A Signalling Theory of Scapegoats

Björn Segendorff*†

May 5, 2000

Abstract

This study investigates under what circumstances there exist a separating equilibrium in which competent leaders choose incompetent co-workers and incompetent leaders choose competent co-workers. The driving force for the competent leader is the insurance motive; if things go wrong he can blame the incompetent co-worker and remain his reputation of being competent. For the incompetent leader the expected gain from such an insurance is outweighed by its costs in terms of lower expected policy outcome. Co-workers are motivated by career opportunities allowing for conflicting interests between the leader and the co-worker.
Journal of Economic Literature Classification Numbers: C72, D72, D82, and J33.

"And Aaron shall lay both his hands upon the head of the live goat, and confess over him all the iniquities of the children of Israel, and all their transgressions in all their sins, putting them upon the head of the goat, and shall send him away by the hand of a fit man into the wilderness:"
(Leviticus 16:21)

1 Introduction

Do strong or competent leaders choose incompetent co-workers? There are many plausible motives for such a choice, e.g. to decrease the number of potential rivals or a need to emphasize the own ability, but there is also a strong insurance motive. The incompetent co-worker can credibly be blamed if things go wrong while it is more difficult to blame someone who is competent. In other words, the leader has the opportunity to expose his incompetent co-worker and by doing

*Department of Economics, Stockholm School of Economics, P.O. Box 6501, SE-113 83 STOCKHOLM and Department of Economics, Princeton University, Fisher Hall, Princeton, NJ 08544.

†I thank Jonas Björnerstedt, Åsa Olli Segendorff and the participants of the Economic Theory Workshop for valuable and helpful comments. Financial support from *Jan Wallander and Tom Hedelius' Foundation* (J98/44) and *The Swedish Council for Research in Humanities and Social Sciences* (HSFR, F0357/97) is gratefully acknowledged.

so he sends a signal that other people can use to update their beliefs about his competence. The sacrifice of the scapegoat helps the leader to remain his reputation of being competent in bad times. This study investigates (i) under what circumstances a political or corporate culture in which competent leaders choose incompetent co-workers because of the insurance motive can be sustained and (ii) what is required for the incompetent but career motivated co-worker to accept such an appointment.

The framework is a two-stage game. In the first stage, the leader, who is either competent or incompetent chooses the type of co-worker; competent or incompetent. The leader and the co-worker constitutes *a team* that undertakes some activity, they *perform a policy*. The policy outcome is stochastic but its expected value is increasing in the competence of the team. There is also an outside observer (the principal, she) who can not observe the true competences of the team members. She cares nevertheless about their competences and in the second stage, after having observed the policy outcome, she chooses whether to acknowledge the competence of the individual team members. She does so if she believes the individual team member to be competent with at least some certain member-specific probability. These probabilities are referred to as the her *acknowledgment policy* and the utility a team member gets from being acknowledged as his *reward*. Being acknowledged is the main objective for both team members but the leader also has preferences directly over the policy outcome which he wants to be as high as possible. The situation described above has many interpretations. One may, as an example, think of the leader as the president of a large firm, the co-worker as some subordinated manager, the policy outcome as the profit of the firm and the principal as the owners of the firm. Another interpretation, and the one that will be used throughout the study, is to think of the leader as the president or the prime-minister of some country, the co-worker as the minister of finance, the policy outcome as the GNP growth rate and the principal as the citizens of the country. The citizens want to have a high future economic growth and care therefore about having an competent government. From the team members' point of view, being acknowledged can be thought of as being reelected.

The principal observes the policy outcome and uses this information to update her beliefs about the competences of the team members. After the realization of the policy outcome, but before the principal's decision making, the leader has the opportunity to blame the co-worker, i.e. to reveal the co-worker's true ability. For the leader, this is an opportunity to influence the principal's beliefs and hence her decision making.

When the policy outcome is favorable the principal believes the leader to be competent and when it is unfavorable she believes him to be incompetent unless he blames an incompetent co-worker. The competent leader therefore blames his co-worker whenever the policy outcome is unfavorable and he is always acknowledged. In equilibrium, the incompetent type of leader doesn't have this opportunity and he is only acknowledged if the policy outcome has been favorable. For these reasons, an competent co-worker is more often acknowledge than an incompetent.

When choosing co-worker, both types of leader face the trade-off between the probability of being acknowledged and the expected policy outcome. Because the competent leader has an ability advantage his expected policy loss from choosing an incompetent co-worker is smaller than that of an incompetent leader. It turns out that a separating equilibrium exists if the acknowledgment policies allow for a double acknowledgment and the rewards and the cost of blaming satisfy some conditions. Without the possibility of a double-acknowledgment the incompetent co-worker can never be acknowledged in equilibrium. This would violate his participation constraint and eliminate the separating equilibrium.

Conflicts of interests arises naturally in many situations and the model is extended to allow for one particular type of conflict; the struggle for power. This is done by assuming that there is only one reward over which the two team members will fight in the case of a double acknowledgment. The probability of the leader winning the fight (*survival probability*) is exogenously given. In the context of the adopted interpretation one may think of a situation where the popular minister of finance challenges the incumbent president in the next primary election. In the separating equilibrium, the survival probability of the leader must have some intermediate value. A too high value makes the incompetent co-worker's expected payoff too low in which case he will not participate and a too low value makes the competent leader always exposing his incompetent co-worker in order to avoid a fight. Again, this makes the incompetent co-worker's expected payoff too low. We also derive a necessary interval for the reward.

To the author's knowledge, there is no study with a formalized model about scapegoats. The related literature on leaders motivated by reputational concerns can be divided into three categories. The first category uses signalling of competence by an incumbent political leader to explain political business cycles. The incumbent signals his competence by choosing a high-inflation policy that booms the economy. This is less costly for an competent incumbent than for an incompetent incumbent who chooses a low-inflation policy. Voters observe the policy choice and reelect the incumbent if they observe a high-inflation policy being implemented. See Rogoff (1990) for a good example of such a study or Persson and Tabellini (1990) for a nice introduction to this literature. The study below differs from this literature since the method of signalling is different. Moreover, in our model the competent leader does not boom the economy. On the contrary, he holds it back by his choice of co-worker. The second category focuses on the principal-agent relationship between the principal and the leader. The leader chooses level of effort that positively affects the expected policy outcome. The leader is then acknowledged only if the policy outcome is above some certain threshold. Recent examples of this literature are Besley and Case (1995), Ferejohn (1986), and Harrington (1993). The main differences between this study and the mentioned literature is that here there are two types of leader and that the competence of the co-worker can be verified while the effort level can not. If the choice of effort level could be verified at some cost it could be used in the same way as the choice of co-worker in the scapegoat model. The third category studies strategic use of information to signal competence. One interesting study is Levy (1999). In brief, competent decision makers have more reliable information than incompetent decision makers and Levy shows that competent decision makers choose incompetent advisors in order to signal their own competence. Making a decision that contradicts the advice signals confidence in the own information and thereby competence. Incompetent decision makers choose competent advisors since they are in need for better information. Other studies of strategic use of information and reputational or career concerns are Effinger and Polborn (1999), Gibbons and Murphy (1992), Jeon (1996), Meyer and Vickers (1997), and Trueman (1994). The main differences between this study and the strategic-information literature is the insurance motive and that strategic use of information is not studied here.

