An Economic Theory of Leadership

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Abstract

This paper studies the role of leadership style in providing incentives to subordinates. A leadership style is characterized by its degree of decentralization of tasks and its degree of empathy towards subordinates interests. I analyze the optimal leadership style in an incomplete contract framework in which the agent as well as the principal jointly have to solve decision problems and implement their solutions. I show that the optimal leadership style crucially depends on the environment (structure of decision problems and associated payoffs) as well as on the agent's personality (willingness and competence). Moreover, I examine a number of other factors that influence the optimal leadership style like monetary incentives, learning and reciprocity.

Key Words: leadership, decentralization, empathy, incomplete contracts.

JEL Classification: J24, M12, M5.

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1 Introduction

Leadership is a topic that has long excited interest among scholars in the field of management science as well as among practitioners.[1] Despite its long tradition in the management literature, there are as many definitions of leadership as there are researchers who have tried to define it.[2] Nevertheless, there are some common components identified as central to the phenomenon of leadership: Leadership is an influence process in which both the leader and a group of followers take part. And, this influence process involves goal attainment in the sense that leaders direct their activities towards accomplishing some tasks. Of particular interest for researchers on leadership is the question, how a leader is able to influence subordinates to effectively accomplish the goals assigned to them.

Management research on this topic of the effectiveness of leadership was initiated in 1945 at the Ohio State University. In their studies the researchers attempted to identify dimensions of leader behavior through a Leadership Behavior Description Questionnaire (LBDQ). Factor analysis of the questionnaire responses indicated that subordinates perceived their supervisor's leadership behavior, also called leadership style, in terms of two dimensions:[3] The first dimension reflects the degree of task

[1] See e.g. Northouse (2003) or Yukl (1989) for surveys.

[2] See e.g. Stogdill (1974), House and Braetz (1979) or Fleishman et al. (1991) for some representative definitions over a quarter century. The definition offered here is consistent with the one offered by Northouse (2003, p. 3): "Leadership is a process whereby an individual influences a group of individuals to achieve a common goal".

[3] See Fleishman (1953) or Halplin and Winer (1957) for the Ohio State studies which initally labelled the two dimensions of leadership as "initiating structure" and "consideration". They correspond to task orientation and relationship orientation, respectively. Other synomys are "job-oriented behavior" and "employee-oriented behavior" introduced by the Michigan leadership studies which were carried out by

orientation of leaders' behavior, that is, the extent to which a leader defines and structures subordinates' work. This behavior includes activities like assigning subordinates to tasks, setting performance goals or coordinating their work. The second dimension refers to the degree of relationship orientation of leaders' behavior, that is the extent to which a leader shows concern for subordinates and looks out for their welfare. This behavior includes activities like doing personal favors to subordinates, providing recognition for their contributions or being willing to accept their suggestions.

One important contribution of these studies is that task orientation and relationship orientation are relatively independent behavior categories. In particular, some leaders could be high or low on both dimensions, high on one and low on the other dimension, or even between the extreme high and low scores. Based on these results, an extensive research in the 50s, 60s and 70s on the effectiveness of leader behavior gave rise to several theories: Blake and Mouton (1954), for example, postulate in their "Managerial Grid Theory" that effective leaders should always be high on both dimensions. Whereas such universal theories suggesting a single ideal type of leader behavior neglect the role of intervening variables, the situational theories of optimal leader behavior explicitly recognize the influence of situational variables on the relative importance of different leadership styles. Reddin's "3-D Management Style Theory" (1967) or Hersey and Blanchard's "Life-cycle Theory of Leadership" (1969, 1996) are two of the best known models in the literature on leadership that try to explain how the optimal pattern of

researchers of the Unversity of Michigan at approximately the same time as the Ohio State studies. They appear similar to the two dimensions "initiating structure" and "considersation" as defined by the Ohio State researchers., see e.g. Yukl (1989, p. 81).

leadership varies across situations.[4]

In his evaluation of the situational theories of leadership Yukl (1989, p.122) comes to the conclusion that these "theories provide insights into reasons for leadership effectiveness, but they all have conceptual weaknesses." In particular, most of these theories do not offer a coherent, explicit rationale for the hypothesized effectiveness of leadership or define situational variables too broadly and conceptually ambiguous. For an economist, this management research on leadership is rather disappointing. However, the economic literature on leadership is disappointing as well. With some exceptions mentioned later most economic theories focus on a contractual relationship between a leader, called principal, and his/her followers, called agents. In the standard principal-agent model the principal offers a contract to the agent which specifies the agent's compensation. This compensation then depends on variables which are imperfectly related to the agent's effort. The underlying assumption is that such a variable is verifiable by the principal, for example, the agent's performance. Hence, monetary incentives to influence the agent to accomplish the principal's goals are in the focus of this literature. The analysis of leadership in the sense that the principal as a leader influences the agent's behavior via his/her own behavior is generally not considered.

There are two notable exceptions which study the question of leadership behavior in an economic setup.[5] Rotemberg and Saloner (1993)

[4]Both theories take task orientation and relationship orientation as independent dimensions. There are several other situational theories of leadership which consider only a one-dimensional spectrum of leadership behavior, e.g. Fiedler's (1964) "Contingency Theory" or Vroom and Yetton's (1973) "Normative Model".

[5]A notable third exception is the article of Hermalin (1998). He studies the question "how a leader can induce rational agents to follow her in situations when

examine a situation in which an agent can expend efforts in developing profit-enhancing ideas. On the basis of these ideas the agent proposes a project to a principal who then must decide whether or not to implement the project. The agent's effort as well as the profits from a project are not verifiable. To influence the agent's effort choice the principal can empathize with the agent by placing some weight on the agent's utility. An empathic leader then cares only about the welfare of the agent, whereas an autocratic leader decides on project implementation by maximizing profits. In the terminology of the managerial leadership literature, the authors investigate the optimal degree of relationship orientation of a leadership style.[6] They show that an empathic leader is superior to an autocratic one, if the environment is rich for good ideas.

The second paper which studies leadership styles is by Aghion and Tirole (1997). Differing from the analysis by Rotemberg and Saloner these authors focus on the optimal degree of task orientation of a leadership style. They consider a situation in which a principal hires an agent to collect information about projects that cannot be described and contracted on. The agent's preferred project, however, does not necessarily coincide with the principal's preferred one. Contemporaneously with the agent's acquisition of information the principal therefore makes his own investigation. Which party then actually has the choice of the project depends on the principal's allocation of authority. Under P-formal au-

the leader has incentives to mislead them" (p. 1188). Whereas in his theory the focus is on the issue of trust-building, this aspect is not considered in this paper. Instead, we assume that the leader's behavior is common knowledge. On the other hand, leadership styles are an aspect not considered in his paper.

[6]Different to the analysis in this paper, Rotemberg and Saloner assume that the leader's personality completely determines the leadership style and consider different personalities of leaders. In contrast, we assume that a leader can choose his leadership style, at least within some range. See also our discussion in Section 6.

thority, the principal may overrule the agent's proposal, whereas under A-formal authority, the agent picks his preferred project and cannot be overruled by the principal. The authors then examine some of the main determinants of the delegation of formal authority.[7]

In sum, both papers by Rotemberg and Saloner (1993) and Aghion and Tirole (1997) study the optimal leadership behavior but focus their analysis on one of the previously mentioned dimensions of leadership. The purpose of my approach is to integrate these two dimensions of leadership in a general comprehensive framework. Taking the above mentioned components as the defining feature of leadership, this theory of leadership builds on three essential elements: the principal's leadership style toward influencing the agent; the agent's behavior toward goal attainment; and the situation in which their interactions take place including the structure of tasks. As a result, I derive general principles of leadership effectiveness that provide guidelines which leadership style is more or less desirable in different situations.

To investigate the effect of different leadership styles I consider an incomplete contract framework in which the agent as the follower as well as the principal as the leader jointly have to solve decision problems and implement their solutions. Decision problems have an operational as well as a strategic dimension and the agent is specialized in acquiring operational information, whereas the principal is specialized in learning about the strategic part. Since each decision problem has several solutions which might differ in profits for the principal and in private

[7]Besides these considerations, the focus of Aghion and Tirole is on the distinction between formal and real authority: The agent has real authority if the principal refrains from reversing the agent's choice although he has the formal authority to do so. The paper examines several factors that increase the agent's real authority under centralization.

benefits for the agent, the allocation of formal authority over the choice and implementation of the problem's solution is crucial and refers to the first dimension of the principal's leadership style, the degree of task orientation. In one extreme, called "centralization", the principal keeps decision making power for all decision problems, that is, the principal always selects the solution and implements this solution. In the other extreme, called "decentralization", the principal delegates decision making authority for all possible decision problems to the agent who now can decide about solutions and their implementation. Besides the degree of task orientation, the principal can also use the degree of relationship orientation to increase the agent's incentives to acquire information. Again, this dimension describes a continuum of different behaviors by the principal, where in one extreme, called "autocracy", the principal always acts as a selfish profit maximizer and chooses solutions only to maximize profits. In the other extreme, called "empathy", the principal acts only in the agent's interests by maximizing the agent's private benefits.

Following the contingency view in management theory, see Lawrence and Lorsch (1967) and Perrow (1970), I show that the optimal leadership style crucially depends on the environment in which joint decision making takes place, see Yukl (1989, p. 164ff). Concerning task characteristics I consider two aspects that influence leadership: the structure of decision problems with respect to the relative percentage of operational and strategic issues; and, the importance of decisions problems for the principal and the agent, given by the associated payoffs.[8] Concerning the agent's personality I show that leadership behavior is influenced by the

[8]The task characteristics appear related to the Vroom and Yetton's moderate variables in their "Normative Model" (1973). They consider "the extent to which the leader possesses information/expertise to make a high-quality decision" and "the importance of the quality of the decision" as essential attributes of a decision problem.

following two factors: the agent's degree of willingness which captures the extent of congruence between the principal's preferred solutions and the one by the agent; and, the agent's degree of competence, that is, the talent the agent has to acquire information and implement solutions.[9] Moreover, I examine a number of other factors that influence the optimal leadership style like monetary incentives, learning and reciprocity.

The paper is organized as follows: Section 2 presents the model. Section 3 considers leadership from an incentive view and examines for different leadership styles the basic-trade off between increasing the agent's incentives and giving up implementation control by the principal. Section 4 then turns to the participation view of leadership which in the absence of incentive considerations focuses on the parties' stakes in implementing decision problems' solutions. Section 5 combines these two views and extends the basic model to look for other factors influencing optimal leadership. Section 6 concludes with some final remarks.

