions of the realised proposal qualities, are defined in the following table, where $\overline{k} \in (0, 1)$ is the expected cost.

	$\mathcal{M}_i$	$\mathcal{M}_j$	$\mathcal{P}$
$q_i = q_j = 0$	0	0	0
$q_i = 1, q_j = 0$	$1 - \overline{k}$	1	1
$q_i = 0, q_j = 1$	1	$1 - \overline{k}$	1
$q_i = q_j = 1$	$2 - \overline{k}$	$2 - \overline{k}$	$1 + A_S$

Since the members act independently, their payoffs are unaffected by the degree of conflicts of interest. The marginal benefit to $\mathcal{P}$ from both members putting in high effort relative to only one of them putting in high effort is A_S. In the analysis we shall focus on the impact on ex ante effort incentives of team vis-à-vis individual production, and so we put $A_T = A_S = 0$. Our results will continue to hold as long as A_T and A_S are sufficiently small. For now, we also assume that if $\mathcal{P}$ wishes to engage a team, he can either choose one with $x = 0$ (a perfectly consensual team), or with $x = 1$ (maximal conflicts of interest).

Given $\mathcal{P}$'s date 0 choice therefore, what is the expected payoff to $\mathcal{M}_i$ from choosing effort e_i, given that $\mathcal{M}_j$ has chosen effort e_j? When $\mathcal{P}$ has decided in favour of individual production, $\mathcal{M}_i$ chooses effort level e_i to maximise

$$U_S(e_i, e_j) = p(e_i)(1 - \overline{k}) + p(e_j) - \alpha c(e_i) \tag{10}$$

And so using (10) the optimal effort level is given by

$$\widetilde{e} : L_S(e) = \alpha c'(e), \text{ where } L_S(e) = p'(e)(1 - \overline{k}) \tag{11}$$

The assumptions on $p(.)$ and $c(.)$ ensure there is a unique interior solution $\widetilde{e}$. $L_S(e)$ is the marginal benefit of effort to a member given individual production, where $1 - \overline{k}$ is the extra payoff to a member from a high quality proposal.

We now study team production. Suppose $\mathcal{P}$ has chosen a team with internal conflicts x. Let $\widehat{e}(x) \equiv \widehat{e}_x$ be the optimal effort level chosen by the members in a symmetric equilibrium. We know from earlier a unique symmetric equilibrium exists, and have

$$\widehat{e}_x : L_x(e) = \alpha c'(e), \text{ where } L_x(e) = p'(e)[p(e)\frac{B(x)}{2} + \{1 - p(e)\}C(x)]$$

$L_x(e)$ is the marginal benefit from effort given a team with the level of conflicts of interest given by x. Suppose first $x = 0$. Then

$$\widehat{e}_0 : L_0(e) = \alpha c'(e), \text{ where } L_0(e) = p'(e)[1 - p(e)]C(0) \tag{12}$$

$C(0) = 2 - \overline{k}$ is the extra payoff a member obtains at the implementation stage from having a high quality proposal relative to having a low quality proposal, given the other member has a low quality proposal. Now suppose $x = 1$. We know

$$\widehat{e}_1 : L_1(e) = \alpha c'(e), \text{ where } L_1(e) = p'(e)[1 - \frac{p(e)}{2}]C(1) \tag{13}$$

$C(1) = 1 - \overline{k}$ is the extra payoff a member obtains at the implementation stage from having a high quality proposal relative to having a low quality proposal, when either the other member has a low quality proposal or has a high quality proposal but does not get control. We see that $L_S(e)$, $L_0(e)$ and $L_1(e)$ are all strictly decreasing in e. Moreover,

$$L_0(0) \geq L_S(0) = L_1(0), \text{ and } L_0(\overline{e}) = L_S(\overline{e}) = L_1(\overline{e}) = 0, \text{ since } p(0) = 0 \text{ and } p'(\overline{e}) = 0$$

Further, for $e \in (0, \overline{e})$, using (11) and (13),

$$L_S(e) - L_1(e) = p'(e)\frac{p(e)}{2}(1 - \overline{k}) > 0$$

We see that the marginal benefit from high effort towards technique proposition to a member in a team with $x = 1$ is lower than her marginal benefit when she operates individually, and so $\widetilde{e} > \widehat{e}_1$. Hence $\mathcal{P}$ prefers individual to team production when $x = 1$.