The outline of the study is as follows. Section 2 contains the basic model omitting the preferences of the co-worker. In Section 3 his preferences are introduced and the case of non-conflicting interests is investigated. The case of conflicting interests is studied in Section 4. Section 5 contains a numeric example and Section 6 a summary and some comments. All proofs are given in the Appendix.

2 The Basic Model

There are three players: the leader L (he), the co-worker C (he) and the principal P (she). The games starts with nature drawing the type of L who either is of the incompetent type ($\mathsf{L} = 0$) or of the competent type ($\mathsf{L} = 1$). Let $p = \Pr(\mathsf{L} = 1) \in (0, 1)$ be common knowledge. Knowing his own type, L chooses C's type, competent ($\mathsf{C} = 1$) or incompetent ($\mathsf{C} = 0$). For the moment it is assumed that any type of C accepts the appointment in order to keep the model simple. This assumption is relaxed in Sections 3 and 4.

The team constituted by L and C undertakes some activity, i.e. it performs a policy. The degree of success is measured by the size of the policy outcome x given by

$$x = g(\alpha\mathsf{L} + \mathsf{C}) + \epsilon$$

where g is increasing in the ability of the team, i.e. $g(0) < g(1) < g(\alpha) < g(\alpha + 1)$. The random variable ϵ is assumed to have a continuous distribution over $\mathbb{R}$. Let $f(\epsilon)$ be its probability density function and F its cumulative density function. Furthermore, $E[\epsilon] = 0$, $f' \geq 0$ for all $\epsilon < 0$ and $f' \leq 0$ for all $\epsilon > 0$. The random variable could, as an example, have a normal, Cauchy, standard logistic or t-distribution. After the realization of x, L has the opportunity to truthfully reveal C at the cost $c > 0$ in which case he is said to blame C. Let $B = 1$ if L blames C and let $B = 0$ if he doesn't. The principal P, who is an outside observer, observes x but is unable to observe L and she only observes C when $B = 1$. Her information set is $\{\mathcal{C}, x\}$ where $\mathcal{C} \in \{\emptyset, 0, 1\}$ is her observation of C. Thus, $\mathcal{C} = \emptyset$ if $B = 0$ and $\mathcal{C} = \mathsf{C}$ if $B = 1$. Her objective is to have an competent leader and she forms her belief over L using the available information.

On the basis of this belief she either acknowledges L's ability ($A = 1$) or not ($A = 0$). Her utility is given by the vNM utility function

$$u_P(A) = \mathsf{L}A - p(1 - A)$$

where p is her (expected) utility if L is not acknowledged. One interpretation is that her utility depends on the probability of finding a new leader who is competent. This probability is then assumed to be equal to p. The main objective of the leader is to be acknowledged but he also cares about the policy outcome. His utility is given by the vNM utility function

$$u_L(\mathsf{C}, B) = x - Bc + A\phi$$

where ϕ represents his reward from being acknowledged. Here $\phi > c$. The situation outlined above has many interpretations and the one used here is to think of L as being the president of some country, C as the minister of finance, P as representing the citizens/voters and x as the GNP growth rate. An acknowledgment can be thought of as a reelection.

2.1 The Separating Equilibrium

The separating equilibrium of interest is one in which the incompetent leader chooses an competent co-worker and the competent leader chooses an incompetent co-worker. Any other equilibria are disregarded from throughout the study and by equilibrium is hereafter meant separating equilibrium. Here the incompetent leader never blames his co-worker and he is seldom acknowledged while the competent leader blames his co-worker only if the policy outcome is unfavorable (defined below) and he is always acknowledged.

A policy outcome is favorable for L if it makes P acknowledge him without L having to blame his co-worker, i.e. if P believes L to be competent with at least probability p having observed only the outcome x but taking the separating choices of co-worker into account.

Definition 1. A policy outcome x is favorable if

$$\Pr(\mathsf{L} = 1 \mid \mathsf{L} \neq \mathsf{C}) \equiv \frac{pf(x - g(\alpha))}{pf(x - g(\alpha)) + (1 - p) f(x - g(1))} \geq p$$

and the set of favorable policy outcomes is

$$X = \{x \mid \Pr(\mathsf{L} = 1 \mid \mathsf{L} \neq \mathsf{C}) \geq p\}.$$

A policy outcome is unfavorable if it is not favorable.

For the assumed class of distributions X is an interval $[\overline{x}, +\infty)$ and a policy outcome is favorable if it is above the threshold $\overline{x}$. If $x \in X$ ($x \notin X$) and $B = 0$ then P believes L to be competent with at least (less than) probability p and when $x \notin X$ the competent type of leader signals his type by blaming

C. In the absence of such a signal, P believes L to be incompetent and doesn't acknowledge him. Hence, L's strategy is

$$s_L^S(\mathsf{L},x)=\begin{cases}\text{If } \mathsf{L}=0 \text{ then } \mathsf{C}=1 \text{ and } B=0 \text{ for all } x\\ \text{If } \mathsf{L}=1 \text{ then } \mathsf{C}=0,\ B=0 \text{ if } x\in X \text{ and } B=1 \text{ if } x\notin X.\end{cases}$$

The strategy of P is to acknowledge L if she believes him to be competent with at least probability p, i.e.

$$s_P^S(\mathcal{C},x)=\begin{cases}A=1 \text{ if } \Pr\left(\mathsf{L}=1\mid\{\mathcal{C},x\},s_L\right)\geq p\\ A=0 \text{ otherwise}\end{cases}$$

where s_L is the strategy she believes L to use. Her equilibrium beliefs are given by Bayes' Rule and $\Pr\left(L=1\mid\{\mathcal{C},x\},s_L^S\right)$ is well defined along the equilibrium path but not outside the path and there are two types of situations that are unexpected; when an competent co-worker is blamed or when an incompetent co-worker is blamed at a favorable policy outcome. Observing something unexpected it is assumed that P only uses $\{\mathcal{C},x\}$ when forming her beliefs. Such a belief formation is reasonable since (a) it captures an attempt only to use verifiable information and (b) it allows her to form her beliefs in a consistent way for all out-of-equilibrium observations. Moreover, it does not conflict with the intuitive criterion (Cho and Kreps (1987)).

Assumption 1. Out-of-equilibrium beliefs: for all $\{\mathcal{C},x\}\in\{0\}\times X\cup\{1\}\times\mathbb{R}$ the principal's beliefs are given by Bayes' rule as follows

$$\Pr\left(L=1\mid\{\mathcal{C},x\},s_L^S\right)=\frac{pf\left(x-g(\alpha+\mathcal{C})\right)}{pf\left(x-g(\alpha+\mathcal{C})\right)+(1-p)f\left(x-g(\mathcal{C})\right)}$$

From Assumption 1 it follows that if P observes $\{0,x\}$ out-of equilibrium, then she believes L to be competent with a probability higher than p. If she observes $\{1,x\}$ out-of equilibrium then she believes L to be competent only if x belongs to a possibly empty subset of X. Clearly, blaming C out of equilibrium does not induce P to acknowledge a leader who otherwise would not have been acknowledged following his equilibrium strategy.