2 The Model

I consider a hierarchical relationship between a principal (she) and an agent (he) in the context of joint decision making. The principal is confronted with a series of decision problems. She hires an agent to collect information about how to solve decision problems. Depending on the principal's leadership style, see below, the agent may also be in charge for the selection and implementation of solutions.

[9] The agent's characteristics appear related to the Blanchard and Hersey's (1969) moderate variables. They consider "ability" which is "the knowledge, experience, and skill that an indiviual ... brings to a particular task" and "willingness" which is "the extent to which an indivdual... has the confidence, commitment, and motivation to accomplish a specific task", see Hersey et al. (2001, p. 176).

Decision problems: Every decision problem has several solutions. Consider a particular decision problem denoted by s. With each solution of s is associated a non-verifiable profit for the principal and a non-verifiable private benefit for the agent. The principal's preferred solution yields known profit B_s with $B_s > 0$, whereas the agent's preferred solution yields known private benefits b_s with $b_s > 0$.

To simplify matters I assume the following payoff structure between these preferred solutions: If the principal's preferred solution is implemented, the agent's private benefits are either zero or b_s. Similarly, if the agent's preferred solution is implemented, it yields either profit B_s or zero for the principal. That is, the two "relevant" solutions to a decision problem yield either a payoff structure (B_s, b_s) or $(B_s, 0)$ to both parties if the principal's preferred solution is implemented, or they yield either a payoff structure (B_s, b_s) or $(0, b_s)$ if the agent's preferred solution is implemented.

The ex ante probability that the same solution is preferred by both parties is denoted by $w \in [0, 1]$. I refer to this congruence parameter as the agent's degree of willingness. This information is common knowledge. If, for example, $w = 1$, the principal knows that the agent prefers the same solution as he does. If, on the other hand, $w = 0$, their preferences are non-congruent and the agent would prefer a different solution as the principal does and vice versa.

The principal is risk-neutral so that her (expected) utility from solving a decision problem is either B_s in case her preferred solution is implemented or $w \cdot B_s$ in case the agent's preferred solution is implemented. This implies that the agent receives a constant wage equal to his reservation wage of zero.[10] The agent derives utility from his wage and his

[10]Note that since the principal's profit is non-contractible, the agent's wage has

private benefits from solving a decision problem. If his preferred solution is implemented, his utility is $u(0) + b_s$, if the principal's preferred solution is implemented, his utility is $u(0) + w \cdot b_s$.

Information acquisition: Every decision problem has an operational as well as a strategic dimension. For a particular decision problem s I assume that $s \in [0,1]$. The interpretation is that s denotes the percentage of strategical issues and $(1-s)$ denotes the percentage of operational issues of this decision problem.[11]

How to solve a decision problem and implement its solution is apriori unknown to both parties. The agent as well as the principal therefore have to acquire information about the solution of the decision problem and its implementation. I assume that the principal is specialized in learning about the strategic part of the decision problem, whereas the agent is specialized in acquiring operational knowledge necessary for its solution. Moreover, I assume that the agent's ability to acquire information depends on his talent $t \in [0,1]$. I interpret t as the agent's degree of competence. That is, the higher his talent t, the more competent is his information acquisition.

At private cost $c_1(I)$ the principal acquires strategic information $I \in [0,1]$ about the decision problem. Of course, the more information she acquires the higher her costs, at an increasing rate, that is, $c_1' > 0$ and

to be a constant. Moreover, since information acquisition is non-contractible, the principal cannot use monetary incentives. See also Section 5.2 for an analysis of monetary incentives.

[11] Of course, depending on the circumstances, one would expect that some kind of correlation between the strategic and operational issues of a decision problem and the principal's, respecitively, agent's associated payoffs. For example, it seems intuitive to assume that the higher the percentage of strategic (operational) issues, the higher the principal's (agent's) payoff. In our analysis we do not make any restrictions on this.

$c_1'' > 0$. Similarly, at private cost $c_1(i)$ the agent acquires operational information $t \cdot i \in [0,1]$ about the decision problem. For simplicity I assume that both parties have identical cost functions.

The information separately acquired by each of the two parties about the decision problem has to be combined in order to implement its solution successfully. I assume that information can be costlessly communicated by the party who collected it. However, to use such information from the other party in one's own decision making, the party implementing the solution has to acquire absorptive knowledge. If, for example, the agent is in charge of solving the decision problem and implementing its solution, he has to acquire not only operational information about the problem but also strategic knowledge. The latter allows him to actually use the strategic information about the problem acquired and communicated by the principal.

Let $c_2(k)$ be the private cost of the agent to acquire strategic knowledge $k \in [0,1]$ about the decision problem, if he is the implementing party. Similarly, let $c_2(K)$ be the principal's cost for acquiring operational knowledge $K \in [0,1]$, if he tries to use the agent's operational information when implementing the solution of the decision problem. Again, for simplicity I assume that both parties have identical cost functions with $c_2' > 0$, $c_2'' > 0$.

Implementation success: Whether the implementing party can successfully implement the solution of the decision problem depends on the knowledge available to this party. I interpret the information acquired by each party as the probability that determines the success of this implementation. Depending on which party actually implements the solution - either the principal is the implementing party or she delegates implementation to the agent - I model the probability of a successful

implementation as follows.

Suppose first that the principal implements the solution. With probability $I \in [0,1]$ she successfully implements the strategic issues of the solution. The success of implementing the operational part of the solution depends on the information $t \cdot i \in [0,1]$ acquired by the agent and on her absorptive knowledge $K \in [0,1]$. I assume that she can absorb only a fraction of the operational information from the agent. In particular, her absorptive capacities are given by $h(K) \in [0,1]$ with $h' > 0$, $h'' < 0$. In sum, with probability $t \cdot i \cdot h(K)$ the principal successfully implements the operational issues of the solution. The overall effective knowledge as probability of a successful implementation by the principal is then given by

$$s \cdot I + (1-s) \cdot t \cdot i \cdot h(K).$$

Similarly, suppose that the principal has delegated implementation to the agent. He successfully implements the operational issues of the solution with probability $t \cdot i \in [0,1]$. He also uses the principal's strategic information $I \in [0,1]$ but the degree to do so depends on his absorptive capabilities. For simplicity, I assume that these are given by $t \cdot h(k)$. That is, the fraction he can absorb of the strategic information communicated by the principal depends on his degree of competence t and his investments in absorptive knowledge k. Altogether, the overall probability of a successful implementation by the agent is then given by

$$s \cdot t \cdot I \cdot h(k) + (1-s) \cdot t \cdot i.$$

Leadership styles: As outlined in the Introduction I describe the principal's leadership behavior along two separate and distinct dimensions, labelled "task orientation" and "relationship orientation". In the context of our model, these two concepts have the following interpretation:

- Task orientation is defined as the extent to which the principal is engaged in choosing solutions for decision problems and implementing these choices. In one extreme, she keeps her decision making power for all possible decision problems $s \in [0, 1]$. In this case, she always selects the solution and implements this solution. I call this extreme "centralization". The principal whose behavior is at the centralization end has a low task orientation. As task orientation rises, the principal delegates part of her authority to decide to the agent. In the other extreme, called "decentralization", the principal delegates her decision making power to the agent for all possible decision problems $s \in [0, 1]$. In this case, the agent always has the authority to decide about the solution and to implement it. High task orientation then refers to the principal's behavior, if it appears to be at the decentralization end of the continuum.

- Relationship orientation is defined as the extent to which the principal supports the interests of the agent in her decisions. Again, this dimension describes a continuum of different behaviors by the principal. In one extreme, she always acts as a selfish profit maximizer. That is, for all possible decision problems $s \in [0, 1]$ she chooses her investments in the acquisition of knowledge and, depending the extent of task orientation, the solution for decision problems only in her own interests. I call this extreme "autocracy". A low relationship orientation then means that the principal's behavior is at the autocracy end. As relationship orientation rises, the principal cares more about the agent's well-being by deciding in his interest. In the other extreme, called "empathy", she chooses her decisions only in the agent's interest. That is, for all possible decision problems $s \in [0, 1]$ her acquisitions of strategic informa-

tion, and, if necessary, her investments in absorptive knowledge and the choice of a solution are solely governed by maximizing the agent's private benefits.

I describe the principal's leadership styles as any mix of these two dimensions. Plotting task orientation from low to high on the horizontal axis and relationship orientation from low to high on the vertical axis makes it possible to describe leadership styles in four quadrants as shown in figure 1.

figure 1

Figure 1: Leadership styles and joint decision making

The following descriptions and payoff structures apply to the four styles:

- Telling (style T): This style is characterized by a low task orientation and a low relationship orientation. That is, for most decision problems the principal acquires absorptive operational knowledge, implements the solution and chooses her decisions to maximize her own profits. For a particular decision problem $s \in [0,1]$, let (I_T, K_T) be the principal's investments in strategic information and absorptive operational knowledge, i_T the agent's investments in operational information and

  $$p_T = s \cdot I_T + (1-s) \cdot t \cdot i_T \cdot h(K_T)$$

  the probability for a successful implementation. Then the principal chooses (I_T, K_T) to maximize her expected profits $\Pi_T(I_T, K_T)$ and the agent chooses i_T to maximize his expected utility $U_T(i_T)$ with

  $$\Pi_T(I_T, K_T) = p_T \cdot B_s - c_1(I_T) - c_2(K_T)$$
  $$U_T(i_T) = p_T \cdot w \cdot b_s - c_1(i_T).$$

- Selling (style S): This style is characterized by a low task orientation and a high relationship orientation. In this case, for most decision problems the principal acquires absorptive operational knowledge and implements the solution but chooses her decisions to maximize the agent's private benefits. Given a particular decision problem $s \in [0,1]$, let (I_S, K_S) be the principal's investments in strategic information and absorptive operational knowledge, i_S the agent's investments in operational information and

$$p_S = s \cdot I_S + (1-s) \cdot t \cdot i_S \cdot h(K_S)$$

the probability for a successful implementation. Then the principal chooses (I_S, K_S) to maximize the agent's expected utility minus her investment costs $U_S - c_1(I_S) - c_2(K_S)$ and the agent chooses i_S to maximize his expected utility $U_S(i_S)$. The resulting payoffs then are

$$\begin{aligned} \Pi_S(I_S, K_S) &= p_S \cdot w \cdot B_s - c_1(I_S) - c_2(K_S) \\ U_S(i_S) &= p_S \cdot b_s - c_1(i_S). \end{aligned}$$