Suppose now $\mathcal{P}$ wishes to have team production. Does he prefer to have a consensual team, or one with high internal conflicts? Notice, for $e \in (0, \overline{e})$, using (11) and (12),

$$L_0(e) - L_1(e) = p'(e)[1 - p(e)(\frac{3 - \overline{k}}{2})] \geq 0 \Leftrightarrow p(e) \leq \frac{2}{3 - \overline{k}}$$

Since $\overline{k} \in (0, 1)$, for every $\overline{k}$, there exists $\widehat{e}_{01} \in (0, \overline{e})$, and $\widehat{\alpha}_{01} \in (0, \infty)$, such that

$$p(e) \leq \frac{2}{3 - \overline{k}} \Leftrightarrow e \leq \widehat{e}_{01}, \text{ and } L_0(\widehat{e}_{01}) = L_1(\widehat{e}_{01}) = \widehat{\alpha}_{01} c'(\widehat{e}_{01})$$

So, when α is large, and $\alpha > \widehat{\alpha}_{01}$, $\widehat{e}_1 < \widehat{e}_0 < \widehat{e}_{01}$, $\mathcal{P}$ prefers to have a consensual team. The converse is true when α is small, and $\alpha < \widehat{\alpha}_{01}$, because $\widehat{e}_1 > \widehat{e}_0 > \widehat{e}_{01}$.

What about the choice between having a perfectly consensual team, and having no team at all? We see, for $e \in (0, \overline{e})$,

$$L_0(e) - L_S(e) = p'(e)[1 - p(e)(2 - \overline{k})] \geq 0 \Leftrightarrow p(e) \leq \frac{1}{2 - \overline{k}}$$

With $\overline{k} \in (0, 1)$, for every $\overline{k}$, there exists $\widetilde{e}_0 \in (0, \overline{e})$, and $\widetilde{\alpha}_0 \in (0, \infty)$, such that

$$p(e) \leq \frac{1}{2 - \overline{k}} \Leftrightarrow e \leq \widetilde{e}_0, \text{ and } L_0(\widetilde{e}_0) = L_S(\widetilde{e}_0) = \widetilde{\alpha}_0 c'(\widetilde{e}_0)$$

Thus, when α is large, and $\alpha > \widetilde{\alpha}_0$, $\widetilde{e} < \widehat{e}_0 < \widetilde{e}_0$, $\mathcal{P}$ prefers to have a consensual team. Conversely, when α is small, and $\alpha < \widetilde{\alpha}_0$, $\widetilde{e} > \widehat{e}_0 > \widetilde{e}_0$, $\mathcal{P}$ prefers to have individual production. Furthermore, we know for any $e \in (0, \overline{e})$, $L_S(e) > L_1(e)$, and so, as seen in Figure 2, $\widetilde{e}_0 < \widehat{e}_{01}$.

[Figure 2 about here]

To summarise, if the choice is between having a team with no conflicts, a team with extreme conflicts, and no team at all, $\mathcal{P}$ never chooses a team with conflicts. The results show that whenever α is sufficiently large, $\mathcal{P}$ prefers a team with no conflicts to one with conflict, as well as to individual production. We have shown previously that when $\mathcal{P}$ was constrained to choose a team, he prefers to introduce conflicts of interest whenever α is sufficiently small. However, as shown above, when he is allowed to have individual production, he prefers to discard the team structure for small α, at least if he can only choose teams either with $x = 0$ or with $x = 1$.

Therefore, $\mathcal{P}$ prefers individual production if and only if $\alpha \leq \widetilde{\alpha}_0$. Compared to having a perfectly consensual team, either discarding the team structure in favour of individual production, or introducing conflicts of interest, have similar advantages, as they both reduce a member's incentive to free-ride on the other's effort towards technique proposition, and may increase the average quality of proposals. What are the advantages of having individual organisation over team production with conflicts of interest ($x > 0$)? The marginal benefit from taking effort towards technique proposition tends to be lower with a team organisation because of the free-riding problem. At the same time, the marginal benefit from taking effort towards technique proposition tends to be higher with a team organisation because of conjoint production at the implementation stage. The question that arises at this stage is whether $\mathcal{P}$ would ever prefer to have team rather than individual production when $\alpha \in (0, \widetilde{\alpha}_0)$. In other words, can $\mathcal{P}$ benefit from introducing conflicts of interest, given that he can always discard the team production structure, when α is small?