Let E_{LC} be the set of realizations of ϵ such that the policy outcome is favorable when L is of type L and C is of type C, i.e.

$$E_{\mathsf{LC}}=\left\{\epsilon\mid\epsilon=x-g\left(\mathsf{L},\mathsf{C}\right),x\in X\right\}.$$

The probability (cumulative density) of realizations of ϵ in E_{LC} is denoted $F\left(E_{\mathsf{LC}}\right)$ which also is the probability of a favorable policy outcome. Suppose that $s^S=(s_L^S,s_P^S)$ constitutes a equilibrium. Then L's expected payoff from s_L^S when being of type L is

$$E\left[u_L\mid s^S,\mathsf{L}\right]=g(\alpha\mathsf{L}+\mathsf{C})+\phi-\left(1-F\left(E_{\mathsf{LC}}\right)\right)\left(\phi-\mathsf{L}(\phi-c)\right). \qquad (1)$$

The profile s^S is a separating equilibrium only if there is no unilateral deviation yielding a higher expected payoff than the proposed equilibrium strategy for any type of leader. Fortunately, it is sufficient to check for one type of deviation; it should not be strictly profitable for any type of L to mimic the behavior of the other type, i.e. to play

$$s_L^D(\mathsf{L}, x) = \begin{cases} \text{If } \mathsf{L} = 0 \text{ then } \mathsf{C} = 0,\ B = 0 \text{ if } x \in X \text{ and } B = 1 \text{ if } x \notin X \\ \text{If } \mathsf{L} = I \text{ then } \mathsf{C} = 1 \text{ and } B = 0 \text{ for all } x. \end{cases}$$

L's expected payoff from s_L^D when being of type L is

$$E\left[u_L \mid s_L^D, s_P^S, \mathsf{L}\right] = g(\alpha\mathsf{L} + \mathsf{C}) + \phi - (1 - F(E_{\mathsf{LC}}))\,(c - \mathsf{L}(\phi - c))\,. \tag{2}$$

In equilibrium is $E\left[u_L \mid s^S, \mathsf{L}\right] \geq E\left[u_L \mid s_L^D, s_P^S, \mathsf{L}\right]$ for $\mathsf{L} = 0, 1$. Solving this inequality for $\mathsf{L} = 0$ and rewriting gives

$$\frac{(1 - F(E_{00}))\,c + g(1) - g(0)}{1 - F(E_{01})} = \overline{\phi} \geq \phi \tag{3}$$

showing that ϕ can not be to high. Doing the same exercise for $\mathsf{L} = 1$ provides a lower bound for ϕ

$$\frac{(1 - F(E_{10}))\,c + g(\alpha + 1) - g(\alpha)}{1 - F(E_{11})} = \underline{\phi} \leq \phi. \tag{4}$$

Notice that both $\underline{\phi}$ and $\overline{\phi}$ are strictly greater than c. At $\underline{\phi}$ and $\overline{\phi}$ respective type of leader is indifferent between s_L^S and s_L^D. The expected gain from appointing a scapegoat is equal to the expected cost. The competent leader has an ability advantage over the incompetent type and his expected cost is lower, as is his expected gain. Which of the two inequalities that will be the larger one depends on the parametrization of the model. Comparing the expressions for $\underline{\phi}$ and $\overline{\phi}$ gives that $\overline{\phi}$ increases faster in c than what $\underline{\phi}$ does if

$$\frac{1 - F(E_{00})}{1 - F(E_{01})} - \frac{1 - F(E_{10})}{1 - F(E_{11})} \geq 0 \tag{5}$$

Hence, $\overline{\phi} \geq \underline{\phi}$ if c is sufficiently large and 5 holds. Moreover, if the relative importance of C's ability decreases sufficiently with L's ability, i.e. if

$$g(\alpha + 1) - g(\alpha) \leq \overline{g} = \frac{1 - F(E_{11})}{1 - F(E_{01})} \tag{6}$$

then $\overline{\phi} \geq \underline{\phi}$ for some c. In the case $\overline{\phi} = \underline{\phi}$ for some $c \geq 0$, denote this cost $\underline{c}$.

Lemma 1. $\overline{\phi} \geq \underline{\phi}$ if either
(a) 5 and 6 hold,
(b) 5 holds strictly and $c \geq \underline{c}$, or
(c) 6 holds strictly and $c \leq \underline{c}$.

Proof. Appendix.

If one of the conditions in Lemma 1 holds then the two non-mimicking constraints can be satisfied simultaneously and there exist rewards such that s^S constitutes an equilibrium.

Proposition 1. If Lemma 1(a), (b) or (c) holds then s^S is a NE (Nash equilibrium) for every $\phi \in \left[\underline{\phi}, \overline{\phi}\right]$.

Proof. Appendix.

This far the focus has been on the leader neglecting the co-worker who is just as important for the existence of a separating equilibrium. If the incompetent co-worker finds that it is not in his interest to participate then there can not exist any separating equilibrium. The next two sections extends the model taking the co-worker's incentives into account.

3 Non-Conflicting Interests

Under what circumstances would the two types of co-worker voluntary participate in equilibrium? The preferences of the co-worker are central when studying this question and here it is assumed that he is somewhat similar to L in the sense of being driven by a desire of being acknowledged. If he is acknowledged ($A_C = 1$) then he receives the reward γ which can be made capturing career opportunities etc. and if he is not acknowledged then $A_C = 0$ in which case he receives nothing. His utility is given by the vNM utility function

$$u_C(B, A_C) = -Bc_C + A_C\gamma$$

where $c_C > 0$ is a cost associated with being blamed. Notice that C has no preferences directly over the policy outcome. This assumption is made to gain simplicity but as long as his preferences can be represented by an additive separable utility function it doesn't change any qualitative results. For each of the two types of co-workers, the reservation utility is given by $\underline{u}_C(\mathsf{C})$ where $\underline{u}_C(1) > \underline{u}_C(0) = 0$. The leader's utility is given by u_L as before.

P cares about having an competent co-worker by the same reasons she cares about having an competent leader. She updates her beliefs over L and C after having observed the policy outcome and eventually C's type. She acknowledges L (C) if she finds him competent with at least probability p (p_C). Her utility is given by

$$\widetilde{u}_P\left(\mathsf{L}, \mathsf{C}, A, A_C\right) = \mathsf{L}A + \mathsf{C}A_C + (1-A)p + (1-A_C)\,p_C$$

and her strategy is

$$\widetilde{s}_P^S(\mathcal{C}, x) = \begin{cases} A = 1 \text{ if } \Pr\left(\mathsf{L} = 1 \mid \{\mathcal{C}, x\}, s_L\right) \geq p \text{ and } A = 0 \text{ otherwise and} \\ A_C = 1 \text{ if } \Pr\left(\mathsf{C} = 1 \mid \{\mathcal{C}, x\}, s_L\right) \geq p_C \text{ and } A_C = 0 \text{ otherwise.} \end{cases}$$

L uses the strategy s_L^S as before and the previous analysis of the his incentives still applies but $\phi \in \left[\underline{\phi}, \overline{\phi}\right]$ is no longer a sufficient for a separating equilibrium.