- Delegating (style D): This style is characterized by a high task orientation and a low relationship orientation. For most decision problems the authority to decide is now delegated to the agent who acquires absorptive strategic knowledge and implements the solution. When deciding about her investments in strategic information, the principal then maximizes her own profits. For a given decision problem $s \in [0,1]$, let I_D be the principal's investments in strategic information, (i_D, k_D) the agent's investments in operational information and strategic absorptive knowledge and

$$p_D = s \cdot t \cdot I_D \cdot h(k_D) + (1-s) \cdot t \cdot i_D$$

the probability for a successful implementation. Then the principal chooses I_D to maximize her expected profits $\Pi_D(I_D)$ and the agent chooses (i_D, k_D) to maximize his expected utility $U_D(i_D, k_D)$ with

$$\Pi_D(I_D) = p_D \cdot w \cdot B_s - c_1(I_D)$$
$$U_D(i_D, k_D) = p_D \cdot b_s - c_1(i_D) - c_2(k_D).$$

- Participating (style P): This style is characterized by a high task orientation and a high relationship orientation. That is, for most decision problems the principal delegates her authority to decide to the agent who acquires absorptive strategic knowledge and implements the solution. The principal chooses her investments in strategic information in the agent's interest. For a particular decision problem $s \in [0,1]$, let I_P be the principal's investments in strategic information, (i_P, k_P) the agent's investments in operational information and strategic absorptive knowledge and

  $$p_P = s \cdot t \cdot I_P \cdot h(k_P) + (1-s) \cdot t \cdot i_P$$

  the probability for a successful implementation. Then the principal chooses I_P to maximize the agent's expected utility minus her investment cost $U_P - c_1(I_P)$ and the agent chooses i_S to maximize his expected utility $U_S(i_S)$. The resulting payoffs then are

  $$\Pi_P(I_P) = p_P \cdot w \cdot B_s - c_1(I_P)$$
  $$U_P(i_P, k_P) = p_p \cdot b_s - c_1(i_P) - c_2(k_P).$$

Contracting and time structure: Since neither information acquisition by the agent nor the choice of the solution of a decision problem can be described and contracted on ex ante, I adopt an incomplete contracting approach. The initial contract between the principal and the

agent therefore specifies the principal's leadership style over joint decision making for possible future decision problems.[12] A leadership style can be conditioned on the nature of future decision problems, that is on $s \in [0,1]$, as well as on the agent's characteristics, that is on his degree of willingness, $w \in [0,1]$, and on his degree of competence, $t \in [0,1]$. The principal chooses her leadership style so that it maximizes her expected payoffs subject to the agent's participation constraint.

The time-schedule of the relationship between the principal and the agent is as follows:

figure 2

Figure 2: Timing of events

The relationship evolves over five periods, see figure 2: In the first period, the principal offers a contract that rules the extent of task orientation and relationship orientation of his leadership style. In the second period, a decision problem arises which has to be solved. In the third period, both parties collect information about the decision problem and its solution. The principal acquires strategic information, the agent operational information. Moreover, depending on the extent of task orientation of the leadership style, the implementing party acquires absorptive knowledge. In period four, the party who does not have the right to choose and implement a solution communicates its information

[12] Note that we implicitly assume here that the principal can choose between different leadership styles. There is an ongoing discussion in the management literature whether the principal can actually adapt his style or whether his style is determined by his personality, see Section 6. Given the principal chooses his style, the additional assumption is that she can commit herself to a particular leadership style. See Hersey et al. (2001, p.287ff) for a discussion, how the principal and the agent can "contract for leadership style".

to the controlling party who selects, and, thereafter, implements a solution. The implementation success and the parties' payoffs are realized in the fifth period.

3 The incentive view of leadership

Before I discuss how a change in leadership behavior changes the parties' incentives to invest in knowledge acquisition, I first analyze the optimal behavior for a given leadership style. Consider, for example, style T: For a certain decision problem s the principal as the implementing party invests in strategic information and absorptive operational knowledge, knowing that she will implement her preferred solution. The agent, on the other hand, invests in operational information to maximize his resulting expected private benefits. The reaction curves in information acquisition for both parties are defined by the first-order conditions

$$s \cdot B_s = c_1'(I_T), \tag{1}$$

$$(1-s) \cdot t \cdot B_s \cdot h'(K_T) \cdot I_T = c_2'(K_T), \tag{2}$$

$$(1-s) \cdot t \cdot w \cdot b_s \cdot h(K_T) = c_1'(i_T). \tag{3}$$

The principal always invests more in information acquisition the higher his profits. Regarding strategic information, she acquires more information, the higher the strategic issues of the decision problem. Regarding absorptive operational knowledge she gathers more information the higher the operational part of the decision problem and the higher the agent's acquisition of operational information. The agent' investments are higher, the higher the operational issues of the problem, the higher his degree of competence and willingness, the higher his private benefits and the principal's absorptive capacities to use his information.

Note that the principal's and the agent's reaction curves are upward sloping, that is, her absorptive operational knowledge acquisition and

his operational information gathering are strategic complements. This is a crucial feature of our model: The more she invests in her absorptive capacities, the better she can use the agent's information, and thus, the agent demonstrates more initiative.[13] In particular, I assume that the reaction curves (2) and (3) have a unique intersection, that is, the principal's reaction curve (2) is steeper than the agent's one (3).[14] Otherwise, no one would invest in operational knowledge.

The following proposition summarizes the parties' optimal investment behavior for the different leadership styles:

Proposition 1 *For each leadership style T, S, D, P equilibrium investments have the following properties:*

1. *Investments of the implementing party in absorptive knowledge as well as investments of the non-implementing party in its specific knowledge, that has to be communicated to the other party for decision making, are the higher, the higher the agent's degree of willingness w for style T and D, the higher the agent's degree of competence t, the higher the agent's private benefits b_s, the higher the principal's profits B_s for style T and D, the higher the percentage of strategical issues s for style D and P, and the lower the percentage of operational issues $(1-s)$ for style T and S.*

2. *Investments of the implementing party in its specific knowledge, that can be directly used in decision making, are the higher, the higher the agent's degree of competence t for style D and P, the higher the agent's private benefits b_s for style S, D, P, the higher*

[13] In contrast, Aghion and Tirole (1997) discuss a situation of strategic subsitutes: The principal's and the agent's information activities are downward sloping.

[14] That is, $\frac{(1-s)twb_s h'(K_T)}{c_1''(i_T)} < \frac{c_2''(K_T)-(1-s)tB_s h''(K_T)i_T}{(1-s)tB_s h'(K_T)}$.

the principal's profits B_s for style T, the higher the percentage of strategical issues s for style T and S, and the lower the percentage of operational issues $(1-s)$ for style D and P.

Given these behavior patterns, what are the costs and benefits of different leadership styles from an incentive perspective? To answer this question, I compare the different styles pairwise and analyze their implications on the parties' incentives to acquire information.

Starting with style T, we look first on the costs and benefits of decentralization, style D. If the principal delegates her decision making power to the agent, the agent will use his authority to choose and implement his preferred solution. Decentralization thus increases the agent's incentives to acquire operational information. On the other hand, as the principal knows that the agent might prefer a different solution as she does, the costs of decentralization are reduced investments by the principal in strategic information acquisition. Due to strategic complementaries, the effect of decentralization on the acquisition of absorptive knowledge depends on two factors: the parties' relative payoffs and the relative percentage of strategic to operational issues. If the decision problems involve an extensive strategic part, the principal invests high in strategic information but the agent low in operational information. Hence, the agent's incentives to invest in strategic absorptive knowledge are higher than the principal's ones to acquire operational absorptive knowledge. This result remains valid, if the operational part of the decision problem becomes more important, but depends on the parties' relative payoffs: For given profits of the principal the agent's private benefits shouldn't be too low - otherwise his incentives would be too weak - but shouldn't also be too high - otherwise he would invest so much in operative information under centralization that the principal

invests more in absorptive operational knowledge than the agent does under decentralization. If the operational part of the decision problem then becomes more important than the strategic part, this argumentation switches and the principal invests more in operational absorptive capacities than the agent in strategic absorptive knowledge.

The effect of decentralization is similar if the principal is empathic (style S vs style P). With respect to the acquisition of specific absorptive knowledge, the principal invests more than the agent, if the operational part of the decision problem is more important than the strategic part, independent of the parties' payoffs. This is because only the agent's private benefits are relevant for decision making under empathy.

Consider now the costs and benefits of empathy by switching from style T to style S. Instead of implementing her preferred solution and choosing investments to maximize her own profits, the principal now acts in the agent's interest by implementing his preferred solution and choosing investments to maximize his private benefits. Hence, the effect of empathy on parties' investments boils down to a comparison of parties' payoffs: If her preferred solution results in a lower payoff than the agent's preferred solution, empathy increases her incentives to invest not only in strategic information but also in operational absorptive knowledge. Due to strategic complementaries, the latter effect leads to higher incentives for the agent to invest in operational information. Whether this result changes if the principal's preferred solution yields a higher payoff than the agent's preferred solution however depends on the agent's degree of willingness. The lower the congruence in interests the lower the principal's incentives to invest in absorptive capacities under autocracy, and hence, the lower the agent's incentives to invest in operational information. As a consequence, the principal's profits have to be sufficiently

high to compensate for this loss in initiative.

In case of decentralization the effect of empathy is similar (style D vs style P). Concerning the principal's incentives, she compares her expected profit wB_s under style D with the agent's private benefits b_s under style P. If the first payoff is lower (higher) than the latter, the principal invests less (more) in strategic information under style D than style P. Strategic complementarity implies that the agent's incentives to invest in strategic absorptive knowledge vary accordingly. His investments in operative information, however, does not change, since he always implements his preferred solution.

A switch from centralization and autocracy, style T, to decentralization and empathy, style P, combines these effects in the following way. Consider first the principal's incentives to invest in strategic information. Under style T this acquisition is governed by implementing her preferred solution. Under style P, however, the agent's preferred solution will be implemented and she acts in his interest. Hence, her decision is governed solely by the agent's private benefits, his ability to successfully use this information and his investments in absorptive strategic knowledge. Her investments in strategic information under style T then are higher than those under style P, if her profits are higher than some critical value. This, for example, is true if her profits are higher than the agent's private benefits or the agent's degree of competence is sufficiently low. As in the case of pure decentralization, the parties' investments in absorptive knowledge again depend on their relative payoffs and the relative percentage of strategic to operational issues. However, due to the switch in relationship orientation, they may also depend on the agent's degree of willingness. So if, for example, the operational part of a decision problem is high relative to its strategic part, the principal invests more

than the agent in strategic absorptive knowledge, given the agent's degree of willingness is not too low - otherwise the agent's incentive to invest in operational information would be too low such that it wouldn't be of value for the principal to invest in absorptive capacities, due to the strategic complementary. If, however, the strategic part is relatively more important, the agent's incentives to invest in strategic absorptive knowledge are higher than the principal's ones to acquire operational absorptive knowledge, independent of his degree of willingness. Finally, the agent's incentives to invest in operational information are always higher under style P than under style T, for decentralization allows him to implement his preferred solution.