Given $\alpha < \widetilde{\alpha}_0$, we investigate this question when α is either in the neighbourhood of $\widetilde{\alpha}_0$ or in the neighbourhood of 0. While a necessary condition does not seem easily available, we can derive sufficient conditions. Let

$$l_{\widetilde{x}}(e) = l_x(e)|_{x=\widetilde{x}}, \text{ where } l_x(e) = \frac{\partial L_x(e)}{\partial x}$$

A sufficient condition for $\mathcal{P}$ to prefer a team with α in the neighbourhood of $\widetilde{\alpha}_0$ is

$$l_0(\widetilde{e}_0) > 0$$

For α sufficiently close to 0, similarly, a sufficient condition is

$$\text{either } \lim_{e \to \overline{e}} l_0(e) > 0, \text{ or } \lim_{e \to \overline{e}} l_1(e) < 0$$

We have

Proposition 2 *Suppose* $\alpha < \widetilde{\alpha}_0$.

(a) For $\widetilde{\alpha}_0 - \alpha$ *sufficiently small, the principal prefers to have team production if*

$$f(1) < \frac{2}{3 - 2\overline{k}}$$

(b) For α *sufficiently close to* 0*, the principal prefers to have team production if*

$$\textit{either } f(1) < 2, \textit{ or } f(0) > 1$$

Proof. (a) It suffices to show that

$$l_0(\widetilde{e}_0) > 0 \Leftrightarrow (3 - 2\overline{k})f(1) < 2$$

Recall, since

$$L_0(\widetilde{e}_0) = L_S(\widetilde{e}_0), \text{ we have } p(\widetilde{e}_0) = \frac{1}{2 - \overline{k}}$$

Also,

$$l_x(e) = p'(e)[p(e)V'(x) + \{1 - p(e)\}C'(x)] > 0 \Leftrightarrow p(e)V'(x) + [1 - p(e)]C'(x) > 0$$

Thus,

$$l_0(e) > 0 \Leftrightarrow p(e)[1 + \frac{f(1)}{2}] > f(1)$$

Hence,

$$l_0(\widetilde{e}_0) > 0 \Leftrightarrow 1 + \frac{f(1)}{2} > (2 - \overline{k})f(1) \Leftrightarrow (3 - 2\overline{k})f(1) < 2$$

(b) Suppose α is in the neighbourhood of 0. When is $\lim_{e \to \overline{e}} l_0(e) > 0$? Using the expression for $l_x(e)$ derived above, we have

$$\lim_{e \to \overline{e}} l_0(e) > 0 \Leftrightarrow 1 + \frac{f(1)}{2} - f(1) > 0 \Leftrightarrow f(1) < 2$$

Further, when is $\lim_{e \to \overline{e}} l_1(e) < 0$? We see

$$\lim_{e \to \overline{e}} l_1(e) < 0 \Leftrightarrow \frac{1 + f(0)}{2} - f(0) < 0 \Leftrightarrow f(0) > 1$$

■

Therefore, for $\alpha < \widetilde{\alpha}_0$, the principal may prefer to induce members to increase ex ante effort by forcing them to compete against each other for control, rather than organising production on an individual basis. Conflict can therefore lead to teamwork: competition for control within teams may make them better vehicles for resolving incentive problems than decoupled individual production. The following example illustrates.

Example 4 *Let $z \in [0,\, 1]$, and suppose*

$$F(z) = \begin{matrix} (1 - \frac{\mu}{4})z + \frac{\mu z^2}{2}, z \in [0, \frac{1}{2}] \\ -\frac{\mu z^2}{2} + (1 + \frac{3\mu}{4})z - \frac{\mu}{4}, z \in [\frac{1}{2}, 1] \end{matrix}$$

Then

$$f(z) = F'(z) = \begin{matrix} (1 - \frac{\mu}{4}) + \mu z, z \in [0, \frac{1}{2}] \\ (1 + \frac{3\mu}{4}) - \mu z, z \in [\frac{1}{2}, 1] \end{matrix}$$

It is clear that $f(.)$ is continuous for all $z \in [0, 1]$, and $F(0) = 0$, and $F(1) = 1$. Suppose $\mu \in (-4, 4)$. Then $f(z) > 0$, $\forall z \in [0, 1]$. Assume then $\mu \in (-4, 4)$, and suppose k, the cost of effort ex post, is distributed according to F. We see that

$$\overline{k} = E(k) = \frac{1}{2}; f(1) = f(0) = 1 - \frac{\mu}{4}$$

Then,

$$(3 - 2\overline{k})f(1) < 2 \Leftrightarrow f(1) < 1 \Leftrightarrow \mu > 0$$

It can also be easily be checked that $B'(x) > 0$ for $\mu \in [0, 2]$.