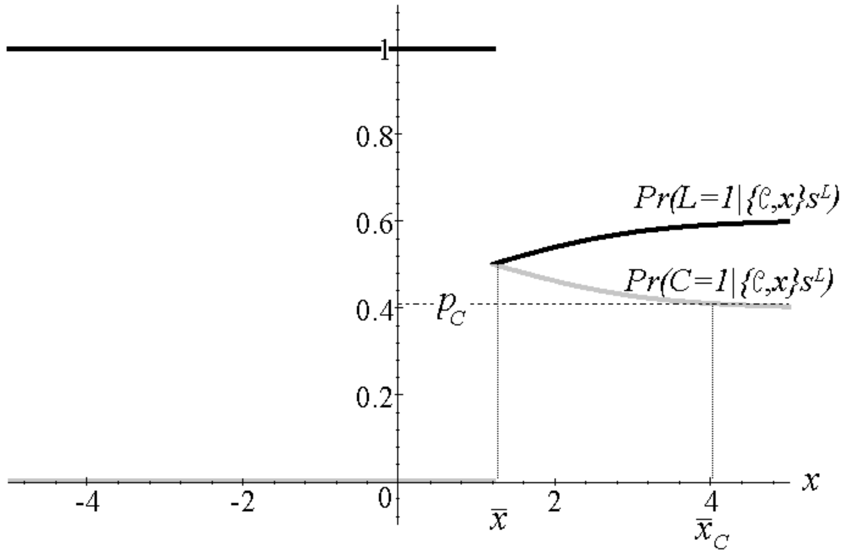

Figure 1: $X = [\overline{x}, +\infty)$ and $X_C = (-\infty, \overline{x}_C]$. The unable co-worker is acknowledged only for outcomes in $X \cap X_C$. Only there is the conditional probability of him being able high enough.

It is only necessary since it doesn't guarantee C's participation. A co-worker of type C accepts an appointment if the expected payoff is greater or equal to his reservation utility. A necessary condition for the incompetent co-worker's participation is that he must be acknowledged with some positive probability, i.e. there must exist policy outcomes such that he is not blamed and P believes him to be competent with at least probability p_C. Any such outcome must belong to X since the incompetent co-worker is blamed otherwise. Let X_C denote the set of policy outcomes such that the competent co-worker is acknowledged in equilibrium, i.e.

$$X_C = \left\{x \mid \Pr\left(\mathsf{C} = 1 \mid \{\emptyset, x\}, s_L^S\right) \geq p_C, x \in X\right\}$$

It follows that the incompetent co-worker cannot be acknowledged if $p_C > 1 - p$ because $\Pr\left(\mathsf{C} = 1 \mid \{\emptyset, x\}, s_L^S\right) \leq 1 - p$ for all $x \in X$ which makes X_C empty. Let $\widetilde{s}^S = (s_L^S, \widetilde{s}_P^S)$.

Lemma 2. If $p + p_C > 1$ then is $\widetilde{s}^S$ not a NE.

Proof. Appendix.

Before the participation constraints are stated it is convenient to have specified the probability of a double acknowledgment. The set

$$D_{\mathsf{LC}} = \{\epsilon \mid \epsilon = x - g(\alpha\mathsf{L} + \mathsf{C}), x \in X_C\}$$

is the set of realizations of ϵ such that $x \in X_C$ when the L is of type L and C is of type C. The probability of a double acknowledgment is thus $F(D_{\mathsf{LC}})$. It is worth noticing that the competent co-worker is acknowledged with probability $F(D_{\mathsf{LC}}) + (1 - F(E_{\mathsf{LC}}))$ because he is acknowledged at all policy outcomes where the incompetent co-worker would have been acknowledged and all those where the incompetent co-worker would have been blamed. The participation constraint of the incompetent type of co-worker is

$$\gamma \geq \underline{\gamma}(\mathsf{L}) = \frac{(1 - F(E_{\mathsf{LC}}))\, c_C}{F(E_{\mathsf{LC}})} \tag{7}$$

where $\underline{\gamma}(\mathsf{L}) = +\infty$ for $p + p_C > 1$. Doing the same exercise for the competent co-worker gives

$$\gamma \geq \overline{\gamma}(\mathsf{L}) = \frac{\underline{u}_C(1)}{F(D_{\mathsf{L}1}) + (1 - F(E_{\mathsf{L}1}))}. \tag{8}$$

Comparative statics on $\underline{\gamma}$ and $\overline{\gamma}$ with respect to L gives $\underline{\gamma}(0) > \underline{\gamma}(1)$ and $\overline{\gamma}(1) > \overline{\gamma}(0)$. The minimum reward consistent with participation is lower if a co-worker is appointed by a leader of the opposite type. The basic intuition is that he is acknowledged with a higher probability when working for a leader of the opposite type than one of his own type. Also, $\underline{\gamma}$ and $\overline{\gamma}$ are increasing in p_C since a tougher acknowledgment policy towards C in sense of a higher p_C decreases his probability of being acknowledged which in turn requires an increased minimum reward to ensure participation. Moreover, $\underline{\gamma}$ increases in p while $\overline{\gamma}$ remains constant with respect to changes in p. A less generous acknowledgment policy towards the L (higher p) decreases the incompetent C's chances of being acknowledged since it makes it more likely that he will be exposed. This lowers his expected payoff and requires a higher minimum reward to restore participation. The competent co-worker is never exposed and his minimum reward does consequently not depend on p. Proposition 2 summarizes the sufficient conditions for s^S to be a equilibrium.

Proposition 2. If (i) Lemma 1(a), (b) or (c) holds, (ii) $p + p_C \leq 1$, and (iii) $\gamma \geq \max\left\{\underline{\gamma}(1), \overline{\gamma}(0)\right\}$ then $\widetilde{s}^S$ is a NE for all $\phi \in \left[\underline{\phi}, \overline{\phi}\right]$.

Proof. Appendix.

By condition (i) is $\underline{\phi} \leq \overline{\phi}$ and there exists no profitable deviation from $\widetilde{s}^S$ for any type of leader when $\phi \in \left[\underline{\phi}, \overline{\phi}\right]$. The participation constraints for the two types of co-worker are well defined by (ii) and hold by condition (iii). It turns out that condition (i) may be relaxed for some values of γ and c_C. Those cases are (a)-(c) in Corollary 1.

Corollary 1. If $\widetilde{s}^S$ constitutes a Nash equilibrium then one of the following must hold

(a) $\gamma < \underline{\gamma}(0), \overline{\gamma}(1)$ and $\phi \in (c, +\infty)$,
(b) $\underline{\gamma}(0) > \gamma \geq \overline{\gamma}(1)$ and $\phi \in \left[\underline{\phi}, +\infty\right)$,
(c) $\underline{\gamma}(0) \leq \gamma < \overline{\gamma}(1)$ and $\phi \in \left(c, \overline{\phi}\right]$, or
(d) $\phi \geq \underline{\gamma}(0), \overline{\gamma}(1)$ and $\phi \in \left[\underline{\phi}, \overline{\phi}\right]$.

Proof. Appendix.

In case (a) the parameters of the model are such that both types of co-worker participate but refuse working for a leader of their own type. Then, no type of leader can deviate by employing "wrong" type of co-worker and the restrictions on ϕ and hence Lemma 1 can be relaxed. In (b) the parameters are such that the competent co-worker, but not the incompetent, accepts working for a leader of his own type. Only the competent leader can deviate by playing s_L^D and $\phi \geq \overline{\phi}$ is consistent with equilibrium. In (c) the reversed is true, only the incompetent leader can deviate which makes $\phi \leq \underline{\phi}$ consistent with equilibrium. Finally, in (d) both types of co-workers accept working for both types of leader and $\phi \in \left[\underline{\phi}, \overline{\phi}\right]$.