Finally, we compare style S and style D. Consider the agent's investments in the acquisition of operational information. Although in both cases he knows that his preferred solution will be implemented, he always invests more in operative information under style D than under style S since the principal can use only part of his information when implementing the solution. The principal's incentives to acquire strategic information depend in case of style S on the agent's private benefits, whereas in case of decentralization these incentives depend on her profits, the agent's degree of competence and willingness and his investments in absorptive knowledge. In particular, she acquires more information under style S, if the agent's private benefits are higher than her profits or the agent's degree of competence or willingness is sufficiently low. Regarding incentives to invest in absorptive knowledge, the principal is governed by the agent's acquisition of operational knowledge and his private benefits whereas the agent's incentives are driven by her strategic information acquisition and his private benefits. In particular, if the decision problem involves more strategic issues than operational ones, the

principal invests less in specific absorptive knowledge under S than the agent under D. If, however, the decision problem involves more operational issues than strategic ones, the opposite is true only if the agent's degree of willingness is sufficiently high.

To summarize, the costs and benefits of different leadership styles are as follows:

Proposition 2 *The four leadership styles have the following properties with respect to the parties' investment incentives:*

T vs S: *The principal invests less in her absorptive operational knowledge and the agent invests less in his operational knowledge under style T than under style S, that is $K_T < K_S$ and $i_T < i_S$, iff her profits B_s are lower than some critical value $\overline{B_s}(w)$, $B_s < \overline{B_s}(w)$, with $\overline{B_s}(1) = b_s$ and $\overline{B_s}'(w) < 0$. Moreover, the principal's investments in her strategic knowledge are lower under style T, iff her profits are lower than the agent's private benefits, that is $I_T < I_S$ iff $B_s < b_s$.*

T vs D: *The principal always invests more in her strategic knowledge and the agent always invests less in his operational knowledge under style T than under style D, that is $I_T > I_D$ and $i_T < i_D$. The principal as the implementing party invests more in her absorptive operational knowledge as the agent would do under style D, that is $K_T < k_D$, iff the parties' relative payoffs and the relative percentage of strategic to operational issues are such that $\frac{B_s}{b_s} \in \left(\frac{1-s}{s}, \frac{s}{1-s}\right)$.*

T vs P: *The principal's investment in strategic knowledge is higher under style T than P, that is $I_T > I_P$, iff the relative payoff $\frac{B_s}{b_s}$ is higher than some critical value $\overline{t}$,which is lower than the agent's degree of competence, i.e. $\frac{B_s}{b_s} > \overline{t}$ with $\overline{t} < t$. The agent always invests more in operational knowledge under style P than under T, $i_T < i_P$.*

Concerning specific absorptive knowledge the principal invests more under T than the agent under P, that is $K_T > k_P$, iff the agent's degree of willingness is higher than a critical value, $w > \overline{w}\left(\frac{B_s}{b_s}\right)$ with $\overline{w}' < 0$, $\overline{w}\left(\frac{s}{1-s}\right) = \frac{s}{1-s}$.

S vs D: The principal's investment in strategic knowledge is higher under style S than D, $I_S > I_D$, iff the relative payoff $\frac{b_s}{B_s}$ is higher than some critical value $\overline{tw}$, i.e. $\frac{b_s}{B_s} > \overline{tw}$ with $\overline{tw} < tw$. The agent always invests more in operational knowledge under style D than under S, $i_D > i_S$. Moreover, the principal invests less in specific absorptive knowledge under S than the agent under D, $K_S < k_D$, iff the agent's private benefits are higher than a critical value, $b_s > \overline{b_s}(s)$ with $\overline{b_s}' < 0$ and $\overline{b_s}\left(\frac{1}{2}\right) = wB_s$.

S vs P: The principal always invests more in her strategic knowledge and the agent always invests less in his operational knowledge under style S than under style P, that is $I_S > I_P$ and $i_S < i_P$. If the principal is the implementing party under S, she invests more (less) in her specific absorptive knowledge than the agent under style P, if the decision problem involves more (less) operational issues than strategic ones, $K_S < k_P$ iff $s > \frac{1}{2}$.

D vs P: The principal invests less (more) in her strategic knowledge and the agent invests less (more) in his absorptive strategic knowledge under style D than under style P, $I_D < I_P$ and $k_D < k_P$, iff her expected profits wB_s are lower (higher) than the agent's private benefits b_s, $wB_s < b_s$. Moreover, the agent's investments in his operational knowledge are identical under both styles, $i_D = i_P$.

4 The participation view of leadership

A leadership style not only fosters the principal's and the agent's incentives to invest in information gathering but may also play a crucial role in ensuring the agent's participation. Take, for example, the degree of task orientation as one component of a leadership style. Decentralization implies here that the agent has the authority to choose his preferred solution of a delegated decision problem. This, of course, raises his overall utility and enables the principal either to lower the agent's wage or to keep decision making authority for those problems which are more important to her. The same holds with respect to the degree of relationship orientation as the second component of a leadership style. If her decision making is sensitive to the agent's preferences, she also raises his utility by choosing and acting in the agent's interests. Again, this allows her either to lower the agent's wage or to act selfish on other decision problems.

I analyze the participation view of leadership by modifying the basic model as follows: There are n independent decision problems, $j = 1, ..., n$. Each decision problem j is characterized by a strategic dimension $s_j \in [0, 1]$, the principal's preferred solution with known profit B_j, $B_j > 0$, and the agent's preferred solution with private benefits b_j, $b_j > 0$.[15] I take the agent's degree of willingness as a personnel characteristic and assume that $w \in [0, 1]$ is independent of the particular decision problem. To concentrate on the participation aspect, I ignore the incentive implications of different leadership styles and assume that parties' investment decisions are given for a particular decision problem j. That is, the principal's investments in strategic information I_j, the

[15] We abuse notation and omit the dependence of payoffs on the strategic and operational issues of the decision problem.

agent's investments in operational information i_j and the investments in absorptive capacity K_j, respectively k_j, by the implementing party are independent of the leadership style. The expected payoffs for the principal and the agent then are for

- style T:

$$\Pi_{Tj} = p_{Tj} \cdot B_j - c_1(I_j) - c_2(K_j),\ U_{Tj} = p_{Tj} \cdot w \cdot b_j - c_1(i_j)$$
$$\text{with } p_{Tj} = s_j \cdot I_j + (1 - s_j) \cdot t \cdot i_j \cdot h(K_j)$$

- style S:

$$\Pi_{Sj} = p_{Sj} \cdot w \cdot B_j - c_1(I_j) - c_2(K_j),\ U_{Sj}(i_j) = p_{Sj} \cdot b_j - c_1(i_j)$$
$$\text{with } p_{Sj} = s_j \cdot I_j + (1 - s_j) \cdot t \cdot i_j \cdot h(K_j)$$

- style D:

$$\Pi_{Dj} = p_{Dj} \cdot w \cdot B_j - c_1(I_j),\ U_{Dj} = p_{Dj} \cdot b_j - c_1(i_j) - c_2(k_j)$$
$$\text{with } p_{Dj} = s_j \cdot t \cdot I_j \cdot h(k_j) + (1 - s_j) \cdot t \cdot i_j$$

- style P:

$$\Pi_{Pj} = p_{Pj} \cdot w \cdot B_j - c_1(I_j),\ U_{Pj} = p_{pj} \cdot b_j - c_1(i_j) - c_2(k_j)$$
$$\text{with } p_{Pj} = s_j \cdot t \cdot I_j \cdot h(k_j) + (1 - s_j) \cdot t \cdot i_j$$

I pairwise compare the four leadership styles. For $l, m \in \{T, S, D, P\}$ let $\lambda_j = 1$, if the principal chooses style l for decision problem j and $\lambda_j = 0$, if she decides for style m. The optimal leadership pattern then maximizes the principal's payoffs subject to the agent's participation constraint:

$$\max_{\{\lambda_1,\ldots,\lambda_n\}} \quad \sum_{j=1}^{n} [\lambda_j \cdot \Pi_{lj} + (1 - \lambda_j)\Pi_{mj}] \qquad \text{s.t.}$$
$$\sum_{j=1}^{n} [\lambda_j \cdot U_{lj} + (1 - \lambda_j) U_{mj}] \geq \overline{u}$$

Proposition 3 *The four leadership styles have the following properties with respect to participation considerations:*

T vs S: *The principal is more likely to make her decisions in line with the agent's preferences, if these decisions matters little to her, that is, her profits B_k are low, or because these decisions are important for the agent, that is, his private benefits b_s are high.*

T vs D or T vs P: *The principal always prefers to be the implementing party if her interests differ tremendously from those of the agent, that is, if the agent's degree of willingness w is too low. If, on the other hand, the agent's interests are almost congruent with those of the principal, she keeps authority for those decision problems which involve high strategic issues, s_j high, or which are important for her, B_j high, respectively, unimportant for the agent, b_k low. Her leadership switches to decentralization for those decision problems which have a significant operational part, even if their solutions yield high profits. Moreover, decentralization becomes more likely, if the agent's costs to acquire absorptive knowledge are relatively lower than those of the principal.*

S vs D or S vs P: *If the principal acts in the agent's interest, she prefers to centralize decision making authority, if the agent's implementation success is low, that is, t is low, or if decision problems involve high strategic issues, s_j high. The tendency to centralize is higher the more important a successful decision implementation is for her, B_j high, respectively, the less important it is for the agent, b_k low. This tendency is negatively correlated with the agent's degree of willingness w and the principal's costs to acquire absorptive knowledge. Moreover, decentralization is more likely, if decision problems have a*

high operational part, s_j low, and the agent's degree of competence t is high.

D vs P: Both styles are identical under participation considerations.

The interpretation of these results is straight forward: In the absence of incentive consideration, a switch from autocracy to empathy under decision centralization only concerns the solution chosen for implementation. The disadvantage for the principal not to choose her preferred solution converts into the agent's advantage that his preferred solution is chosen. Hence, the principal's decision with respect to her degree of relationship orientation is driven only by the relative payoffs of the two parties. The principal's decentralization decision under autocracy is more ambiguous: Of course, if the probability that the agent would choose a different solution than her preferred one is great, she keeps decision authority. In particular, this is the case, if the decision matters for her. Moreover, if the agent's ability to acquire information is limited by his talent, the success of implementation is reduced and it is better for her to keep authority. On the other hand, decentralization is likely for decision problems with a significant operational part.