Further,

$$f(1) < 2 \Leftrightarrow \mu > -4$$

Thus, for $\mu \in (0, 4)$, the principal prefers to have team production for α sufficiently close to $\widetilde{\alpha}_0$, and also for α sufficiently close to 0.

5 Multi-member teams

In this section, we study whether teams with internal conflicts of interest will be chosen if each team consists of more than 2 members. For simplicity, we shall assume that $F(.)$ is differentiable and strictly increasing on [0, 1], and that individual production is not possible. In order to focus on the effect of $\mathcal{P}$'s choice on ex ante effort incentives, we further assume that $A_T = 0$. All results will continue to hold for A_T small enough.

The basic model is otherwise unchanged. Any team contains n ex ante symmetric members, with the level of internal conflict given by $x \in [0, 1]$. After team selection, members first decide on effort towards technique proposition. The quality of a proposal is q and can be 0 or 1. Once proposal qualities are realised, the principal decides which to select, or, equivalently, whom to assign control. Members then observe the cost of implementation effort k, and choose whether or not to put in high implementation effort.

Given k, if q_s, the quality of the selected proposal, is 0, no member takes high effort, while if $q_s = 1$, the controller takes high effort for all k, and a subordinate takes high effort if and only if $k \leq 1 - x$. Let $C_n(x)$ and $S_n(x)$ be the expected payoffs to a controller and a subordinate respectively at the beginning of date 3.

$$C_n(x) = [1 + (n-1)F(1-x)] - \overline{k} \tag{14}$$

$$S_n(x) = (1-x)[1 + (n-1)F(1-x)] - \overline{k}^x \tag{15}$$

$$B_n(x) = x[1 + (n-1)F(1-x)] - (\overline{k} - \overline{k}^x), \text{ where } B_n(x) = C_n(x) - S_n(x) \tag{16}$$

Assume that $B_n(x) > 0$. At date 2, if a single proposal has $q = 1$, it is selected. Otherwise, one of the available proposals with highest quality is chosen at random. Thus, if a member's proposal quality is 0, her date 3 payoff is $q_s S_n(x)$, where q_s is the quality of the selected proposal. Suppose her proposal quality is 1, and let r be the number of other members with high quality proposals. Her expected payoff is then

$$\frac{1}{r+1} C_n(x) + \frac{r}{r+1} S_n(x) \tag{17}$$

At date 1, each member chooses an effort level $e \in [0, \overline{e}]$ towards generating a proposal. We study the symmetric equilibrium of this effort choice game. The equilibrium, denoted as $\widehat{e}_n(x)$, is given by, using (14) through (17),

$$L(e; n, x) = \alpha c'(e), \text{ where } L(e; n, x) = p'(e) J(e; n, x) \tag{18}$$

$$\text{and } J(e; n, x) = [1 - p(e)]^{n-1} C_n(x) + [1 - np(e)\{1 - p(e)\}^{n-1} - \{1 - p(e)\}^n] \frac{B_n(x)}{np(e)} \tag{19}$$

As $p(.)$ is increasing in e, we shall write $J(.; x, n)$ as a function of $p = p(e)$. We see

$$\frac{\partial J(p; 2, x)}{\partial p} = -[C_2(x) - \frac{B_2(x)}{2}] < 0$$

while for $n \geq 3$,

$$\frac{\partial J(p; n, x)}{\partial p} = -(n-1)(1-p)^{n-2}[C_n(x) - \frac{B_n(x)}{2}] - \frac{B_n(x)}{np^2} \sum_{r=3}^{n} \binom{n}{r} p^r (1-p)^{n-r} < 0$$

Hence $L(e; x, n)$ is decreasing in e for all $e \in (0, \overline{e})$, and so, using (18), a unique interior symmetric equilibrium exists, as $\alpha \in (0, \infty)$. We now investigate whether the principal will choose a team with $x > 0$, in order to maximise $\widehat{e}_n(x)$.