This far it has been assumed that the value of being acknowledged is independent of the number of actors being acknowledged. This assumption simplifies the model but rules out a possible conflict of interests between the leader and the co-worker. It is easy to imagine a situation where an acknowledged co-worker feels strong enough to challenge the incumbent leader in some respect. Examples are struggles for power in political parties, firms, and labor unions. In reality, conflicts of this kind are likely to be of great importance for the incentives of the actors involved.

4 Conflicting Interests

There are many types of conflicts in interests but the particular type studied below is of the type here called rivalry. Rivalry arises when both team members have been acknowledged and there is only one reward that they have to fight over. Rivalry can thus be thought of as a struggle for power; the popular minister of finance feels strong enough to challenge the incumbent president in the next primary elections. A team member receives ϕ if he is alone of being acknowledged and in the case of a double acknowledgment there is a struggle which L wins probability t and C with probability $1-t$. The winner gets ϕ and the loser gets nothing. For L, the expected value of a double acknowledgment is $t\phi$ and for C it is $(1-t)\phi$. Thus, a low t makes the leader's expected payoff from a double acknowledgment low and a new type of deviation must therefore be considered; the incompetent leader may want to blame the co-worker just to avoid a struggle, i.e. to let $B = 1$ also for $x \in X_C$. This deviation is unprofitable if $\phi - c \leq t\phi$ which defines a highest reward $\widetilde{\phi}(t) = c/(1-t)$ consistent with equilibrium. The separating equilibrium cannot exist when $\phi > \widetilde{\phi}(t)$ and when $\phi \leq \widetilde{\phi}(t)$ only the mimicking deviation s_L^D has to be considered. Modifying and simplifying 3 and 4 gives

$$\phi \geq \underline{\phi}^* (t) = \underline{\phi} \, \frac{1 - F(E_{11})}{1 - F(E_{11}) - (1-t)(F(D_{10}) - F(D_{11}))} \tag{9}$$

and

$$\phi \leq \overline{\phi}^* (t) = \overline{\phi} \, \frac{1 - F(E_{01})}{1 - F(E_{01}) - (1-t)(F(D_{00}) - F(D_{01}))}. \tag{10}$$

The reward's upper bound $\overline{\phi}^*$ is well-defined, continuous and increasing in t as long as $p + p_C < 1$. Unfortunately, the effect on the lower bound $\underline{\phi}^*$ from a change in t is ambiguous and $\underline{\phi}^*$ may not be well defined for some t (henceforth denoted t whenever it exists) making the denominator zero. Notice that if t exists, then it is unique and $\underline{\phi}^*$ is thus continuous in t for all $t \neq \mathsf{t}$. Moreover, if $t \leq \mathsf{t}$ then the competent leader will always prefer s_L^D to $\widetilde{s}^S$ and the separating equilibrium can not exist. This latter observation is stated in Lemma 3(i). From 9 and 10 it follows that $\underline{\phi}^*(1) = \underline{\phi}$ and $\overline{\phi}^*(1) = \overline{\phi}$. Then, by continuity the following is true; if $\overline{\phi} > \underline{\phi}$ then there exists a smallest $t^* < 1$ such that the incentive constraints for the two types of leader can be satisfied simultaneously for all $t \geq t^*$. This is formalized in Lemma 3(ii).

Lemma 3. (i) If t exists and $t \leq \mathsf{t}$ then $\widetilde{s}^S$ is not a NE.
(ii) If Lemma 1(a), (b) or (c) holds and $p + p_C < 1$ then there exists a smallest $t^* \in [0, 1)$ such that $0 < \underline{\phi}^*(t) \leq \overline{\phi}^*(t), \widetilde{\phi}(t)$ for all $t \in [t^*, 1]$.

Proof. Appendix

Rewriting the participation constraints 7 and 8 for the two types of co-workers gives

$$\underline{\gamma}^*(\mathsf{L}, t) = \underline{\gamma}(\mathsf{L}) \frac{1}{(1-t)} \tag{11}$$

and

$$\overline{\gamma}^*(\mathsf{L}, t) = \overline{\gamma}(\mathsf{L}) \frac{F(D_{\mathsf{L}1}) + 1 - F(E_{\mathsf{L}1})}{(1-t) F(D_{\mathsf{L}1}) + 1 - F(E_{\mathsf{L}1})} \tag{12}$$

The participation constraints are increasing in t since a lower survival probability $1 - t$ must be compensated for by a higher reward. As t approaches 1 the minimum reward of the incompetent type ($\underline{\gamma}^*$) goes to infinity because he will never be rewarded. This implies that his participation constraint can not be satisfied in which case $\widetilde{s}^S$ is not a equilibrium. Moreover, an increased cost of being blamed also increases his minimum reward. It turns out that for every $t < 1$ and every reward the two participation constraints hold if c_C and $\underline{u}_C(1)$ are low enough. The lowest reward that generally can be sustained in equilibrium is $\underline{\phi}^*(t)$. Setting $\phi = \underline{\phi}^*(t)$ and taking t as given the highest values of c_C and $\underline{u}_C(1)$ such that the participation constraints hold are given by

$$\overline{c}_C(t) = \frac{\underline{\phi}^*(t)(1-t)F(D_{10})}{1 - F(E_{10})}$$

and

$$\overline{u}_C(t) = \underline{\phi}^*(t)\left((1-t) F(D_{01}) + 1 - F(E_{01})\right).$$

Sufficient conditions for the existence of a separating equilibrium can now be stated by the use of Lemmas 1, 2 and 3

Proposition 3. If (i) Lemma 1(a), (b) and (c), (ii) $p + p_C < 1$, (iii) $t \in [t^*, 1)$, (iv) $c_C \leq \overline{c}_C(t)$, and (v) $\underline{u}_C(1) \leq \overline{u}_C(t)$ then constitutes $\widetilde{s}^S$ a NE for all $\phi \in \left[\underline{\phi}^*(t), \min\left\{\overline{\phi}^*(t), \widetilde{\phi}(t)\right\}\right]$.

Conditions (i) and (iii) guarantee the existence of an interval of rewards that satisfies the incentive constraints of the two types of leader and (ii)-(v) guarantee that the participation constraints of the two types of co-worker are not violated for any reward within the interval. The separating equilibrium exists for any reward within the specified interval. The profile $\widetilde{s}^S$ may, as in the case of non-conflicting interests, be supported outside the specified interval of rewards for some parametrization of the model. For such a parametrization one may relax conditions (i) and (iii). However, under no circumstances can $t \leq \mathsf{t}$ or $\phi_1 > \widetilde{\phi}(t)$ in equilibrium.

Corollary 2. If $\widetilde{s}^S$ constitutes an equilibrium then one of the following must hold

(a) $\underline{\gamma}^*(0,t), \overline{\gamma}^*(1,t)$ and $\phi \in \left(c, \widetilde{\phi}(t)\right]$,

(b) $\overline{\gamma}^*(1,t) \leq \phi_1 < \underline{\gamma}^*(0,t)$ and $\phi \in \left[\underline{\phi}^*(t), \widetilde{\phi}(t)\right]$,

(c) $\underline{\gamma}^*(0,t) \leq \phi_1 < \overline{\gamma}^*(1,t)$ and $\phi \in \left(c, \min\left\{\overline{\phi}^*(t), \widetilde{\phi}(t)\right\}\right]$ or

(d) $\underline{\gamma}^*(0,t), \overline{\gamma}^*(1,t) \leq \phi_1$ and $\phi \in \left[\underline{\phi}^*(t), \min\left\{\overline{\phi}^*(t), \widetilde{\phi}(t)\right\}\right]$.