Since I ignore incentive aspects in this discussion, parties' expected payoffs under decentralization are invariant in the degree of relationship orientation. Hence, under the participation view style D and P are equivalent. The only relevant comparison between leadership styles then is the decentralization decision of the principal in case of empathy. Different to the case of autocracy, the agent's degree of willingness does not directly influence this decision, for the principal relies on the agent's choice in either case. However, since her preferred solution is never implemented, she decentralizes decision authority, if the degree of

willingness is so low that it does not pay to bear the costs for acquiring absorptive knowledge.

It should be noted that these participation considerations are not independent of investment choices. This not only relates to the investments in absorptive capacity which are shifted under decentralization from the principal to the agent, but also to the parties' investments in their specific information. Since the implementing party's specific information are not shared by the other party and the specific information of the non-implementing party are only partially shared by the implementing party, the probability of a successful implementation depends on these efforts. The implications are obvious. The higher the principal's investment in strategic information, the more likely he retains authority over implementation, and, vice versa, the higher the agent's investment in operational information, the more likely is decentralization.

5 The optimal leadership style

Which leadership style now is optimal? So far, the incentive view (Section 3) and the participation view (Section 4) yield complementary determinants of the degree of task and relationship orientation. Although only a comprehensive structural model can deliver conclusive hypothesis I will indicate in this section some relevant implications for the choice of an optimal leadership style.

5.1 Testable Implication

Consider first the testable implications of the previous analysis. Viewed from the incentive perspective our analysis in Section 2 leads to the following four implications:

Implication (1) Decentralization of the principal's decision making

power to the agent is more likely for decision problems whose operational part relative to its strategic part is high. And, vice versa, the principal should not decentralize if decision problems involve a significant strategic part.

Implication (1), of course, captures general managerial wisdom, in the sense that those who are more qualified for solving a decision problem should be in charge for the solution. In the context of our model the reasoning is as follows: the higher (lower) the operational part, s decreasing (increasing), the more important the agent's (principal's) specific information for the implementation success. Since his (her) incentives to invest in those information are higher under decentralization (centralization), the conclusion follows. Note that this argumentation is independent of whether the principal's relationship orientation is high or low.

Implication (2) Style T is more appropriate for the principal, if her profits are relatively higher than the agent's private benefits. If, on the other hand, the agent's private benefits are relatively higher than the principal's profits, she should choose an empathic leadership style S or P.

That is, if the decision is more important for the principal, she should keep her decision making power and decide selfish, respectively should care more about the agent's well-being by deciding in his interest. At least the first hypothesis is obviously in line with practical evidence. For, suppose that B_s/b_s is high. Then style T is better than style S since all parties' investments are higher. And, style T is better than style D since the principal's investments are higher under centralization (B_s high) and the agent's investments are low (b_s low) anyway. Of

course, this latter statement rests on the fact that the operational part of the decision problem is sufficiently low, which, however, seems natural. In fact, one would expect that in general the correlation between the relative strategic impact s of a problem and the principal's profits B_s are positive. In contrast, suppose that B_s/b_s is low. Then style P, respectively style S, leads to higher investments of all parties compared to those under style D, respectively style T.

Implication (3) If the agent's degree of willingness is low, style T is always the best. If, on the hand, the agent's degree of willingness is high, the impact on the optimal leadership style depends on the parties' relative payoffs. For B_s greater (lower) than b_s an autocratic leadership style is better (worse) than an empathic one.

Suppose first that w is low. Of course, if the agent always prefers a different solution as the principal does, it is neither a good idea to decentralize decision power to the agent nor to decide in his interest. In both cases, the principal's incentives to invest are low. To see the second part of the hypothesis, suppose that both parties have identical interests, $w = 1$. Then the agent's optimal reaction function is identical for style T and S, respectively style P and D, since his private benefits b_s are independent of the party who chooses the solution. The question which style leads to higher investment incentives for the principal (and, hence, for the agent) then reduces to a comparison between her investment incentives b_s in case of empathy and B_s in case of autocracy.

Implication (4) Finally, a high degree of competence makes decentralization more attractive, and vice versa, a low degree of competence induces more centralization.

This seems consistent with casual observation and rests on two facts. In the first case, a highly talented agent has higher incentives to invest in operational information and strategic absorptive knowledge, for his implementation success is higher which in turn lets to higher investments by the principal. In the second case, if t is low, decentralization will not be optimal, for the agent's probability to successfully implement a solution is small.

Fortunately, the implications from the participation perspective are almost identical to the ones form the incentive perspective although the reasoning is different. Consider implication (1). If the strategic (operational) issues of a decision problem are relatively important, s high (low), centralization becomes more (less) attractive than decentralization. This is because the probability of success is higher (lower): Under centralization the principal (agent) uses her (his) investments in specific information directly in decision making, whereas in the case of decentralization (centralization) only part of this information is used by the agent (principal). This advantage for the implementing party is higher the higher its impact for a successful implementation. The argumentation is similar for implication (2), since for decisions with high (low) profits for the principal and low (high) private benefits for the agent the participation view also suggests that an autocratic leadership style is better (worse) than an empathic one under centralization.[16] The reason now is as follows: Since switching from autocracy to empathy under decision centralization only changes the solutions chosen for implementation, the principal's decision between style S and T is driven only by the relative payoffs of the two parties. Concerning the impact of the agent's

[16]Note that this is not true under decentralization because style P and D are identicial.

degree of willingness, implication (3), the participation view makes a less-clear statement for the dominance of style T, if w is low. Under autocracy, style T is better than style D, because the implementation success is higher under centralization and the relative costs and benefits between style T and style S are not influenced by the agent's degree of willingness w since all parties' investments are identical. If, on the hand, w is high, the comparison between centralization and decentralization depends, as under the incentive view, on the relative payoffs of the two parties. Finally, with respect to implication (4), a low degree of competence of the agent makes centralization more attractive for the principal because it leads to a better use of the available information for decision making. Again, the argumentation is not so clear-cut, if the agent's talent is high. Even if $t = 1$, decentralization might be preferred by the principal, for example, if her profits as well as the agent's degree of willingness are high.

In addition to these implications, the participation view points to another factor that influences the principal's decentralization decision in her leadership style:

Implication (5) Decentralization becomes more likely, if the agent's costs to acquire absorptive knowledge are relatively lower than those of the principal.

This is because the principal can shift her investments in absorptive capacity under decentralization to the agent.

5.2 Monetary Incentives

So far I assumed that monetary incentives were not available for the principal to direct the agent's behavior. In the following I will extent the basic model to allow the principal to use monetary incentives. Suppose

her profits are verifiable and she pays the agent a wage $W_s > 0$, if her preferred solution with profit B_s is successfully implemented. In this case, the principal's net profits are $B_s - W_s$. The agent's utility is $u(W_s) + b_s$ (where $u(0) = 0,\ u' > 0,\ u'' < 0$), if he receives private benefits b_s and a wage W_s. If the agent is the implementing party, the solution he will choose as well as his expected utility depend on his wage W_s: If $u(W_s) < b_s$, he chooses his preferred solution and his expected payoff is $b_s + wu(W_s)$. If $u(W_s) > b_s$, he chooses the principal's preferred solution and his expected payoff is $u(W_s) + wb_s$. If the principal is the implementing party and her leadership style is empathic, she implements his preferred solution, if $u(W_s) < b_s$. Otherwise, for $u(W_s) > b_s$, she implements her preferred solution.

To analyze the effects of monetary incentives on the optimal leadership style I discuss its two dimensions - task and relationship orientation - separately. Consider first how monetary incentives change the parties' investment incentives under style T. Since the principal always chooses her preferred solution and the agent receives an expected payoff $w(b_s + u(W_s))$, the reaction curves (1)-(3) in information acquisition for both parties become

$$s \cdot (B_s - W_s) = c_1'(I_T), \tag{4}$$

$$(1-s) \cdot t \cdot (B_s - W_s) \cdot h'(K_T) \cdot I_T = c_2'(K_T), \tag{5}$$

$$(1-s) \cdot t \cdot w \cdot (b_s + u(W_s)) \cdot h(K_T) = c_1'(i_T). \tag{6}$$

Of course, paying the agent a wage reduces the principal's incentives to invest in strategic information acquisition, that is $\frac{\partial I_T}{\partial W_s} < 0$. The effect on her absorptive knowledge and the agent's operational information is not so clear-cut. Take the agent's incentives to invest in operational information. Due to his additional utility, he tends to invest more. How-

ever, the principal invests less in her absorptive knowledge, which negatively effects his incentives. This trade-off between increased utility and reduced implementation success is crucial for the principal's decision to pay wages. To see this consider the derivative of the principal's profit with respect to wage W_s:

$$\frac{\partial \Pi_T}{\partial W_s} = -\left[sI_T + (1-s)\, ti_T h\left(K_T\right)\right] + (1-s)\, th\left(K_T\right)\left(B_s - W_s\right)\frac{\partial i_T}{\partial W_s}. \tag{7}$$

The first term on the right hand side corresponds to the increased success probability of implementation, and hence, the increase in the wage bill. The second term reflects the agent's change in initiative. The first observation from these derivative is that the optimal wage is zero, $W_s = 0$, if the agent's degree of willingness w or his degree of competence t is sufficiently low.[17] The second observation is that the agent's wage is positive only if the operational issues of the decision problem is sufficiently high. Indeed, if s is high, the principal does not pay a wage, $W_s = 0$, for the right hand side of (7) is negative. If, on the other hand, s is low and the wage has a positive impact on parties' investments in the operational part of the solution of the decision problem, that is $\frac{\partial K_l}{\partial W_s}, \frac{\partial i_T}{\partial W_s} > 0$ (e.g. if $wu'\left(W_s\right) - 1$ is sufficiently positive), the optimal wage is positive, $W_s > 0$.[18]

What changes, if we move from centralization to decentralization? A positive wage again has a clear incentive effect on the agent's investments in operative information, that is $\frac{\partial i_D}{\partial W_s} > 0$. Similar to style T, the

[17] Note that from equation (5) and (6), we have $\frac{\partial K_l}{\partial W_s}, \frac{\partial i_T}{\partial W_s} < 0$ for w low, see equation (A6)-(A7) in the Appendix.