For given n, suppose $e = \widehat{e} \in (0, \overline{e})$. Suppose also $\frac{\partial L(\widehat{e},x;n)}{\partial x}|_{x=0} > 0$, i.e., a small increase in x from 0 raises the marginal benefit from effort when $e = \widehat{e}$. Then, if α is in the neighbourhood of $\widehat{\alpha} = \frac{L(\widehat{e},0;n)}{c'(\widehat{e})}$, the principal will choose a team with $x > 0$. When is $\frac{\partial L(e,0;n)}{\partial x} > 0$, or, equivalently, $\frac{\partial J(p,0;n)}{\partial p} > 0$? Note that

$$C_n'(0) = -(n-1)f(1); B_n'(0) = n - f(1)$$

and so, using (19),

$$\frac{\partial J(p,0;n)}{\partial x} = \frac{[1 - np(1-p)^{n-1} - (1-p)^n]}{np}[n - f(1)] - f(1)(n-1)(1-p)^{n-1}$$

Thus,

$$\frac{\partial J(p,0;n)}{\partial x} > 0 \Leftrightarrow f(1) < K(p,n) = \frac{n}{1 + \frac{n(n-1)p(1-p)^{n-1}}{1-np(1-p)^{n-1}-(1-p)^n}}$$

We see that $\lim_{p\to 1} K(p,n) = n$, and $\lim_{p\to 0} K(p,n) = 0$. So, if $n > f(1)$, $\frac{\partial J(p,0;n)}{\partial x} > 0$ for sufficiently large p. Using the results above, we have

Proposition 3 *(a) For any n, if $f(1) < n$, the principal chooses a team with $x > 0$ whenever α is sufficiently small.*

(b) For any $\alpha \in (0, \infty)$, the principal chooses a team with $x > 0$ whenever n is sufficiently large.

Proof. (a) We have shown above that if $n > f(1)$, $\frac{\partial J(p,0;n)}{\partial x} > 0$ for sufficiently large p, and so $\frac{\partial L(e,0;n)}{\partial x} > 0$ for sufficiently large e. So, for α sufficiently small, the principal prefers a team with $x > 0$ over a team with $x = 0$.

(b) Given α, let e solve

$$L(e, 0, n) = \alpha c'(e)$$

and let $p = p(e)$. Then, if

$$\frac{\partial J(p,0;n)}{\partial x} > 0$$

the principal chooses a team with $x > 0$.

$$\frac{\partial J(p,0;n)}{\partial x} > 0 \Leftrightarrow \frac{1}{f(1)} > \frac{1}{n} + \frac{p(n-1)(1-p)^{n-1}}{1-np(1-p)^{n-1}-(1-p)^n}$$

It is easy to see that

$$\lim_{n\to\infty} \frac{p(n-1)(1-p)^{n-1}}{1-np(1-p)^{n-1}-(1-p)^n} = 0$$

and so $\frac{\partial J(p,0;n)}{\partial x} > 0$ whenever n is sufficiently large. ■

Hence, the principal will always introduce conflicts when teams are large. With consensual teams, there is little difference in payoff at the implementation stage between the controller and the subordinates. With many members, ex ante effort incentives are then severely muted. The principal's incentive to introduce conflicts, and thereby induce competition for control, is therefore high when teams are large. Thus our result suggests that conflicts are more likely in larger groups. Such conflicts may serve a purpose: by encouraging competition for control, these tensions help mitigate free-rider problems.

6 Conclusion

Conflicts of interest can arise in teams through deliberate design. When team members have to propose as well implement projects, conflicts can reduce cooperation at the implementation stage, and lower incentives to take high effort towards conceiving a strategy. At the same time, since any member desires control at the execution stage only when there are conflicts of interest, increased conflicts can raise the competition for control through creation of superior policy. This trade-off determines whether the principal can gain from the presence of such 'beneficial conflict'. These kinds of conflicts can also be used to understand teamwork, and indeed, fractious teams may prove to be superior platforms for resolving free-rider problems when compared to individual or segregated production. Further, the principal's incentive to choose disputatious teams may be greater when team size is larger.