Proof. Appendix.

The intuition behind Corollary 2 is identical to the intuition behind Corollary 1. Conditions (ii)-(v) guarantee the participation of both types of co-worker in equilibrium. If the parameters of the model and the reward ϕ are such that a co-worker of type C does not accept working for a leader of the same type then the incentive constraint of that leader becomes irrelevant. In case (a) this is true for $\mathsf{C} = 0, 1$, in (b) for $\mathsf{C} = 0$, and in (c) for $\mathsf{C} = 1$. Finally, as in case (d), $\mathsf{C} = 0, 1$ accepts working for $\mathsf{L} = 0, 1$ and we require $\overline{\phi}^*(t) \leq \phi_1 \leq \underline{\phi}^*(t)$.

5 Example

Let $\alpha = 2$, $p = 0.5$, $c = 1$, and $g(\alpha L + C) = \sqrt{\alpha L + C}$. Then $X = [1.21, +\infty)$, $\underline{c} = 0$, $\underline{\phi} = 2.06$, and $\overline{\phi} = 3.21$. Neglecting the preferences of the co-worker and applying Proposition 1 gives that s^S is a equilibrium for all $\phi \in [2.06, 3.21]$.

Let $\underline{u}(1) = 1$, $p_C = 0.45$, $c_C = 0.1$. Notice that $p + p_C = 0.95 < 1$ which is consistent with equilibrium (Lemma 2). The set of policy outcomes resulting in a double acknowledgment and the participation constraints of the two types of co-worker are summarized in the first column of Table I. The second column summarizes an other case that is discussed at the end of this section.

Table I

	$c_C = 0.1$, $p_C = 0.45$	$c_C = 0.75$, $p_C = 0.4$
$X \cap X_C$	$[1.21, 2.27]$	$[1.21, +\infty)$
$\underline{\gamma}(0)$	0.56	2.51
$\underline{\gamma}(1)$	0.18	0.61
$\overline{\gamma}(0)$	1.10	1
$\overline{\gamma}(1)$	1.43	1

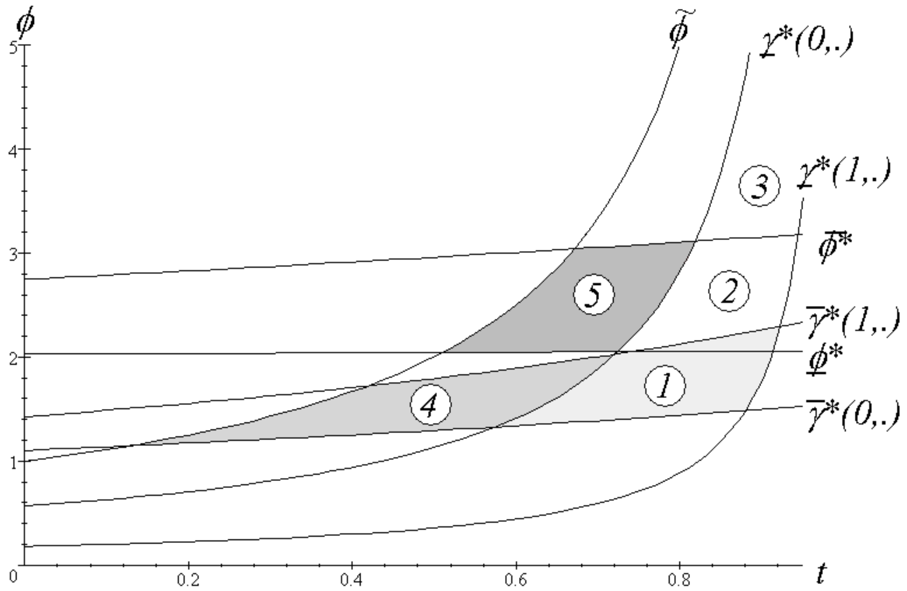

Figure 2: Equilibrium regions in the case of conflicting interests.

Notice that $\overline{\gamma}(1) > \overline{\gamma}(0) > \underline{\gamma}(0) > \underline{\gamma}(1)$. Applying Proposition 2 gives that $\widetilde{s}^S$ is a equilibrium for some values of γ and ϕ. However, recall that the participation constraints of both types of co-worker must hold in equilibrium. Here, this implies $\gamma \geq \overline{\gamma}(0)$ which rules out cases (a) and (b) in Corollary 1. Hence, $\widetilde{s}^S$ is an equilibrium for the reward structure

$$\gamma \in [\overline{\gamma}(0), \overline{\gamma}(1)) = [1.1, 1.43) \text{ and } \phi \in \left(c, \overline{\phi}\right] = (1, 3.21]$$

which corresponds to case (c) in Corollary 1 and

$$\gamma \geq \overline{\gamma}(1) = 1.43 \text{ and } \phi \in [2.06, 3.21] = \left[\underline{\phi}, \overline{\phi}\right]$$

which corresponds to case (d).

Figure 2 describes the case of conflicting interests for this example. The separating equilibrium exists in regions 1-5. Region 1 corresponds to case (a) in Corollary 2, region 2 to (b), region 3 to (c) and regions 4 and 5 to (d). Any equilibrium reward structure must be above $\underline{\gamma}(1, \cdot)$ and $\overline{\gamma}(0, \cdot)$ but below $\widetilde{\phi}(\cdot)$. Examples of combinations of (t, ϕ) for which $\widetilde{s}^S$ constitutes an equilibrium are given in the left-hand side of Table II. In terms of Corollary 2 all four types of equilibria are possible and the letters (a)-(d) refer to cases (a)-(d) in Corollary 2.

Table II

		$c_C = 0.1,$ $p_C = 0.45$			$c_C = 0.75,$ $p_C = 0.4$	
	(a)	(b)	(c)	(d)	(a)	(b)
(t, ϕ)	$(0.75, 1.5)$	$(0.85, 2.5)$	$(0.5, 1.5)$	$(0.7, 2.5)$	$(0.5, 1.4)$	$(0.7, 2.5)$
$\underline{\phi}^*(t)$	2.05	2.06	2.04	2.05	1.87	1.94
$\overline{\overline{\phi}}^*(t)$	3.08	3.13	2.96	3.06	2.68	2.87
$\underline{\gamma}^*(0, t)$	2.26	3.76	1.13	1.88	5.02	8.36
$\underline{\gamma}^*(1, t)$	0.71	1.18	0.35	0.59	1.46	2.03
$\overline{\gamma}^*(0, t)$	1.41	1.47	1.29	1.39	1.29	1.46
$\overline{\gamma}^*(1, t)$	2.06	2.19	1.79	2.00	1.46	1.79

In the second example c and p are the same as in the first example but C's cost of being exposed c_C and P's acknowledgment policy p_C towards C are different. Let $c_C = 0.75$ and $p_C = 0.4$. The latter makes $X = [1.21, +\infty)$, i.e. P's acknowledgment policies p and p_C are such that the competent co-worker always is acknowledged. Hence, $\overline{\gamma}(0) = \overline{\gamma}^*(1) = \underline{u}(1)$. The participation constraints of the two types of co-worker are summarized in the right-hand side of Table I. The separating equilibrium exists by Proposition 2 for some reward structures. In equilibrium is $\gamma \geq \overline{\gamma}(0)$ which rules out reward structures of type (a) and (c) in Corollary 1. Thus, $\widetilde{s}^S$ is an equilibrium if

$$\gamma \in [1, 2.51) = \left[\overline{\gamma}(1), \underline{\gamma}(0)\right) \text{ and } \phi \geq \left[\underline{\phi}, +\infty\right) = [2.06, +\infty)$$

or

$$\gamma \geq 2.51 = \underline{\gamma}(0) \text{ and } \phi \in \left[\underline{\phi}, \overline{\phi}\right] = [2.06, 3.21]$$

which corresponds to cases (b) and (d) in Corollary 1. The right-hand side of Table II describes the case of conflicting interests. Here, the separating equilibrium exists only if (t, ϕ) is of type (a) or (b). In terms of the situation described in Fig. 1, the basic intuition is that the changes in c_C and p_C move the restriction $\underline{\gamma}^*(0, \cdot)$ to a position above $\widetilde{\phi}(\cdot)$ which means that the incompetent co-worker will not accept working for an incompetent leader. This eliminates regions 4 and 5, i.e. cases (c) and (d) in Corollary 2.

6 Summary and Discussion

The question of under what circumstances a particular separating equilibrium exist has been investigated in a framework of incomplete contracting which is an important simplifying assumption. The assumption is nevertheless a reasonable description of many interesting situations, e.g. general elections and shareholder meetings where voters or owners have to decide whether they have confidence in the incumbent leader or not. Also the assumption that the principal can not observe the true abilities of the team members (with exception of the co-worker when he is blamed) can be defended by real-life arguments. However, there is one implicit assumption in the model that is more difficult to defend, namely that the policy outcome is reduced to a function of the abilities of the team members. In the world of the model, the leader is somehow competent to make the co-worker loyal to him in his effort to maximize the policy outcome.[1] This is generally not in the interest of the competent co-worker who benefit from a poor policy outcome and sometimes not in the interest of the incompetent co-worker either. Viewing this as a monitoring problem, the leader's choice is to appoint an competent co-worker who may need to be carefully monitored or an incompetent co-worker who may need less monitoring. An interesting aspect of monitoring is that it may be difficult to blame someone who has been carefully monitored. The difference in incentives between the two types of co-worker and the trade off between monitoring and responsibility are likely to be of importance for the existence of a separating equilibrium. Finally, changing the principal's acknowledgment policy regarding the leader to some arbitrary probability does not change any qualitative results. However, if this probability is too low then a separating equilibrium can not exists since the insurance motive is eliminated.

[1] Grooves (1973) shows that if the leader (principal) is free to design payment schemes then there exists a payment scheme that solves every incentive problem and makes the co-worker (team members) act in a way that maximizes the leader's (principal's) utility.

Appendix

Proof of Lemma 1. Rewriting $\overline{\phi} \geq \underline{\phi}$ gives

$$\left(\frac{1-F(E_{00})}{1-F(E_{01})} - \frac{1-F(E_{10})}{1-F(E_{11})}\right) c \geq \frac{g(\alpha+1)-g(\alpha)}{1-F(E_{11})} - \frac{1}{1-F(E_{01})}. \quad (13)$$

(i) Suppose 6 and 5 hold. The right-hand side of 13 is non-positive and the left-hand side is non-negative since c is non-negative by assumption. Hence, 13 holds for all $c \geq 0$. (ii) Suppose 5 holds strictly and 6 doesn't hold. Both sides of 13 is strictly positive and 13 holds for all $c \geq \underline{c}$ where

$$\underline{c} \equiv \frac{\frac{g(\alpha+1)-g(\alpha)}{1-F(E_{11})} - \frac{1}{1-F(E_{01})}}{\frac{1-F(E_{00})}{1-F(E_{01})} - \frac{1-F(E_{10})}{1-F(E_{11})}} \geq 0. \quad (14)$$

(iii) Suppose 6 holds strictly while 5 doesn't hold. Both sides of 13 are strictly negative since $c \geq 0$ by assumption. Hence, if $c \leq \underline{c}$ then 13 holds.

Proof of Proposition 1. Suppose s^S is not an equilibrium. Then there exists some strictly profitable deviation s_L for a leader of type $\mathsf{L} \in \{0,1\}$. Suppose s_L prescribe $\mathsf{C} = 0$. From s_P^S and the principal's out-of-equilibrium beliefs it follows that letting $B = 1$ for all $x \notin X$ and $B = 0$ for all $x \in X$ maximizes the expected payoff for all L. This implies that

$$E\left[u_L \mid s_L^D, s_P^S, \mathsf{L} = 0\right] \geq E\left[u_L \mid s_L, s_P^S, \mathsf{L} = 0\right]$$

and

$$E\left[u_L \mid s^S, \mathsf{L} = 1\right] \geq E\left[u_L \mid s_L, s_P^S, \mathsf{L} = 1\right].$$

By assumption is $\underline{\phi} \leq \phi \leq \overline{\phi}$ which makes $E\left[u_L \mid s^S, \mathsf{L}\right] \geq E\left[u_L \mid s_L^D, s_P^S, \mathsf{L}\right]$ and s_L can not prescribe $\mathsf{C} = 0$ for which reason it must prescribe $\mathsf{C} = 1$. From s_P^S and the principal's out-of-equilibrium beliefs it follows that $B = 0$ for all x maximizes the expected payoff of both types of leader when $\mathsf{C} = 1$. Hence,

$$E\left[u_L \mid s^S, \mathsf{L} = 0\right] \geq E\left[u_L \mid s_L, s_P^S, \mathsf{L} = 0\right]$$

and

$$E\left[u_L \mid s_L^D, s_P^S, \mathsf{L} = 1\right] \geq E\left[u_L \mid s_L, s_P^S, \mathsf{L} = 1\right].$$

Since $\underline{\phi} \leq \phi \leq \overline{\phi}$ is $E\left[u_L \mid s^S, \mathsf{L}\right] \geq E\left[u_L \mid s_L^D, s_P^S, \mathsf{L}\right]$ and $\mathsf{C} = 1$ can not be a part of any strictly profitable deviation and s_L^S therefore maximizes the expected payoff of both types of leader. By definition, s_P^S maximizes the expected utility of the principal and s^S constitutes a Nash equilibrium. ■

Proof of Lemma 2. By showing that the participation constraint is violated for $L = 0$ when $p_C + p > 1$ it is shown that $\widetilde{s}^S$ does not constitute a Nash equilibrium. In equilibrium is

$$\Pr\left(\mathsf{C} = 1 \mid \{\mathcal{C}, x\}, s_L^S\right) = 1 - \Pr\left(\mathsf{L} = 1 \mid \{\mathcal{C}, x\}, s_L^S\right).$$

Suppose $p_C + p > 1$, then $E\left[u_C \mid \widetilde{s}^S, \mathsf{C}=0\right] = -c_C$ since $\Pr\left(\mathsf{C}=1 \mid \{\mathcal{C}, x\}, s_L^S\right) < p_C$ (and thus $A_C = 0$) for all equilibrium observations $\{\mathcal{C}, x\}$.

Proof of Proposition 2. Condition (i) guarantees that $\underline{\phi} \leq \overline{\phi}$. Conditions (ii) guarantees that $\underline{\gamma}(1)$ is finite and condition (iii) ensures that $\gamma \geq \underline{\gamma}(1), \overline{\gamma}(0)$. Hence, if conditions (i)-(iii) are met and $\phi \in \left[\underline{\phi}, \overline{\phi}\right]$ then there exists no strictly profitable deviation for any type of leader and both types of co-worker participates. The principal's strategy $\widetilde{s}_P^S$ maximizes the principals expected utility. Hence, $\widetilde{s}^S$ is a separating equilibrium. ■

Proof of Corollary 1. Conditions (ii) and (iii) in Proposition 2 must be met in equilibrium and since $\underline{\gamma}(0) > \underline{\gamma}(1)$ and $\overline{\gamma}(1) > \overline{\gamma}(0)$ there are six possible orderings of $\underline{\gamma}(0), \underline{\gamma}(1), \overline{\gamma}(0)$, and $\overline{\gamma}(1)$. Using that $\gamma \geq \underline{\gamma}(1), \overline{\gamma}(0)$ in equilibrium reduces the six cases to four possible cases, (a)-(d) in Corollary 1. Whenever $\gamma \geq \underline{\gamma}(0)$, $\mathsf{C}=0$ accepts an offer from $\mathsf{L}=0$ who consequently has the possibility to deviate by playing s_L^D. Hence, if $\underline{\gamma} \geq \underline{\gamma}(0)$ then $\phi \leq \overline{\phi}$ in equilibrium. Analogously, if $\gamma \geq \overline{\gamma}(1)$ then $\phi \geq \underline{\phi}$ in equilibrium. By the same logic, if $\gamma < \underline{\gamma}(0)$ then $\mathsf{L}=0$ can not appoint $\mathsf{C}=0$ which makes $\phi > \overline{\phi}$ consistent with the separating equilibrium. Also, if $\gamma < \overline{\gamma}(1)$ then $\mathsf{L}=1$ can not appoint $\mathsf{C}=1$ and $\phi < \underline{\phi}$ is consistent with equilibrium.

Proof of Lemma 3. (i) Rewriting the inequality $\phi \geq \underline{\phi}^*(t)$ gives

$$1 - F(E_{11}) - (1-t)(FD_{10} - F(D_{11})) \geq \overline{\phi}(1 - F(E_{11}))/\phi. \qquad (15)$$

If t exists then the left-hand side of 15 is equal to zero at t and negative for all $t < \mathsf{t}$. The right-hand side is constant and positive since $\phi > 0$ by assumption. Inequality 15 is thus violated for all $t \leq \mathsf{t}$ implying that $E\left[u_L \mid s_L^D, s_P^S, \mathsf{L}=1\right] > E\left[u_L \mid s^S, \mathsf{L}=1\right]$ for all such t. Hence, s^S is not a Nash equilibrium for any $t \leq \mathsf{t}$.
(ii) By the continuity of $\underline{\phi}^*$ and $\overline{\phi}^*$ (proof omitted) there exists an interval $\mathcal{N} = (n, 1]$ such that $\overline{\phi}^*(t) \geq \underline{\phi}^*(t) > 0$ for all $t \in \mathcal{N}$. Let $\mathcal{N}^*$ be the largest interval with this property and let t' be the infinimum of $\mathcal{N}^*$. Note that if t exists, then $t' > \mathsf{t}$.
The function $\widetilde{\phi}$ increases continuously from $\widetilde{\phi}(0) = c$ to $\lim_{t \to 1} \widetilde{\phi}(t) = +\infty$. By the properties of $\underline{\phi}^*$ it follows that whether t exists or not, there exists a $t'' \in (0,1)$ which is the smallest t such that $\underline{\phi}^*(t) \leq \widetilde{\phi}(t)$ for all $t \in [t'', 1]$. Note that if t exists, then $t'' > \mathsf{t}$.
Let $t^* = \max\{t', t''\}$, then $\underline{\phi}^*(t) \leq \widetilde{\phi}(t), \overline{\phi}^*(t)$ for all $t \in [t^*, 1]$.

Proof of Proposition 3. By Lemma 3 and condition (i) and (iii) is $\underline{\phi}^*(t) \leq \overline{\phi}^*(t), \widetilde{\phi}(t)$. By the properties of $\underline{\phi}^*, \overline{\phi}^*$, and t^* there exists no profitable deviation for $\mathsf{L}=0,1$ when $\phi_1 \in \left[\underline{\phi}^*(t), \max\left\{\overline{\phi}^*(t), \widetilde{\phi}(t)\right\}\right]$ (the method of showing this is analogous to the proof of Proposition 1). The participation constraint for $\mathsf{C}=0$ is satisfied for all $\phi \geq \underline{\gamma}^*(0,t)$ since $c_C \leq \overline{c}_C(t)$

and the participation constraint for $\mathsf{C} = 1$ satisfied since $\underline{u}_C(1) \leq \overline{u}_C(t)$. Hence, $\widetilde{s}^S$ constitutes a Nash equilibrium. ■

Proof of Corollary 2. If $\widetilde{s}^S$ constitutes a Nash equilibrium then conditions (iv) and (v) in Proposition 3 must be met, i.e. $\phi \geq \max\left\{\underline{\gamma}^*(1,t), \overline{\gamma}^*(0,t)\right\}$. Having established this, the rest of the proof is analogous to the proof of Corollary 1.

References

[1] Besley, T. and Case, A. (1995). "Does Electoral Accountability Affect Economic Policy Choices? Evidence from Gubernatorial Term Limits", *Quarterly Journal of Economics* **110**, 769-798.

[2] Cho, I-K. and Kreps, D.M. (1987). "Signaling Games and Stable Equilibria", *Quarterly Journal of Economics* **102**, 179-221.

[3] Effinger, M. and Polborn, M. (1999). "Herding and Anti-Herding: A Model of Reputational Differentation", mimeo, University of Munich.

[4] Ferejohn, J. (1986). "Incumbent Performance and Electoral Control", *Public Choice* **50**, 5-26.

[5] Gibbons, R. and Murphy, K.J. (1992). "Optimal Incentive Contracts in the Presence of Career Concerns: Theory and Evidence", *Journal of Political Economy* **100(3)**, 468-505.

[6] Groves, T. (1973). "Incentives in Teams", *Econometrica* **41(4)**, 617-631

[7] Harrington, J.E. (1993). "Economic Policy, Economic Performance, and Elections", *American Economic Review* **83(1)**, 27-42.

[8] Jeon, S. (1996). "Reputational Concerns and Managerial Incentives in Investment Decisions", *European Economic Review* **42**, 1203-1219.

[9] Levy, G. (1999). "Strategic Consultation and 'Yes Man' Advisors" in *Essays on Strategic Information Transmission*, Dissertation in Economics, Princeton University.

[10] Meyer, M.A. and Vickers, J. (1997). "Performance Comparisons and Dynamic Incentives", *Journal of Political Economy* **105(3)**, 547-581.

[11] Rogoff, K. (1990). "Equilibrium Political Business Cycles", *American Economic Review* **80(1)**, 21-36.

[12] Persson, T. and Tabellini, G. (1990). *Macroeconomic Policy, Credibility and Politics*. London: Harwood Academic Publishers.

[13] Trueman, B. (1994). "Analyst Forecasts and Herding Behavior", *Review of Financial Studies* **7**, 97-124.