[18] By the envelope theorem we then have

$$\text{sign}\ \frac{\partial W_s}{\partial s} = \text{sign}\ \left\{-\left[I_T - ti_T h\left(K_T\right)\right] - th\left(K_T\right)\left(B_s - W_s\right)\frac{\partial i_T}{\partial W_s}\right\}$$

and W_s is decreasing in s, if the sign is negative.

effect on how the strategic part of the decision problem is implemented is ambiguous: There is positive effect on the agent's investment in absorptive knowledge due to his additional utility, but a negative effect due to the principal's reduced incentives to invest in strategic information. Let $(k_D(W_s), i_D(W_s), I_D(W_s))$ be the optimal investments. Depending on the agent's wage, the principal's payoff is

$$\Pi_D = \begin{cases} (stI_D h(k_D) + (1-s)\, ti_D)\, w(B_s - W_s) - c_1(I_D) \text{ if } u(W_s) < b_s \\ (stI_D h(k_D) + (1-s)\, ti_D)(B_s - W_s) - c_1(I_D) \text{ if } u(W_s) > b_s \end{cases}.$$

Then the derivative of the principal's profits with respect to wage in the lower case is proportional - times w^{-1} - to the one in the upper case and given by

$$-\left[(stI_D h(k_D) + (1-s)\, ti_D)\right] + \left[stI_D h'(k_D)\frac{\partial k_D}{\partial W_s} + (1-s)\, th(K_D)\frac{\partial i_D}{\partial W_s}\right](B_s - W_s).$$

Let W_s be the wage that maximizes this marginal profit function. Then, if $W_s < u^{-1}(b_s)$, either W_s or $u^{-1}(b_s)$ is the optimal wage, depending on w:[19] For w high, W_s is the optimal wage, for w low it is $u^{-1}(b_s)$. If, however, $W_s > u^{-1}(b_s)$, W_s is the optimal wage.

To compare style T and style D we consider the relative effects of a wage increase on incentives: First, because the agent can directly use his operational information under decentralization, an additional payment increases his investment incentives more than in case of centralization where his information is only partially used by the principal. Second, and for the same reason, the principal's incentives to invest in strategic information are more reduced under centralization than under decentralization, and hence, due to complementarity, also the investments of the

[19] Note that it is never optimal for the principal to pay a wage just below $u^{-1}(b_s)$ because she induces the implementation of her preferred solution by increasing the wage slightly.

implementing party in absorptive capacity. Hence, there is a trade-off between the agent's higher incentives to invest in operational information and the parties' (possibly) reduced incentives to invest in strategic information and knowledge. This trade-off depends on the percentage of operational (strategic) issues of this decision problem. Consider a decision problem for which the agent's operational information is important for the implementation success, s low. Then the agent's additional incentives under decentralization are more essential for the implementation success than the principal's reduced incentives in information acquisition. That is, the leverage effect of an increase in the wage bill is higher under style D than under style T, if s is low. To summarize, we have the following conclusion:

Implication (6) Monetary incentives are given only for decision problems which involve a significant operational part. Moreover, monetary incentives make decentralization more likely.

Coming next to the implication of monetary incentives on the degree of relationship orientation, consider style S. Since the principal's incentives are driven by the agent's payoff, an increase in the wage bill not only increases the agent's incentives to invest, $\frac{\partial i_S}{\partial W_s} > 0$, but also the principal's one, that is $\frac{\partial I_S}{\partial W_s}$, $\frac{\partial K_S}{\partial W_s} > 0$. Her profits then are

$$\Pi_S = \begin{cases} [sI_S + (1-s)\, ti_S h(K_S)]\, w(B_s - W_s) - c_1(I_S) - c_2(K_S) \text{ if } u(W_s) < b_s \\ [sI_S + (1-s)\, ti_S h(K_S)](B_s - W_s) - c_1(I_S) - c_2(K_S) \text{ if } u(W_s) > b_s \end{cases}.$$

Marginal profits with respect to wage in the second case are

$$-[sI_S + (1-s)\, ti_S h(K_S)] + [s(B_s - W_s) - c_1'(I_S)]\frac{\partial I_S}{\partial W_s}$$
$$+[(1-s)\, ti_S h'(K_S)(B_s - W_s) - c_2'(K_S)]\frac{\partial K_S}{\partial W_s} + (1-s)\, th(K_S)(B_s - W_s)\frac{\partial i_S}{\partial W_s}.$$

The first and the fourth term are always positive and the second and third term are both positive as long as $B_s - W_s > u(W_s) + wb_s$. Hence, if $B_s > wb_s$, the optimal wage is always positive, $W_s > 0$. Then, if $W_s < u^{-1}(b_s)$, either W_s or $u^{-1}(b_s)$ is the optimal wage, depending on w: For w high, W_s is the optimal wage, for w low it is $u^{-1}(b_s)$. If, however, $W_s > u^{-1}(b_s)$, W_s is the optimal wage.

To discuss the impact of monetary incentives on the optimal degree of relationship orientation, remember that Style T is better for the principal than style S, if and only if her profits are relatively higher than the agent's private benefits, see implication (2). Since monetary incentives reduce her profits and increase his utility, an empathic style becomes more valuable for her.

Implication (7) Monetary incentives make empathy more likely. They are given for those decision problems for which the principal's profits exceed the agent's expected private benefits.

5.3 Dynamic Leadership

The purpose of this subsection is to extend the basic one-period relationship between the principal and the agent to a dynamic one. The link between different periods comes from the consequences a leadership style has on the future behavior of the agent. In particular, I assume that a leadership influences the agent's degree of competence as well as his degree of willingness.

Suppose that the agent's degree of competence is endogenously determined by the degree up to which the agent has learned how to implement solutions.[20] The idea is that the agent's talent to solve decision problems

[20] Of course, the agent's competence also increases with his experiences how to acquire operational information about decision problems. We abstract from this

increases with the number of decision problems he has implemented in the past. To extent the basic model, suppose that the relationship between the principal and the agent lasts for T periods. In each period $t \in \{1, ..., T\}$ the number of decision problems to be solved is n_t. Define the degree of task orientation (decentralization) in period t as

$$d_t = \frac{1}{n_t} \cdot \sum_{j=1}^{n_t} \lambda_{jt}$$

where $\lambda_{jt} = 1$, if decision problem $j \in \{1, ..., n_t\}$ is decentralized by the principal in period t, and $\lambda_{jt} = 0$, if not.[21] Let t_t be the agent's degree of competence in period t. Then

$$t_1 = t, \ t_t = \max\{f(d_{t-1}), t_{t-1}\} \ \text{ for } t > 1$$

with $t_1 = t$ the initial talent of the agent and $f(d_{t-1}) - t_{t-1}$ the increase in the agent's competence due to past implementations, $f(0) = 0, \ f' > 0, \ f'' < 0$. To analyze the implications of learning on the optimal degree of task orientation, we look first at the first two periods 1 and 2. Let d_1 be the optimal degree of decentralization in period 1 in case the principal does not take into account learning effects. Then I will argue that, if the principal factors the agent's learning in her optimal leadership style, the optimal degree of decentralization typically increases. To see this, note that the costs and benefits of a higher degree of decentralization in period 1 are threefold: (1) It reduces the principal's first period profits due to overdecentralization, (2) it may lead to higher second period profits due to a higher agent's talent, and (3) it saves opportunity costs of the principal in case she is overloaded, not only in period 1 but also in period 2, if the agent's competence t_2 actually increased, see implication (4).

point to focus solely on the implication of decentralization on the agent's talent.

[21] Of course, not only the number of decision problems may vary over time but also their type s. I do not explicitly model this fact.

Extending this argumentation to subsequent periods, the benefits (2) and (3) increase, whereas the costs (1) remain invariant. Hence, if the time horizon is sufficiently large or the learning effect is significant, the benefits of a higher degree of decentralization exceed their costs. Moreover, since the marginal learning of the agent is decreasing in one period, it is optimal for the principal to increase the degree of decentralization successively. In sum:

Implication (8) The possibility of learning makes decentralization more likely. Moreover, the principal successively increases the degree of decentralization over time.

Let's consider next the possibility that the agent's degree of willingness is endogenously determined by the principal's leadership behavior. Here I assume that the probability that the same solution is preferred by both parties depends on the degree of empathy of the principal's leadership style. Define for period $t \in \{1, ..., T\}$ the degree of relationship orientation (empathy) as

$$e_t = \frac{1}{n_t} \cdot \sum_{j=1}^{n_t} \lambda_{jt}$$

where $\lambda_{jt} = 1$, if she chooses style S for decision problem $j \in \{1, ..., n_t\}$ in period t, and $\lambda_{jt} = 0$, if she chooses style T. Let w_t be the agent's degree of willingness in period t. Then

$$w_1 = w, \; w_t = e_{t-1} \text{ for } t > 1$$

where $w_1 = w$ is the initial congruence parameter. The idea behind this formalization is that of reciprocity: If the principal acts in the agent's interests in a certain period, the agent's interest in the following pe-

riod are more aligned with the principal's ones, and vice versa.[22] The implications of reciprocity on the optimal leadership style are straight forward: The incentive and participation view of leadership both imply that under centralization the degree of empathy is limited by the parties' relative payoffs, see implication (3). Even if the agent's degree of willingness is high, the principal will decide in her own interest, if her profits B_s are higher than the agent's private benefits. However, according to the participation view, a higher degree of willingness makes decentralization more attractive for the principal. Hence, if the principal takes the agent's reciprocity into account when deciding about her optimal leadership style, the optimal degree of empathy and decentralization typically increases. Consider a two period relationship: Although the increase in empathy (1) reduces the principal's first period profits due to overempathy, (2) it may lead to higher second period profits due to a higher agent's degree of willingness, and (3) it saves opportunity costs of the principal in period 2 in case he is overloaded due to a possibly higher degree of decentralization. However, different to our argumentation of learning, the benefits (2) and (3) are limited, whereas the costs (1) incur in every period, if the relationship evolves over time. In sum:[23]

[22] One could also argue that the agent's degree of willingness depends on the degree of task orientation in the following sense: The more decision problems are decentralized, the higher is the agent's motivation to act in the principal's interest. I do not explicitly model this dependency but if the principal took this effect into account, decentralization would even be more likely, see implication (8).

[23] It is interesting to note, that implications (8) and (9) seems to support Blanchard and Hersey's (1969, 1996) "Life-Cyle Theory of Leadership". According to their theory, the principal's leadership has a delayed effect on the agent's "maturity" or "readiness" which is characterized by his ability and willingness (see footnote 9). They propose that the principal can increase the agent's level of maturity by relaxing successively the degree of task orientation, respectiveley varying the degree of rela-

Implication (9) The possibility of reciprocity makes empathy as well as decentralization more likely. However, the advantages of reciprocity are limited and not increasing over time.

6 Summary

Leadership is an important phenomenon in organizations. Despite more than 80 years of research, the management literature in most parts does not offer an explicit rationale for the effectiveness of leadership styles in different situations. In the words of Yukl (1989, p. 119): "In order to support a situational theory, the pattern of results in a study must be consistent with the propositions of the theory. If the theory postulates a causal chain of sequential effects from leader behavior to intervening variables to outcomes, the results must be consistent with this explanation. Unfortunately, most of the situational theories are stated so ambiguously that it is difficult to derive specific, testable propositions. Most of the research provides only an indirect or partial test of the situational theories. In general, the research suffers from lack of accurate measures and reliance on weak research designs that do not permit strong inferences about direction of causality."

In the paper presented here, I hope to have given a coherent theoretical basis for the economic analysis of leadership styles. In particular, I have shown how the model matches leadership styles with situational factors such as the structure of task and the agent's personality. Of course, there are other situational determinants which might have substantial influence on leadership, including the leader's position in the hierarchy, the function and size of the organizational unit administered

tionship orientation from low (for low maturity) to high (for moderate maturity) to low (for high maturity).

by the leader, the lateral interdependence between the leader's unit and other units, or the external pressure to perform tasks, for example, in a crisis or in hostile environments.[24]

The leadership behavior toward a particular subordinate depends, of course, on the leader's behavior toward her other subordinates. Leadership occurs in groups and involves several additional functions of behavior not considered in this paper. With respect to task orientation, the leader has to help the group to accomplish its task, for example by coordinating the group members' activities or by setting clear individual as well as common goals and assignments. With respect to the relationship orientation, the leader has to focus not only on the presumably diverse interests of group members but also on the human relations within the group, for example by managing conflicts or building a joint group spirit. One way to extent the basic model would be to assume that the leader treats her followers in a collective way, using an average leadership style. However, as we have seen in the analysis, the optimal leadership style depends crucially on the follower's personality. An average leadership style cannot cope with these differences that might exist between the leader and each of her followers.[25] An extension of the study of leadership in a dyadic relationship to leadership of groups must pay attention to the variety of specific relationships with all of her subordinates.

Another simplifying assumption made in this paper concerns the flexibility of the leader to change her leadership behavior. I implicitly assume here that a leader can choose her style within the entire spectrum

[24] See Yukl (1989, p. 148ff) for a review of situational determinants of leader behavior in the management literature.

[25] In the management literature on leadership, the "Leader-Member Exchange Theory" explicitly makes the dyadic relationship between the leader and his followers the basis for group leadership, see e.g. Graen and Uhl-Bien (1995).

of task and relationship orientation. In the management literature on leadership the question whether a leader can actually adopt her style to varying situations is controversially discussed. On the one hand, researchers as Fiedler (1967) argue that a leader's style reflects her psychological characteristics. For example, Fiedler regards esteem which appears related to empathy as a personality trait and considers that "at best it takes one, two, or three years of intensive psychotherapy to effect lasting changes in personality structure" (1967, p. 248). As a consequence, Fiedler suggested that the situational elements confronting a leader should be modified to fit to her style. On the other hand, researchers as Blanchard and Hersey (1969, 2001) argue that at least within a certain style range a leader is able to vary her style: "Learning to use the four basic styles is not an issue; the question is one of willingness" (2001, p. 267). As a consequence, they propose a leadership training and development program to enhance leadership. Apart from this controversy, this paper examines the optimal leadership style for given situational factors. Whether in case of a gap between the actual and the optimal style of a leader it is more appropriate to change situational factors or to change the style, is unimportant for the analysis.

7 Appendix

Proof of Proposition 1. Let $l \in \{T, S, D, P\}$ be a specific leadership style and define $x_l \in [0, 1]$ as the investments of the implementing party in absorptive knowledge, $y_l \in [0, 1]$ as the investments of the implementing party in its specific knowledge that can be directly used in decision making, and $z_l \in [0, 1]$ as the investments of the non-implementing party in specific knowledge that has to be communicated to the implementing party for decision making.

The first-order conditions for optimal investments then read as

$$\alpha_l h'(x_l) z_l - c_2'(x_l) = 0 \tag{A1}$$

$$\beta_l - c_1'(y_l) = 0 \tag{A2}$$

$$\gamma_l h(x_l) - c_1'(z_l) = 0 \tag{A3}$$

with

l	x_l	y_l	z_l	α_l	β_l	γ_l
T	K_T	I_T	i_T	$(1-s)\cdot t\cdot B_s$	$s\cdot B_s$	$(1-s)\cdot t\cdot w\cdot b_s$
S	K_S	I_S	i_S	$(1-s)\cdot t\cdot b_s$	$s\cdot b_s$	$(1-s)\cdot t\cdot b_s$
D	k_D	i_D	I_D	$s\cdot t\cdot b_s$	$(1-s)\cdot t\cdot b_s$	$s\cdot t\cdot w\cdot B_s$
P	k_P	i_P	I_P	$s\cdot t\cdot b_s$	$(1-s)\cdot t\cdot b_s$	$s\cdot t\cdot b_s$

I assume that the reaction curves (A1) and (A3) have a unique, stable intersection (x_l, z_l), that is

$$\frac{\gamma_l h'(x_l)}{c_1''(z_l)} < \frac{c_2''(x_l) - \alpha_l h''(x_l) z_l}{\alpha_l h'(x_l)}. \tag{A4}$$

Solving condition (A1) for z_l and inserting this into condition (A3) then determines the equilibrium investment in absorptive knowledge as

$$\gamma_l h(x_l) - c_1'\left(\frac{c_2'(x_l)}{\alpha_l h'(x_l)}\right) = 0. \tag{A5}$$

Let v be one of the exogenously given variables, $v \in \{s, t, w, b_s, B_b\}$. Using the envelope theorem gives

$$\frac{\partial x_l}{\partial v} = -\frac{\frac{\partial \gamma_l}{\partial v} h(x_l) + \frac{\partial \alpha_l}{\partial v}\frac{c_2'(x_l)}{\alpha_l^2 h'(x_l)} c_1''\left(\frac{c_2'(x_l)}{\alpha_l h'(x_l)}\right)}{\gamma_l h'(x_l) - c_1''\left(\frac{c_2'(x_l)}{\alpha_l h'(x_l)}\right)\frac{c_2''(x_l)h'(x_l) - c_2'(x_l)h''(x_l)}{\alpha_l (h'(x_l))^2}} \tag{A6}$$

The denominator is negative according to (A4) and the nominator is positive, iff $\frac{\partial \gamma_l}{\partial v}$, and hence $\frac{\partial \alpha_l}{\partial v}$, is positive.

Regarding the optimal investment in specific knowledge that can be used directly in decision making condition (A2) implies

$$\frac{\partial y_l}{\partial v} = \frac{\frac{\partial \beta_l}{\partial v}}{c_1''(y_l)} \tag{A7}$$

which is positive, iff $\frac{\partial \beta_l}{\partial v} > 0$.

The optimal investment in specific knowledge that has to be communicated by the non-implementing party has, according to condition (A3), the following properties:

$$\frac{\partial z_l}{\partial v} = \frac{\frac{\partial \gamma_l}{\partial v} h(x_l) + \gamma_l h'(x_l) \frac{\partial x_l}{\partial v}}{c_1''(z_l)} \tag{A8}$$

Since $\frac{\partial x_l}{\partial v}$ is positive, iff $\frac{\partial \gamma_l}{\partial v}$ is positive, the proposition follows.

Q.E.D. ■

Proof of Proposition 2. Using the notation of the Proof of Proposition 1 we can derive the relationships between the various investments of the parties as follows: Consider first the investments of the implementing party in absorptive knowledge. Condition (A5) yields that

$$\frac{\partial x_l}{\partial \gamma_l} = -\frac{h(x_l)}{\gamma_l h'(x_l) - c_1''\left(\frac{c_2'(x_l)}{\alpha_l h'(x_l)}\right) \frac{c_2''(x_l)h'(x_l) - c_2'(x_l)h''(x_l)}{\alpha_l (h'(x_l))^2}} > 0,$$

$$\frac{\partial x_l}{\partial \alpha_l} = -\frac{\frac{c_2'(x_l)}{\alpha_l^2 h'(x_l)} c_1''\left(\frac{c_2'(x_l)}{\alpha_l h'(x_l)}\right)}{\gamma_l h'(x_l) - c_1''\left(\frac{c_2'(x_l)}{\alpha_l h'(x_l)}\right) \frac{c_2''(x_l)h'(x_l) - c_2'(x_l)h''(x_l)}{\alpha_l (h'(x_l))^2}} > 0.$$

Define $\sigma_s = \frac{1-s}{s}$ as the relative percentage of strategic to operational issues. Then,

1. $K_T < K_S$ if $B_s < b_s$, and $K_T > K_S$, iff $B_s > \overline{B_s}(w) \geq b_s$, with $\overline{B_s}(1) = b_s$, $\overline{B_s}'(w) < 0$.

2. $K_T < k_D$ if $\sigma_s B_s < b_s$ and $\sigma_s b_s < B_s$, that is, if $b_s \in (\sigma_s B_s, \sigma_s^{-1} B_s)$. In particular, $\sigma_s < 1$, i.e. $s > \frac{1}{2}$. By the same logic, $K_T > k_D$, if $b_s \in (\sigma_s^{-1} B_s, \sigma_s B_s)$, which is true only if $s < \frac{1}{2}$.

3. $K_T < k_P$ if $\frac{B_s}{b_s} < \sigma_s^{-1}$ and $w < \sigma_s^{-1}$ and $K_T > k_P$ if $\frac{B_s}{b_s} > \sigma_s^{-1}$ and $w > \sigma_s^{-1}$. Hence, suppose that $\frac{B_s}{b_s} > \sigma_s^{-1}$. Then w has to be higher than some critical value $\overline{w}\left(\frac{B_s}{b_s}\right)$, with $\overline{w}\left(\frac{B_s}{b_s}\right) < \sigma_s^{-1}$ such

that $K_T > k_P$. Note that $\overline{w}'\left(\frac{B_s}{b_s}\right) < 0$. On the other hand, suppose that $\frac{B_s}{b_s} < \sigma_s^{-1}$. Then again w has to be higher than some critical value $\overline{w}\left(\frac{B_s}{b_s}\right)$, with $\overline{w}\left(\frac{B_s}{b_s}\right) > \sigma_s^{-1}$ such that $K_T > k_P$. Moreover, $\overline{w}'\left(\frac{B_s}{b_s}\right) < 0$. If $\frac{B_s}{b_s} = \sigma_s^{-1}$, then $w > \sigma_s^{-1} = \overline{w}\left(\sigma_s^{-1}\right)$ is sufficient.

4. $K_S < k_D$, if $\sigma_s < 1$, i.e. $s > \frac{1}{2}$, and $\sigma_s < w\frac{B_s}{b_s}$. And, $K_S > k_D$, if $\sigma_s > 1$ and $\sigma_s > w\frac{B_s}{b_s}$. A similar argumentation as above then shows that for given w, B_s, there exists a critical value $\overline{b_s}(s)$ such that for all $b_s > \overline{b_s}(s)$, $K_S < k_D$ with $\overline{b_s}(s) < wB_s\sigma_s^{-1}$ and $\overline{b_s}'(s) < 0$, if $\sigma_s < 1$. If $\sigma_s > 1$, b_s again has to be higher than some critical value $\overline{b_s}(s)$ with $\overline{b_s}(s) > wB_s\sigma_s^{-1}$ such that $K_S < k_D$. Again, $\overline{b_s}'(s) < 0$. For $\sigma_s = 1$, we have $\overline{b_s}(s) = wB_s$.

5. $K_S < k_P$, iff $s > \frac{1}{2}$.

6. $k_D < k_P$, iff $wB_s < b_s$.

Concerning the investments of the implementing party in its specific knowledge that can be directly used in decision making, condition (A2) of the Proof of Proposition 1 yields

$$\frac{\partial y_l}{\partial \beta_l} = \frac{1}{c_1''(y_l)} > 0.$$

Hence, $I_T < I_S$, iff $B_s < b_s$, $I_T < i_D$, iff $B_s < \sigma_s t b_s$, $I_T < i_P$, iff $B_s < \sigma_s t b_s$, $I_S < i_D$, iff $\sigma_s^{-1} < t$, $I_S < i_P$, iff $\sigma_s^{-1} < t$. and $i_D = i_P$.

Third, consider the investments of the non-implementing party in specific knowledge that has to be communicated to the implementing party for decision making. Condition (A3) implies

$$\frac{\partial z_l}{\partial \gamma_l} = \frac{h(x_l)}{c_1''(z_l)} > 0 \text{ and } \frac{\partial z_l}{\partial x_l} = \frac{\gamma_l h'(x_l)}{c_1''(z_l)} > 0.$$

Since $x_l > x_m$, if $\gamma_l > \gamma_m$ and $\alpha_l > \alpha_m$, we have $z_l > z_m$, if $\gamma_l > \gamma_m$ and $\alpha_l > \alpha_m$ and, vice versa, $z_l < z_m$, if $\gamma_l < \gamma_m$ and $\alpha_l < \alpha_m$ for two

leadership styles $l, m \in \{T, S, D, P\}$.

Finally, we compare the investments of a party in its specific knowledge, if this party is the implementing party (style l), with its investments, if this party is not the implementing party (style m). From conditions (A2) and (A3) we know that

$$y_l > z_m \text{ iff } \beta_l > \gamma_m h(x_m).$$

Note that $y_l > z_m$, if $\beta_l \geq \gamma_m$. Hence,

1. $I_T > I_D$ since $1 > tw$, and $i_D > i_T$ for the same reason.
2. $I_T > I_P$, iff $B_s > \overline{t} b_s$ with $\overline{t} < t$, and $i_P > i_T$ since $1 > w$.
3. $I_S > I_D$, iff $b_s > \overline{tw} B_s$ with $\overline{tw} < tw$, and $i_D > i_S$ since $\beta_D = \gamma_S$.
4. $I_S > I_P$ since $1 > t$, and $i_P > i_S$ since $\beta_P = \gamma_S$.

   Q.E.D.

■

Proof of Proposition 3. Let μ denote the multiplier of the participation constraint. Then the optimal pattern of leadership between style l and m is given as follows:

$$\text{If } \Pi_{lj} - \Pi_{mj} > \mu [U_{lj} - U_{mj}], \text{ then } \lambda_j = 1 \text{ (style } l)$$
$$\text{If } \Pi_{lj} - \Pi_{mj} < \mu [U_{lj} - U_{mj}], \text{ then } \lambda_j = 0 \text{ (style } m)$$

Using the parties' payoffs for leadership style $l, m \in \{T, S, D, P\}$ we get the following results:[26]

[26] Note that there is no difference in participation between style D and style P, that is $\Pi_{Dj} = \Pi_{Pj}$, $U_{Dj} = U_{Pj}$.

- Style $T\,(=l)$ vs style $S\,(=m)$: Since $U_{lj}-U_{mj}=\left[s_jI_j+(1-s_j)\,ti_jh\,(K_j)\right](1-w)\,b_j>0$ we have

$$\frac{\Pi_{lj}-\Pi_{mj}}{U_{lj}-U_{mj}}=\frac{\left[s_jI_j+(1-s_j)\,ti_jh\,(K_j)\right](1-w)\,B_j}{\left[s_jI_j+(1-s_j)\,ti_jh\,(K_j)\right](1-w)\,b_j}=\frac{B_j}{b_j}$$

Hence, $\lambda_j=1$, if B_j high or b_j low, and $\lambda_j=0$, if B_j low or b_j high.

- Style $T\,(=l)$ vs style $D\,(=m)$: Let $U_{lj}-U_{mj}>0$. Then $\lambda_j=1$, if

$$\frac{\Pi_{lj}-\Pi_{mj}}{U_{lj}-U_{mj}}>\mu.$$

If, however, $U_{lj}-U_{mj}<0$, $\lambda_j=1$, if

$$\frac{\Pi_{lj}-\Pi_{mj}}{U_{lj}-U_{mj}}<\mu.$$

Using the parties' payoffs we get

$$\begin{aligned}\frac{\Pi_{lj}-\Pi_{mj}}{U_{lj}-U_{mj}}&=\frac{\left[s_jI_j\,(1-wth\,(k_j))+(1-s_j)\,ti_j\,(h\,(K_j)-w)\right]B_j-c_2\,(K_j)}{\left[s_jI_j\,(w-th\,(k_j))+(1-s_j)\,ti_j\,(wh\,(K_j)-1)\right]b_j+c_2\,(k_j)}\\&:=\frac{AB_j-c_2\,(K_j)}{ab_j+c_2\,(k_j)}\end{aligned}\tag{A9}$$

Note first that $A>a$ since

$$\begin{aligned}s_jI_j\,(1-wth\,(k_j)-w+th\,(k_j))&>(1-s_j)\,ti_j\,(wh\,(K_j)-1-h\,(K_j)+w)\\s_jI_j\,(1-w)\,(1+th\,(k_j))&>-(1-s_j)\,ti_j\,(1-w)\,(1+h\,(K_j))\,.\end{aligned}$$

Moreover, $A>0$ for s_j sufficiently high, or w,t, or i_j sufficiently low, and $A<0$ for s_j sufficiently low and $h_j<w$. And, $a>0$ for s_j sufficiently high and $th_j<w$ and $a<0$ for w sufficiently low. Consider first the case in which $c_2\,(K_j)$ and $c_2\,(k_j)$ are sufficiently low. For $a>0$, (A9) is positive and increasing in B_j, respectively, decreasing in b_j, implying that $\lambda_j=1$ for B_j high or b_j low, and

$\lambda_j = 0$ for B_j low or b_j high. For $A > 0 > a$, (A9) is negative and $\lambda_j = 1$ is always optimal. For $A < 0$, (A9) is positive and increasing in B_j, respectively, decreasing in b_j. Since $U_{lj} - U_{mj} < 0$ we then have $\lambda_j = 0$ for B_j high or b_j low, and $\lambda_j = 1$ for B_j low or b_j high.

Now consider the case that $c_2(K_j)$ is increasing. Compared to previous analysis, the denominator of (A9) gets smaller. As long as $\Pi_{lj} - \Pi_{mj}$ is positive, the argumentation above does not change although $\lambda_j = 1$ now is less often optimal. If, however, $c_2(K_j)$ is so high that the denominator of (A9) is negative, we always have $\lambda_j = 0$ for $U_{lj} - U_{mj} > 0$. For $U_{lj} - U_{mj} < 0$ we then have $\lambda_j = 0$ for B_j high or b_j low, and $\lambda_j = 1$ for B_j low or b_j high.

If, on the other hand, $c_2(k_j)$ increases, the nominator of (A9) gets greater, implying that (A9) becomes smaller, if $\Pi_{lj} - \Pi_{mj} > 0$, respectively greater, if $\Pi_{lj} - \Pi_{mj} < 0$. In both cases, $\lambda_j = 0$ is less often optimal.

- Style $S\,(= l)$ vs style $D\,(= m)$: In this case,

$$\frac{\Pi_{lj} - \Pi_{mj}}{U_{lj} - U_{mj}} = \frac{\left[s_j I_j\left(1 - th\left(k_j\right)\right) + \left(1 - s_j\right) ti_j\left(h\left(K_j\right) - 1\right)\right] wB_j - c_2\left(K_j\right)}{\left[s_j I_j\left(1 - th\left(k_j\right)\right) + \left(1 - s_j\right) ti_j\left(h\left(K_j\right) - 1\right)\right] b_j + c_2\left(k_j\right)}$$
$$:= \quad \frac{A' B_j - c_2\left(K_j\right)}{a' b_j + c_2\left(k_j\right)}. \tag{A10}$$

Note that $A' = a'w$ and $a' = \left[s_j I_j\left(1 - th\left(k_j\right)\right) + \left(1 - s_j\right) ti_j\left(h\left(K_j\right) - 1\right)\right] > 0$ if s_j is sufficiently high or t is sufficiently low.

Consider first the case in which $c_2(K_j)$ and $c_2(k_j)$ are sufficiently low. For $a' > 0$, (A10) is positive and increasing in B_j, respectively, decreasing in b_j, implying that $\lambda_j = 1$ for B_j high or b_j low, and $\lambda_j = 0$ for B_j low or b_j high. Note that the critical B_j for which $\lambda_j = 1$ has to be higher the lower w is. For $a' < 0$, (A10) is

positive and increasing in B_j, respectively, decreasing in b_j. Since $U_{lj} - U_{mj} < 0$ we then have $\lambda_j = 0$ for B_j high or b_j low, and $\lambda_j = 1$ for B_j low or b_j high. Again, w has a negative impact on the critical B_j for which $\lambda_j = 0$.

Now consider the case that $c_2(K_j)$ is increasing. As long as $\Pi_{lj} - \Pi_{mj}$ is positive - which implies $A' > 0$ - our argumentation above does not change although $\lambda_j = 1$ now is less often optimal. If, however, $c_2(K_j)$ is so high that the denominator of (A10) is negative, we always have $\lambda_j = 0$ for $U_{lj} - U_{mj} > 0$.

If, on the other hand, $c_2(k_j)$ increases, the nominator of (A10) gets greater, implying that (A10) becomes smaller, if $a' > 0$, but (A10) gets higher, if $a' < 0$. In both cases, $\lambda_j = 0$ is less often optimal.

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8 Literature

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