The paper proposes a perspective on conflict that differs, through its stress on the relation with consensus and the struggle for control, from existing functional theories (see, e.g., Coser (1956) and Simmel (1968)), which typically focus on the role of conflict as an "integrative force" (Simmel (1955)) in society.[21] The results may be useful in comprehending some of the tensions between competition and cooperation in various team or community settings, and the role such strains play in modulating incentive problems. In the context of leadership, the analysis can help understand whether a principal should select a team whose members have well-aligned interests and therefore adopt a cooperative or consensual style of operation, or whether he should encourage 'creative tension' between them. It may also be interesting to investigate the impact of control allocation on the resolution of incentive problems in more general settings, and whether conflicts between vested competitors influence the distribution of authority. Such issues are left for future research.

7 References

1. Aghion, P., M. Dewatripont and P. Rey (2002): "On Partial Contracting", *European Economic Review,* v. 46, p. 745-53.

2. Aghion, P., M. Dewatripont and P. Rey (2004): "Transferable Control", *Journal of the European Economic Association,* v. 2, p. 115-38.

3. Aghion, P. and J. Tirole (1997): "Formal and Real Authority in Organizations", *Journal of Political Economy,* v. 105, p. 1-29.

4. Banerjee, P. (2007): "Collective Punishments: Incentives and Examinations in Organisations", *B.E.J. Contributions to Theoretical Economics*, v. 7: Iss. 1, Article 34.

5. Banerjee, P. (2008): "Corruption and the Delegation of Authority", *mimeo.*

6. Brown, L. (1983): *Managing Conflict at Organisational Interfaces.* Reading: Addison Wesley.

[21] For a look at conflict in hierarchical firms, see Rotemberg and Saloner (1995, 2000).

7. Burkart, M., D. Gromb and F. Panunzi (1997): "Large Shareholders, Monitoring, and the Value of the Firm", *Quarterly Journal of Economics,* v. 112, p. 693-728.

8. Che, Y-K. and S-W. Yoo (2001): "Optimal Incentives for Teams", *American Economic Review,* v. 91, p. 525-41.

9. Coser, L. (1956): *The Functions of Social Conflict.* New York: The Free Press.

10. De Janasz, S., K. Dowd and B. Schneider (2001): *Interpersonal Skills in Organisations.* New York: McGraw Hill.

11. Dessein, W. (2002): "Authority and Communication in Organizations", *Review of Economic Studies,* v. 69, p. 811-38.

12. Dewatripont, M. and J. Tirole (1999): "Advocates", *Journal of Political Economy,* v. 107, p. 1-39.

13. Donald, D. (1996): *Lincoln.* New York: Simon and Schuster.

14. Drucker, P. (1974): *Management: Tasks, Responsibilities, Practices.* New York: Harper Collins.

15. Dur, R. and O. Swank (2005): "Producing and Manipulating Information", *Economic Journal,* v. 115, p. 185-99.

16. George, A. (1980): *Presidential Decisionmaking in Foreign Policy: The Effective Use of Information and Advice.* Boulder: Westview Press.

17. Hambrick, D. (1995): "Fragmentation and the Other Problems CEOs have with their Top Management Teams", *California Management Review,* v. 37, p. 110-27.

18. Kakabadse, A. and H. Smyllie (1994): "Management for Doctors: Effective Top Teams: Luxury or Necessity?" *British Medical Journal,* v. 309, p. 1653-4.

19. Katzenbach, J. and D. Smith (1993): "The Discipline of Teams", *Harvard Business Review,* v. 71, p. 111-20.

20. Li, H. (2001): "A Theory of Conservatism", *Journal of Political Economy,* v. 109, p. 617-36.

21. Li, H., S. Rosen and W. Suen (2001): "Conflicts and Common Interests in Committees", *American Economic Review,* v. 91, p. 1478-97.

22. Li, H. and W. Suen (2004): "Delegating Decisions to Experts", *Journal of Political Economy,* v. 112, p. S311-35.

23. Mann, J. (2004): *Rise of the Vulcans: The History of Bush's War Cabinet.* New York: Viking.

24. Mello, A. and M. Ruckes (2006): "Team Composition", *Journal of Business,* v. 79, p. 1019-40.

25. Newsweek (2002): "Chemistry in the War Cabinet", 28/1/2002.

26. Prat, A. (2002): "Should a Team be Homogeneous?", *European Economic Review,* v. 46, p. 1187-1207.

27. Priem, R. (1990): "Top Management Team Group Factors, Consensus, and Performance", *Strategic Management Journal*, v. 11, p. 469-78.

28. Rajan, R. and L. Zingales (1998): "Power in a Theory of the Firm", *Quarterly Journal of Economics,* v. 113, p. 387-432.

29. Rotemberg, J. and G. Saloner (1995): "Overt Interfunctional Conflict (and Its Reduction through Business Strategy)", *RAND Journal of Economics*, v. 26, p. 630-53.

30. Rotemberg, J. and G. Saloner (2000): "Visionaries, Managers and Strategic Direction", *RAND Journal of Economics*, v. 31, p. 693-716.

31. Simmel, G. (1955): *Conflict and the Web of Group-Affiliations,* translated by K. Wolff and R. Bendix. New York: The Free Press.

32. Simmel, G. (1968): *The Conflict in Modern Culture and Other Essays,* tranlsated by P. Etzkorn. New York: Teachers College Press.

33. Szalay, D. (2005): "The Economics of Extreme Options and Clear Advice", *Review of Economic Studies,* v. 72, p. 1173-98.

34. USA Today (2002): "Rivalry Can Make US Policy Look Shaky", 14/6/2002.

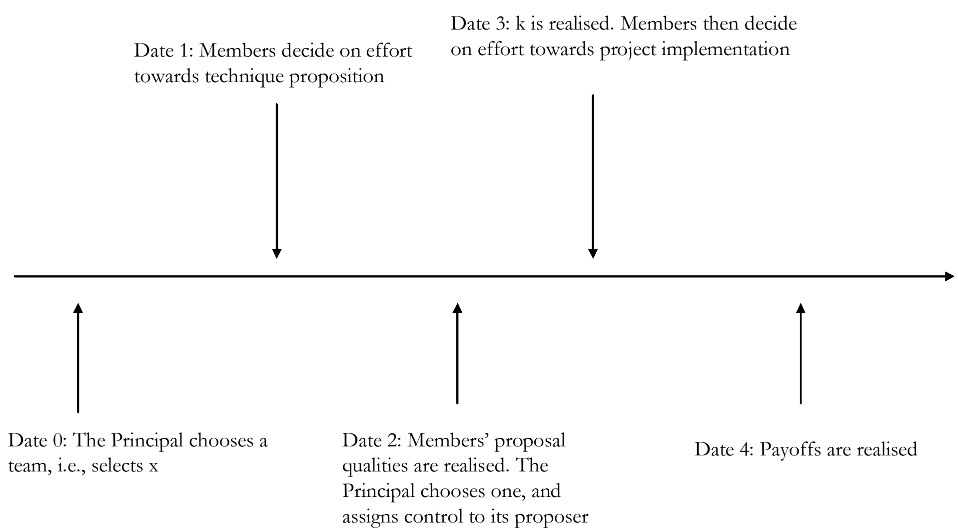
Date 1: Members decide on effort towards technique proposition
Date 3: k is realised. Members then decide on effort towards project implementation
Date 0: The Principal chooses a team, i.e., selects x
Date 2: Members' proposal qualities are realised. The Principal chooses one, and assigns control to its proposer
Date 4: Payoffs are realised

Figure 1:

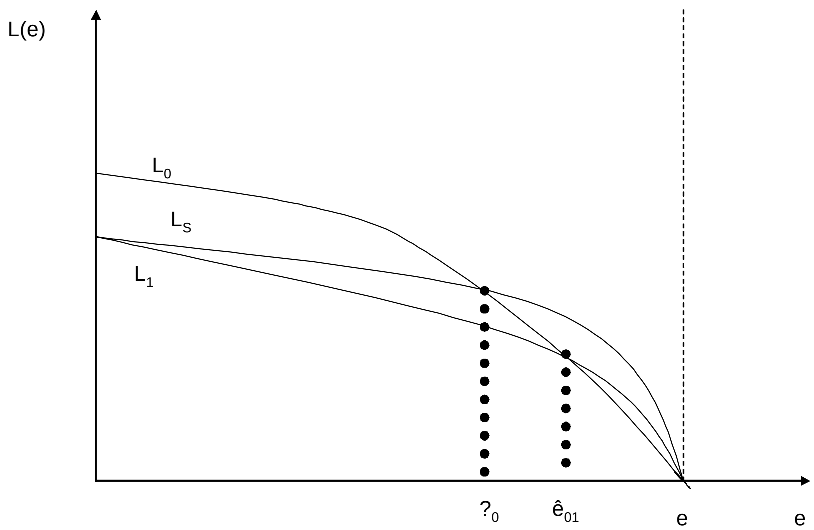

Figure 2: