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The role of information asymmetry in escalation phenomena: Empirical evidence

Joyce E. Berg [a], John W. Dickhaut [b], Chandra Kanodia [c,*]

[a] University of Iowa, United States
[b] Economic Sciences Institute, Chapman University, United States
[c] 321 19th Avenue South, Carlson School of Management, University of Minnesota, Minneapolis, MN 55455, United States

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ABSTRACT

Economic rationality dictates that only incremental costs and benefits should affect decisions. Observed behavior often seems to violate this principle, resulting in unwarranted commitment to past choices and their escalation. In this paper, we present experimental results that show that information asymmetry plays a key role in determining when such escalation behavior occurs. This finding opens new avenues for mitigating escalation behavior since information asymmetry is an environmental feature that can be modified by organization design and explicit economic rewards.

1. Introduction

Economic rationality dictates that only incremental costs and benefits should affect decisions; past actions and costs are irrelevant. This tenet of rationality is simple and obvious, yet human behavior often seems to violate it. Social psychologists have documented numerous instances where individuals stubbornly escalate their commitment to past actions when incremental analysis suggests otherwise (Staw and Ross, 1987). In this paper, we present experimental results showing that the information environment in which decisions are made is an essential part of such escalation phenomena. We manipulate information structure in otherwise identical economies and find that the existence of *information asymmetry* plays a key role in determining when escalation behavior occurs.

The most widely cited explanations of escalation behavior are internal and external justification (Staw, 1981). Internal justification is defined as a psychological need to justify past decisions to oneself, leading to "retrospective rationality" rather than the "prospective rationality" assumed in economic decision theory (Staw, 1976). External justification is defined as a need to justify past decisions to others and is attributed either to face-saving or the social norm that consistent decision makers are better leaders (Staw and Ross, 1980). These theories depart from standard notions of economic rationality and make no reference to information asymmetries.

* Corresponding author. Tel.: +1 612 624 6880; fax: +1 612 626 1331.
E-mail address: ckanodia@umn.edu (C. Kanodia).

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KBD (1989) propose a theory in which escalation is a rational equilibrium response to information asymmetry and reputation forces. KBD argue that there is a talent, "foresight", that is highly valued in managers. Foresight is the ability to *quickly* uncover or recognize information that helps in predicting the future. Farsighted managers are rare and command an economic premium. However, foresight is not directly observable and is assessed probabilistically from observation of a manager's decisions and their consequences over time. Thus, the manager's decisions acquire a reputation value.

For example, suppose a manager is considering whether to continue or switch from a course of action he earlier initiated. Additionally suppose that information relevant to this decision is private to the manager. A switch would signal others that the manager has discovered new information that is important enough to overturn his previous calculations, information that he missed seeing at the time he made his earlier choice. Such revelation naturally raises the question whether this same information could have been detected earlier by a more farsighted manager. Thus, switching damages the manager's reputation even though an objective incremental analysis, from the organization's point of view, may favor switching. On the other hand, if the manager continues with his earlier choice there is always a chance that a good outcome could result from a poor decision. Faced with a sure loss if he switches versus only a probability of loss if he doesn't, the manager could rationally choose escalation over switching.

The theory that escalation is driven by rational responses to information asymmetry is in contrast to theories that rely on psychological needs for internal and external justification. If valid, the theory opens new avenues for mitigating escalation behavior since information asymmetry is an environmental feature that can be altered by organization design and explicit economic rewards.

Prendergast and Stole (1996) and McAfee et al. (2006) have also developed rational explanations of escalation phenomena based on information asymmetries and concern for reputation. Prendergast and Stole show that in a multi-period setting the desire to acquire a reputation for quickly learning the correct course of action initially leads to overreaction to new private information, but after some period of time the decision maker is unwilling to respond to new information that would suggest his previous behavior was wrong. McAfee et al. study a setting where strategic complementarities in teams impart value to a reputation for commitment, leading to an unwillingness to switch projects in spite of unfavorable private information.

Besides these theoretical developments, there have been studies (see Camerer and Weber, 1999) that attempt to distinguish between economic explanations and psychological explanations of escalation behavior. However such studies occur in field settings where it is virtually impossible to determine the level of information asymmetry at the time of choice. So, for example, in Camerer and Weber it is difficult to assess the information asymmetry between basketball teams. Thus, it is difficult to determine the incremental effect of psychological forces when reputation effects are also present. Other studies probe deeper into the psychological forces that may cause escalation to occur. Arkes and Ayton (1999) find that young children, when placed in an economic setting with sunk costs, exhibit more normatively correct behavior than do adults. Arkes and Hutzel (2000) investigated the relationship between over-estimates of the probability of success and escalation behavior, and Heath (1995) relates de-escalation and escalation behavior to whether individuals set or do not set mental budgets to control their resource expenditures.

The purpose of this paper is to test experimentally the predictions of the KBD theory and determine the extent to which information asymmetries versus justification (internal and external) affects escalation behavior. Previous laboratory studies of escalation have used a case study methodology to manipulate internal and external justification by manipulating variables such as personal responsibility, job insecurity, policy resistance, diffusibility of blame, the extent to which a setback could have been foreseen, and social norms for consistency. Each of these variables has been shown to influence escalation behavior.[1] However, one can argue that each of these variables is highly correlated with manipulations of the information environment. Since there are no explicit economic rewards and subjects are asked to imagine themselves in real world settings, one cannot determine whether escalation is driven by the psychological forces that the authors attempt to manipulate or by subjects' changing assumptions about the information environment inherent in similar real world tasks.[2]

We deviate from past research in this area by using an experimental economics methodology to control both economic rewards and information environment. This control allows us to isolate the economic forces induced by changes in the information environment from purely psychological forces. We study behavior in three different settings: a single-person setting in which there are no experimenter induced social (external) forces, a multi-person setting in which social forces are induced but no information asymmetry exists, and a multi-person setting in which both social forces and information asymmetry are induced. We find that a social setting alone is not enough to generate escalation beyond the escalation found in the single-person setting. When information asymmetry is introduced, the level of escalation increases significantly.

The remainder of the paper is organized as follows. In Section 2 we sketch a version of the KBD model that is used in our experiments. The experimental design, parameter specifications, and predictions are described in Section 3. In Section 4 we

[1] See Arkes and Blumer (1985), Conlon and Leatherwood (1989), Fox and Staw (1979), Leatherwood and Conlon (1987, 1988) and Staw and Ross (1980).
[2] See Section 5 for an illustration of this argument.

describe and analyze our experimental results, and Section 5 concludes with a brief discussion of how our results relate to earlier studies of escalation.

2. Theoretical background

Our experiments use a simplification of the theoretical model developed in KBD that is sketched below.[3] At date 1 a manager chooses one of two projects, A or B. The return to the project is realized at date 3 and could be either high (x_H) or low (x_L). The probability of high return is increased if the project matches an underlying state of nature that could be either θ_A orθ_B. Each state of nature has prior probability of 0.5. Project A (B) has higher expected return if θ_A (θ_B) is the state of nature. At date 2, the manager decides whether to continue with the earlier choice (escalate) or switch projects in the light of new information. The cost of switching projects is $C > 0$, regardless of whether the switch is from A to B or from B to A.

The manager is one of two types Z_T (possessing foresight) or Z_N (not possessing foresight), with prior probabilities ρ and $(1-\rho)$. The manager's type is not known to anybody, including the manager himself. Foresight is operationalized in the following way. Before the initial choice of projects at date 1, the manager privately observes one of three possible signals, y_A, y_B, or y_o. The following probability specifications are assumed for each $z \in \{Z_T, Z_N\}$:

$$P(y_A|\theta_A, z) = P(y_B|\theta_B, z) > 0$$

$$P(y_B|\theta_A, z) = P(y_A|\theta_B, z) = 0$$

$$P(y_0|\theta_A, z) = P(y_0|\theta_B, z) > 0.$$

Thus the signal y_A indicates for certain that the state is θ_A, y_B indicates for certain that the state is θ_B, and signal y_0 contains no information on the state. If the date 1 signal is either y_A or y_B no additional information is learned at date 2, but if y_0 is observed at date 1, the manager receives an additional signal at date 2 that perfectly reveals the true state. These specifications imply that the manager always sees the underlying state, but could see it either early (date 1) or late (date 2). We assume that a Z_T manager is more likely to see the state early than a Z_N manager; that is for each $\theta \in \{\theta_A, \theta_B\}$:

$$P(y_0|\theta, z_T) < P(y_0|\theta, z_N).$$

Let p_m (p_u) be the probability of x_H when project and state are matched (unmatched). It is assumed that $p_m > p_u$ and:

$$p_m x_H + (1-p_m)x_L - C > p_u x_H + (1-p_u)x_L$$

(i.e. switching costs are not so high that it never pays to switch).

After project returns are realized, the manager enters a labor market in which identical firms bid, in Bertrand competition, to hire him. Farsighted managers are more valuable to hiring firms (in an expected marginal product sense). The value of a Z_T manager is G_T and the value of a Z_N manager is G_N, with $G_T > G_N$. However, manager type cannot be directly observed. Firms in the labor market observe only the manager's past sequence of project choices, $d \in \{AA, BB, AB, BA\}$, and realized project return, $x \in \{x_H, x_L\}$. The information signals observed by the manager at dates 1 and 2 (i.e. the signals observed by the manager when making project choices on private account prior to being hired) are not observed by the market.

A sequential equilibrium consists of conditional probability assessments that the manager is farsighted, $\pi(z_T|d,x)$, wage schedules $w(d, x)$, and project choice strategies at dates 1 and 2. KBD establish that, in a sequential equilibrium, the information contained in (AA, x) is the same as in (BB, x) and the information in (AB, x) is the same as in (BA, x). Thus, for each x, the information contained in each sequence of project choices is described entirely by the events: Escalation (E) and switching (S). KBD establish that when G_T is sufficiently larger than G_N, the following strategies and beliefs constitute a sequential equilibrium.

2.1. Project choices

When y_A is observed the manager chooses A at date 1 and escalates at date 2. When y_B is observed the manager chooses B and escalates. When y_0 is observed the manager chooses A with probability 1/2 and B with probability 1/2 at date 1 and continues with his chosen project at date 2 no matter what subsequent information he receives. Thus the manager always escalates and switching is off the equilibrium path.

[3] Generalizations of this model and proofs of the results cited here are contained in KBD.

2.2. Beliefs

Using ρ to denote the prior probability of type z_T:

$$\pi(z_T|E, x_H) = \frac{[p_m - 1/2(p_m - p_u)P(y_0|\theta, z_T)]\rho}{p_m - 1/2(p_m - p_u)[P(y_0|\theta, z_T)\rho + P(y_0|\theta, z_N)(1-\rho)]},$$

$$\pi(z_T|E, x_L) = \frac{[(1-p_m)+1/2(p_m-p_u)P(y_0|\theta,z_T)]\rho}{(1-p_m)+1/2(p_m-p_u)[P(y_0|\theta,z_T)\rho+P(y_0|\theta,z_N)(1-\rho)]},$$

$$\pi(z_T|S, x_H) = \pi(z_T|S, x_L) \equiv \pi(z_T|S) = \frac{P(y_0|\theta, z_T)\rho}{P(y_0|\theta, z_T)\rho + P(y_0|\theta, z_N)(1-\rho)}.$$

In the above, $\pi(z_T|S)$ is an off equilibrium path belief, and is calculated as the limit of Bayesian probabilities derived from a sequence of mixed strategies that converges to the equilibrium strategy.

2.3. Wages

$$w(E, x_H) = \pi(z_T|E, x_H)G_T + [1 - \pi(z_T|E, x_H)]G_N,$$

$$w(E, x_L) = \pi(z_T|E, x_L)G_T + [1 - \pi(z_T|E, x_L)]G_N,$$

$$w(S, x_H) = w(S, x_L) \equiv w(S) = \pi(z_T|S)G_T + [1 - \pi(z_T|S)]G_N.$$

The intuition underlying this equilibrium is as follows. KBD show that in the above equilibrium, $\pi(z_T|E, x_H) > \pi(z_T|E,x_L) > \pi(z_T|S)$. This ordering of probabilities implies that $w(E, x_H) > w(E, x_L) > w(S)$. Thus, when the manager observes the state at date 1, he maximizes both his expected project return and his expected wage in the labor market by choosing the corresponding matching project at date 1 and continuing with this project at date 2. Similarly, when he fails to see the state at date 1, but luckily happens to choose the correctly matching project, he sees no reason to switch at date 2.

However, suppose the manager initially fails to see the underlying state, and later receives information indicating that his initially chosen project does not match the state of nature (such information is referred to as "disconfirming information"). There are two opposing forces that the manager must take into account in deciding whether to switch projects or escalate. Switching projects increases his expected project return net of switching costs. However, switching also unambiguously signals the labor market that the manager learned the true state later rather than earlier. Since untalented managers are more likely to discover information late, switching damages the manager's reputation and decreases his wage in the labor market. If G_T is sufficiently larger than G_N the loss in expected wage more than offsets the gain in expected project return, so the manager escalates rather than switches.

While escalation is optimal in the asymmetric information setting, it is easy to see that given disconfirming information, switching is optimal in public information settings. Suppose that the signal received at date 1 is public. Then all of the information concerning the manager's talent is contained in this signal, and project choices and returns contain no additional information. Thus the manager's reputation and wages in the labor market become independent of his decisions, and there are no economic gains from escalation in the face of disconfirming information.

3. Experimental design and hypotheses

Our experiments are designed to disentangle the effects of information asymmetry from those of internal and external justification. We create an experimental environment similar to that in the KBD model and compare behavior in an asymmetric information setting to behavior in settings where there is no induced social force (a single-person setting) or no induced information asymmetry (a public information setting). Fig. 1 depicts this design. Since there are no induced social forces in the single-person setting, behavior in that setting is a benchmark and a measure of the impact of internal justification. Comparing behavior in the two social settings allows us to disentangle the impact of information asymmetry from other forms of external justification.

	Stage 1 Benchmark	Stage 2 Social Setting
Experiment Set 1 (4 replications)	Single-Person Decision Making Setting	Public Information
Experiment Set 2 (4 replications)	Identical to Experiment Set I Stage I	Asymmetric Information

Fig. 1. Experimental design for the laboratory economies.

Table 1
Parameter values used in the experiments.

Parameter description	Parameter value
Project alternatives	A or B
Possible states	A or B
Probability of each state	.50
Probabilities of high return when project and state are matched	.80
Probabilities of high return when project and state are unmatched	.20
Project returns	
Low return	100 points
High return	900 points
Switching cost	100 points
Probability of being a talented manager	.50
Probability of observing the state of nature early when one is a *talented manager*	1.00
Probability of observing the state of nature early when one is an *untalented manager*	.00
Social settings only	
Value of a *talented manager* to a hiring firm (selected randomly from the set)	{6000, 6500, 7000, 7500} (values measured in points)
Value of an *untalented manager* to a hiring firm (selected randomly from the set)	{500, 1000, 1500, 2000} (values measured in points)

All settings use the same parameters, except that there is no labor market in the single-person setting. To make subjects' inference tasks easier, we suppress the observability of project returns and simplify the probability of the date 1 signals. We also add structure to the labor market. These changes preserve the essential forces in the KBD model. The parameters used in all experiments are summarized in Table 1.

3.1. The single-person setting

The sequence of events for the single-person setting is depicted in panel A of Fig. 2. The set of alternatives at each point is shown in italics below the description of the event. Before the manager makes any decision, he is assigned one of two types:

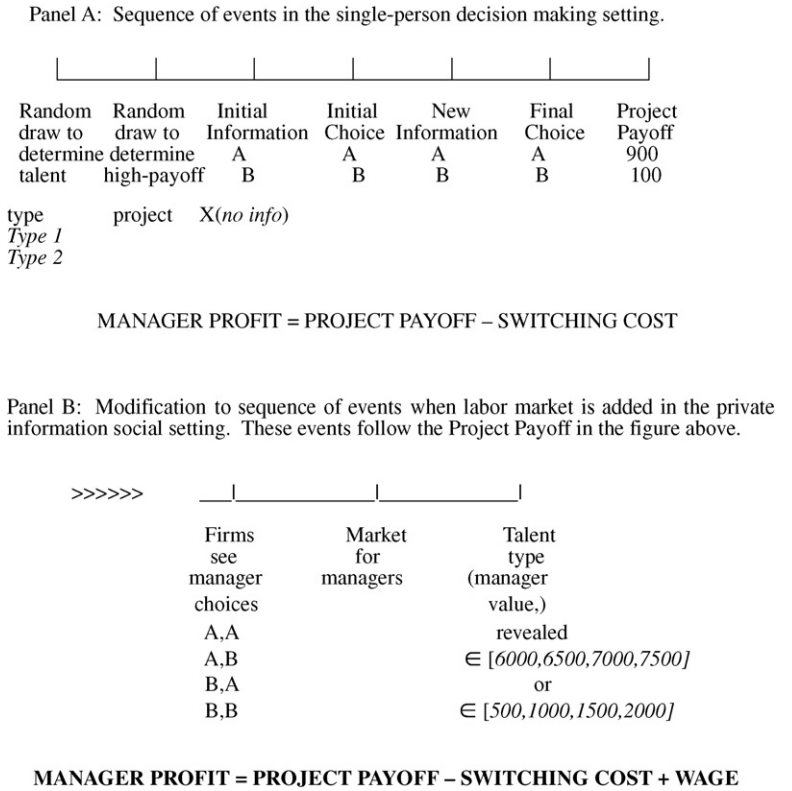

Fig. 2. Sequence of events in the experimental settings. Possible realizations of Random outcomes are shown in italics. Panel A: sequence of events in the single-person decision making setting. Panel B: modification to sequence of events when labor market is added in the private information social setting. These events follow the Project Payoff in the figure above.

type 1 (talented, possessing foresight) or type 2 (untalented, not possessing foresight). The manager's type is not disclosed to anybody, but all subjects know that each type is equally likely. Next, a state (A or B) is drawn with each state being equally likely. If the manager is talented, he learns the true state with certainty. If the manager is untalented, he receives the signal X indicating no state information.

Next the manager chooses one of two projects (A or B). After this initial choice is made but before the project returns are realized, each manager receives a second signal indicating the true state. The manager then chooses from A and B again, either switching projects and paying the switching cost or continuing the earlier choice. Project return, 900 points or 100 points, is realized after this second choice is made. If the final project choice matches the state a return of 900 has an 80 percent chance of occurring, while if there is a mismatch between project and state a return of 900 has only a 20 percent chance of occurring. Switching costs are 100 points. The manager's payoff is his realized project return less any switching costs.

3.2. The information asymmetry social setting

The information asymmetry setting is identical to the single-person setting except that a labor market is introduced. This modification is shown in panel B of Fig. 2. After project returns are realized, managers enter a labor market in which firms bid to hire them. Firms in the labor market observe only managers' sequences of project choices.[4] Project returns and the information signals that managers received are not disclosed to firms in the labor market.[5] We use a second price sealed-bid market; firms submit bids for each manager and the firm bidding the highest amount for a particular manager, hires that manager at the second highest bid amount.[6] Bids are submitted for all managers before any managers are allocated to firms, and firms can hire more than one manager.

Parameters specific to the labor market are shown in the lower portion of Table 1. The value to the firm of hiring a talented manager is substantially higher than the value of hiring an untalented manager. In each period, each firm's value for a talented manager is drawn randomly and independently[7] from the set {6000, 6500, 7000, 7500}, while the value for an untalented manager is drawn randomly and independently from the set {2000, 1500, 1000, 500}. A firm's profit in a particular period is the value of each manager hired minus the wages paid for these managers plus a 500 point fixed fee.[8] A manager's payoff is equal to the wage at which he was hired in the marketplus his project return less any switching costs.

3.3. The public information social setting

The public information setting is identical to the asymmetric information setting except that firms in the labor market see the same pre-decision information that the manager does.

3.4. Procedures

Subjects were undergraduates at the University of Minnesota selected randomly from a subject pool and assigned randomly to one of eight experimental groups.[9] All experiments were conducted using networked computers, and all random outcomes were generated via software. Subjects were told that the experiment would require about 2.5 h to complete and that more subjects than actually needed would be asked to show up for the experiment.[10] Each subject received a $5.00 show-up fee; subjects who were not selected to participate received an additional $3.00 overbooking fee.

Each experiment followed the same general sequence of events and had the same economic parameters.[11] "Points" served as the experimental currency and were converted to cash at the end of the experiment using a linear conversion rate: for project managers, 8000 points = $1.00; for firms, 1200 points = $1.00.[12] Instructions first acquainted subjects with computerized randomization. Subjects had opportunities to generate sequences of 20 draws from the four distributions that they would encounter later in the experiment: 1 or 2 each being equally likely (used for the random draw of manager type); A or B, each being equally likely (used for the random draw of the state); 100 or 900, with a 20 percent change of 900 (used for the random draw of return from an unmatched project); and 100 or 900, with an 80 percent chance of 900 (used for the random draw of return from a matched project). Subjects may generate as many sequences from these distributions as they desire.

[4] This information is displayed on each firm's screen and on an overhead at the front of the room as managers make their choices. The order in which project managers are listed in these displays is randomly determined each period to prevent cross-period reputation effects.

[5] In the KBD model, project return is public information. We chose not to make this information public in the experiments to simplify the inference problem that subjects face. The revelation of project return would diminish, but not eliminate, the gain from escalation.

[6] In case of ties, the hiring firm is determined randomly.

[7] Bidders in second price auctions are predicted to bid their values, so that if all bidders have the same value each bidder would be indifferent between winning the auction (with zero profit) and losing the auction (with zero profit). We introduce a range of values so winning firms profit by hiring managers.

[8] Since talent is known only probabilistically, firms may pay more for a manager than the value of the manager's realized type. The 500 point fixed fee offsets such losses.

[9] Subjects previously participated in an unrelated computerized single-person decision-making experiment.

[10] We overbooked the experiments so that we would be reasonably sure of being able to run 10 person experiments.

[11] Experimental instructions are available on request from the authors.

[12] These conversion rates were chosen so that subjects' predicted earnings (under the information asymmetry model) were approximately the same regardless of assigned role. Subjects were informed of their own conversion rate before making decision, but were not told about the conversion rates of any other subjects. Each subject's conversion rate is displayed at the top of his screen during the experiment.

Each subject first completes 15 periods in the single-person setting. At the start of each period the computer determined a talent type ("type 1" or "type 2") and the state (A or B). This was done independently for each subject and each period. Based on these assignments, an A, B, or X was displayed on each subject's terminal, and the subject proceeds with the project choice task. At the end of each period, subjects' payoffs for the period and payoffs to date in the experiment were computed and displayed on the terminal.

After participating in the single-person setting, subjects were placed in one of the two social settings. Subjects were informed about the market institution as well as the way in which mangers' and firms' payoffs were determined. Following these instructions, subjects completed a short quiz to determine whether they knew the probability distributions and market rules before proceeding. Four subjects were then assigned to be firms, the others remained project managers. Subjects completed 25 periods of the social setting task.

3.5. Predictions

We examine managers' switching-escalation decisions as well as wages in the labor market since both are essential to the KBD theory. The theory predicts that managers will make their decisions in response to the wage structure in the labor market. These wages contain information about firms' inferences and beliefs regarding the value of a manager. If there is a belief that consistent decision makers are better managers (as predicted by Staw and Ross, 1980), then this belief should be reflected in higher wages for escalating managers regardless of the information environment. In turn, such wage structures should lead to managerial decisions quite different from those predicted by KBD. On the other hand, if firms' are inferring managers' foresight as predicted by KBD, then this should be reflected in wage structure differences across the two social settings. Thus, it is important to test the two-way interaction between mangers and firms in the labor market, rather than focus entirely on one side of the market.

All predictions assume risk neutrality for managers as well as firms in the labor market. Given this assumption, the equilibrium described in Section 2 predicts that in the asymmetric information setting, managers will always escalate regardless of the information they get. In this case, since project returns are not observed by firms in our experiment, escalation contains no information about manager type. Posterior beliefs given that escalation should be the same as prior beliefs; hence firms should assess the probability that a manager is talented, given he escalated, to be 0.5. Hence the median (mean) wage for switching managers is predicted to be 1500 (1499) points.

In the public information setting, all pre-decision information available to the manager is also available to firms in the labor market. Since untalented managers never receive an initial informative signal and talented managers always do, firms can perfectly infer manager type without examining managers' project choices. Thus managers' decisions to switch or escalate should be unaffected by labor market assessments. Managers are predicted to switch projects when faced with disconfirming information. The median (mean) wage for a talented manager in the public information setting is predicted to be 7000 (6949) points, and the median (mean) wage for an untalented manager is predicted to be 1500 (1449) points.

Expected utility theory predicts that subjects in the single-person setting will never escalate in the face of disconfirming information. When disconfirming information is received, the expected point payoff from switching ($0.8 \times 900 + 0.2 \times 100 - 100 = 640$ points) exceeds the expected payoff from escalation ($0.2 \times 900 + 0.8 \times 100 = 260$ points). However, if internal justification plays a role, subjects may choose to escalate rather than switch.[13]

Thus, economic rationality and the assumption of risk neutrality lead to the following hypotheses about switching-escalation behavior and market wages:

1. Escalation behavior:
   - 1a In the single-person setting the manager will switch projects when faced with disconfirming information.
   - 1b In the social setting with public information the manager will switch projects when faced with disconfirming information, and his switching rate will be indistinguishable from that in the single-person setting.
   - 1c In the social setting with asymmetric information the manager will escalate when faced with disconfirming information.
2. Market wages:
   - 2a In the public information setting, wages do not depend on escalation/switching behavior.[14]
   - 2b In the public information setting, the wage for a talented manager is higher than for an untalented manager.
   - 2c In the asymmetric information setting, the wage for a manager who escalates is higher than the wage for a manager that switches.
   - 2d In the asymmetric information social setting, the wage for an untalented manager who escalates is indistinguishable from the wage of a talented manager that escalates.

[13] Given that there are switching costs, extreme risk aversion could also account for escalation in the face of disconfirming information. We incorporated a non-zero switching cost so that the (risk-neutral) equilibrium prediction in the asymmetric information setting is unique.

[14] Note that this prediction is based on the assumption that managers respond rationally to the signals they receive. In the public information setting, escalation and switching behavior contain no incremental information about the manager's type and should not affect the manager's wage.

	Stage 1 Single-Person Decision Making Setting	Stage 2 Social Setting
Experiment Set 1: (Information is PUBLIC When subjects are in the Social Setting)	.18 $n = 157$[1]	.08 $n = 142$
Experiment Set 2: (Information is PRIVATE when subjects are in the Social Setting)	.13 $n = 167$	.51 $n = 154$

[1] n represents the number of instances in which a subject received disconfirming information

Fig. 3. Escalation behavior: percentage of times subjects (project manager) continued the initially chosen project rather than switching after receiving disconfirming information.

2e Wages for talented managers in the public information setting will be higher than wages for managers who escalate in the asymmetric information setting.

2f Wages for untalented managers in the public information setting will be the same as wages for managers who switch in the asymmetric information setting.

These hypotheses differ from those based on internal justification or other external justification forces. There is no prior reason to believe that the need for internal justification varies across the settings in our experiments. Further, theories of external justification that do not rely on information asymmetry (Fox and Staw, 1979; Leatherwood and Conlon, 1987) predict the same levels of external justification in our two social settings. Therefore, escalation should be observed in all three settings with the level in the single-person setting lower than that in the two social settings (contrary to 1a, 1b, and 1c).

Theories that rely on a social norm for consistency (Staw and Ross, 1980) as the basis for external justification imply that society "values" consistency more and rewards consistent decision makers with higher wagers. In this case, managers in the public information setting who escalate (are consistent) would be more highly valued than those who switch (contrary to 2a). Wages for managers who see the state of nature early in the public information setting would be the same as wages for managers who escalate in the asymmetric information settings (contrary to 2e). Wages for managers who see the state of nature late in the public information setting but happen to choose the right initial project would be higher than wages for managers who incorrectly guess the project and subsequently switch (contrary to 2a). Wages for managers who switch projects in the asymmetric information setting would be lower than for untalented managers who happen to choose the right initial project in the public information setting (contrary to 2f).

4. Experimental results

Four replications of each of the social settings were conducted. There were 10 inexperienced subjects in seven of the eight experiments, and 8 inexperienced subjects in one of the experiments.[15] To examine escalation behavior, we isolate observations for which project managers receive an uninformative initial signal and later receive disconfirming information. In each experiment, this represents approximately 25 percent of all decisions. To evaluate the behavior of wages, we examine the market wage (the second highest bid) for each manager.

4.1. Escalation behavior

Fig. 3 reports the overall escalation rate in each of the four cells of our experiment. This rate is calculated as the total number of times in which subjects escalated in the face of disconfirming information as a percentage of the total number of cases in which disconfirming information was received.

In the single-person settings, the average escalation rates are 18 percent for the subject group that later participates in the public information setting ($n = 157$) and 13 percent for the subject group that later participates in the asymmetric information setting ($n = 167$). Across groups, eighty percent of the 78 subjects exhibit escalation rates less than 33 percent, with approximately 50 percent of the subjects exhibiting escalation rates less than 10 percent. Although the escalation rate tends to be lower for subjects who later participate in the asymmetric information setting, the difference is not statistically significant (Kolmogorov–Smirnov two sample test, .20 level). This supports the hypothesis that there is no uncontrolled

[15] We intended to have 10 subjects in every experiment, but too few arrived for one of the experiments.

subject difference across subject groups in our social settings.[16] Escalation in the single-person setting is consistent with psychological needs for internal justification, but could also be driven by extreme risk aversion.

The overall escalation rate in the public information social setting is 8 percent with 96 percent of the subjects ($n = 23$) exhibiting escalation rates of 17 percent or lower. The distribution of individual escalation rates in the public information setting is significantly lower than that of the same subject group in the single-person setting (Kolmogorov–Smirnov test, .01 level). Thus, the introduction of social forces alone tends to decrease escalation rather than increase it. There is no evidence that escalation rates decrease over time in the public information settings.[17]

Escalation rates in the asymmetric information social setting are significantly higher than those in the public information social setting (Kolmogorov–Smirnov test, .01 level). The overall escalation rate in the asymmetric information setting is 51 percent, with the rate in the last 10 periods increasing to 63 percent. The distribution of individual escalation rates is distinctly bimodal: 46 percent of subjects ($n = 24$) exhibit escalation rates below 25 percent, while the remainder exhibit rates above 67 percent. This effect is magnified by experience: during the last 10 periods, 39 percent of subjects have escalation rates of 25 percent or below, while 57 percent of subjects have escalation rates of 100 percent.[18] This result is similar to that found in the sequential bargaining literature where subjects appear to be of two types: strategic (in our case, escalating) and non-strategic (in our case, switching).[19]

We now assess escalation rates in relation to the difference between escalating and switching wages. In the asymmetric information social setting, economic rationality requires that managers, when faced with disconfirming information, compare the expected net increase in project outcome that would result from switching to the expected loss in market wages that would result from switching. Thus, when the difference between the market wage for escalating managers and the market wage for switching managers increases, the escalation rate should also increase. To test this hypothesis, we use the most recent difference between an escalating manager's wage and a switching manager's wage as a proxy for expectations about the wage differential and examine the relationship between this measure and escalation behavior.[20] We find that escalation rates increase as the wage differential increases.

In making this claim, we examine 278 instances of disconfirming information using logit analysis. Variables are defined as

$$y_t = \begin{cases} 1 \text{ if the subject escalates in instance } t, \\ 0 \text{ if the subject switches in instance } t; \end{cases}$$

$$x_{1t} = \begin{cases} 1 \text{ if the subject is in the asymmetric information setting,} \\ 0 \text{ if the subject is in the public information setting} \end{cases}$$

$$x_{2t} = \begin{cases} \text{Wage differential if subject is in the asymmetric information setting} \\ 0 \text{ if subject is in the public information setting.} \end{cases}$$

The logit analysis relates the probability that the manager escalates ($y_t = 1$) to the type of social setting the manager faces and the wage differential in the asymmetric information setting. Both the information environment coefficient and the wage differential coefficient are predicted to be positive. Since escalation in the public setting should be close to zero, the intercept is predicted to be significantly negative.

Table 2 contain the results of the logit analysis. As predicted, the coefficient of each variable is significantly positive (t-test, .01 level): escalation rates increase when subjects are in the asymmetric information setting and as the wage differential increases. The small coefficient on wage differential reflects scaling; wage differences were often several thousand points in magnitude. As predicted, the intercept is significantly negative, indicating escalation rates close to zero in the public information setting.

We employed diagnostics suggested in Cox and Snell (1989, pp. 69–75) to uncover heteroscedasticity relative to logit predictions, levels of the independent variables, and individuals in the experiment. To examine heteroscedasticity with

[16] If subjects in the asymmetric information economies do have lower initial escalation rates in the single-person decision-making settings, there is a bias against finding escalation rates that are higher in the asymmetric information economy than the public information economy.

[17] The escalation rates we find in the single-person setting and the public information social setting are consistent with the results reported in Phillips et al. (1991). That paper examines whether subjects' reported values for an asset are influenced by sunk costs. Phillips et al. report that in a single person, repeated-play setting where subjects value risky assets, approximately 19% of the subjects display a systematic relationship between the magnitude of sunk cost and their subjective valuation of the gamble. However, when subjects participate in a multi-person market setting where they bid against each other to acquire an asset after paying a sunk entry fee for participating in the market, only 5% of subjects exhibit sunk cost behavior. Although sunk costs are not essential in our study, our findings are similar. In both studies, a market setting moves subjects closer to rational behavior.

[18] We cannot make a stronger statement here since subjects on average experience only two or three instances of disconfirming information in the last 10 periods.

[19] Johnson et al. (1991) use a process tracing methodology to argue that these differences are attributable to difference in the information processing characteristics of subjects.

[20] We calculate this difference as the last observed escalation wage less the last observed switching wage. If there is more than one wage for a particular class of managers, the wages are averaged. All data from period one in each replication of the asymmetric information economy is eliminated since there is no proxy for expectations.

Table 2
Results of logit analysis examining the effects of information environment (public or private) and wage differential on escalation behavior.

	Coefficient	*t*-Statistic
Constant	−2.40	−7.61
Information environment	1.77	3.92
Wage differential	0.0002	2.48

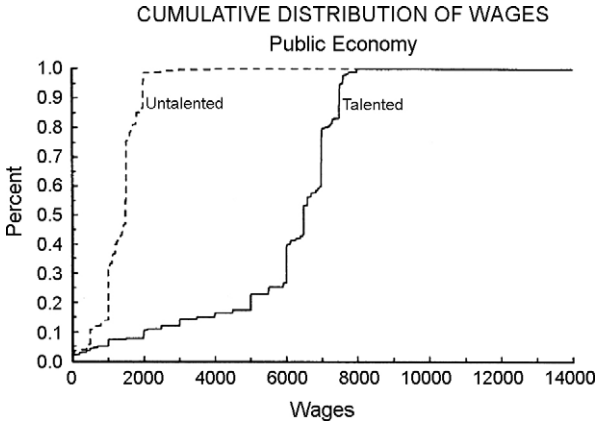

Fig. 4. Cumulative distribution of wages for talented and untalented managers in the public information setting.

respect to predicted values, we grouped logit predictions (probabilities) by deciles and compared actual escalation to predicted escalation for each decile. We find no statistically significant relationship (Chi-square = 3.14, d.f. = 9, insignificant at the .25 level). Partitions of the independent variables yielded equivalent conclusions. The only evidence of heteroscedasticity occurred with individuals: six of the 24 managers in the asymmetric information setting consistently switched, while one of 23 managers in the public information setting frequently escalated.

We examined the opportunity cost of foregoing the rational decision (escalation) in the asymmetric information setting with disconfirming information. In this setting, switching projects would have an expected payoff of $0.29, while escalation has an expected payoff of $0.72. Thus, for a single choice the opportunity cost of a suboptimal decision is 60 percent of the expected profit that could have been made. Subjects did not make suboptimal choices all the time. The table below describes the distribution of overall foregone expected profits for those managers who chose to switch projects in the asymmetric information setting when KBD's theory would predict escalation.

Foregone expected profits	Percent of managers
$2.58	25 percent
$2.29	15 percent
$2.09	10 percent
<$1.00	50 percent

4.2. Market wages

4.2.1. Wages in the public information settings

Given the parameters in our experimental design, the manager's type is fully revealed by the sequence of information signals received in the public information setting. Thus, in the public information setting, wages should be related to manager type rather than to switching–escalation behavior. We expect to see talented managers paid more than untalented managers. Further, within talent type, managers who escalate should receive the same wage as managers that switch. These predictions differ from those of the "norm for consistency" hypothesis. If consistent managers are valued more highly, then wages for escalating managers in the public information setting should be identical regardless of the manager's type.

Fig. 4 shows the cumulative distribution of wages for talented and untalented managers in the public information setting. Almost all the mass of the distribution of wages for untalented managers is below 2000 with the median wage 1500. The cumulative distribution of wages for talented managers is shifted significantly to the right of that for untalented managers (Kolmogorov–Smirnov test, .01 level). The median wage for talented managers is 6500.

To examine the hypothesis that market wages are independent of switching–escalation behavior in the public information setting, we grouped the population of untalented managers into three categories based on publicly available data: those who receive disconfirming information and switch, those who receive disconfirming information and escalate, and those who

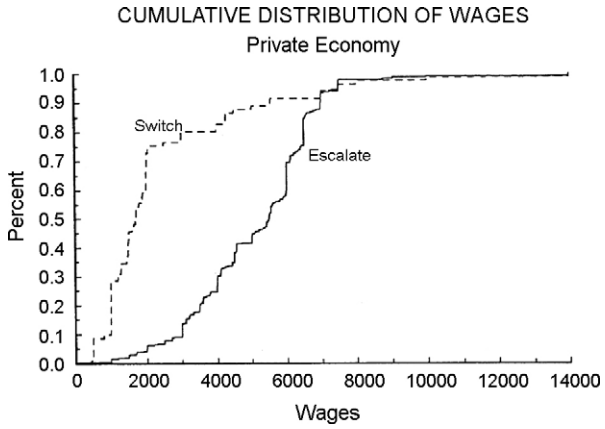

Fig. 5. Cumulative distribution of wages for switching and non-switching managers in the asymmetric information social setting.

receive confirming information and escalate.[21] There is no significant difference in these distributions, and wages in each category are consistently below 2000. Using the Kolmogorov–Smirnov test, no pairs of the three distributions are significantly different from one another at the .20 significance level.[22]

These results are consistent with rational inference by the labor market as incorporated in KBD's theory. They do not support the "norm for consistency" hypothesis.

4.2.2. Wages in the asymmetric information settings

In the asymmetric information setting, we find that whether a manager escalates or switches projects has a strong impact on his market wage. Fig. 5 shows the cumulative distributions of wages for managers who switched and managers who escalated in the asymmetric information setting. Escalation shifts the distribution of wages significantly to the right (Kolmogorov–Smirnov test, significant at the .01 level). The median wage for managers who switched is 1700; the median wage for managers who escalated is 5500. The latter wage is higher than our predicated risk neutral median wage for managers who escalate (4000 points). However, that prediction is part of an equilibrium in which managers always escalate in the face of disconfirming information regardless of their type. These wage distributions are indistinguishable (Kolmogorov–Smirnov test, .20 level), indicating that untalented managers successfully hid their type by escalation.

4.2.3. Comparison of wages across public and private information settings

KBD's theory predicts that the wage for talented managers in the public information setting will be higher than the wage for escalating managers in the asymmetric information setting since in this latter setting escalation does not perfectly discriminate between talented and untalented managers. Consistent with this prediction, we found that wages for known talented managers in the public information setting are significantly higher than for escalating managers in the private information setting (significant at the .01 level, Kolmogorov–Smirnov test).

Finally, KBD's theory predicts that there will be no difference in wages for untalented managers in the public information setting and switching managers in the asymmetric information setting. This hypothesis is also supported by the data: the median wage for untalented managers in the public information setting is 1500 while the median wage for switching managers in the asymmetric information setting is 1700.

5. Conclusion

In surveying the empirical literature on escalation, Brockner (1992) concluded that while self-justification seems to play a significant role it does not explain all of the escalation phenomenon. Our results for the single-person setting indicate that internal justification, though present, is not by itself a potent force for escalation. External justification plays a more powerful role. This finding confirms the intuition in Fox and Staw (1979, p. 453) who state: "When faced with an external threat or evaluation, individuals may be motivated to prove to others that they were not wrong in an earlier decision and *the force for such external justification could well be stronger than the protection of individual self-esteem"* (emphasis added). However, the

[21] Talented managers cannot be classified in this manner since, given our parametric assumptions, talented managers would always receive confirming information.

[22] Although these distributions are not significantly different from one another, wages for managers who escalate after receiving disconfirming information are slightly lower than those of managers who switch after receiving disconfirming information. This may be due to disciplining by the labor market, and could account for the decrease in escalation rates when subjects move from the single person setting to the public information setting.

mere presence of a social setting and external evaluation is not enough to give rise to escalation. Our results indicate that information asymmetry is crucial.

This suggests that information asymmetry may be a confounding variable at work in previous studies of escalation. For instance, Fox and Staw (1979) document that policy resistance influences escalation behavior. Policy resistance is implemented by having the decision maker submit a recommendation backed by a written memo providing his reasons for the initial choice. The subject then receives a memo from the Board of Directors that is either supportive or critical of the manager's choice. In the low resistance condition, a subject is told: "Board members were highly satisfied, and supportive of your recommendation and were firmly convinced that you had recommended the correct course of action. In the final analysis, the Board completely supported your judgment" (Fox and Staw, 1979, p. 458) In the high resistance condition, subjects are told, "Board members were highly skeptical and critical of your recommendation and were firmly convinced you had recommended the wrong course of action. In the final analysis, *the Board reluctantly deferred to your judgement*" (Fox and Staw, 1979, p. 458, emphasis added). This suggests an information asymmetry manipulation. In the high policy resistance condition, the board reluctantly defers to the manager's judgment in spite of its extreme skepticism, suggesting that the Board believes that the manager has, or should have, information and insights that they do not. In the low policy resistance condition, the Board's strong support for the initial choice suggests that the Board has the same information as the manager, and the Board agrees that all foreseeable information has been taken into account.

Understanding the role of information asymmetry in escalation is important since information asymmetry is an environmental feature that could be modified by organization design choices and explicit reward schemes. Consider the Staw and McClane (1984) study of escalation in the commercial lending division of a major American bank, reported in Staw and Ross (1987). Staw and McClane were surprised to find little tendency for escalation and attributed this to an organizational design structured to minimize project, psychological, social and structural variables that might foster escalation. Specifically, the bank's loan officers were explicitly required to report both client strengths and weaknesses before funding a loan. All officers were expected to have some loans turn sour. Once identified, problem loans were referred to a separate work-out group which conducted a thorough inquiry into the loan. The bank's greatest sanctioning resulted not from having a loss, per se, but from not recognizing the possibility of loss at the time of funding.

In the Staw and McClane field study, we see an explicit sharing of information between loan officers, superiors, and the work-out group. Incentives for information sharing are provided by imposing harsh penalties for suppressing information and failing to anticipate and report problems that later come to light. In addition to performing the specialized task of collecting problem loans, the work-out group performs a monitoring task that ensures that unanticipated problems are revealed as unanticipated, thus shedding direct light on loan officers' foresight. The bank has essentially created a public information setting through its organization design and reward system. Thus, the absence of escalation behavior in this bank is fully consistent with KBD's theory and with our experimental findings. Our study shows that firms that organize their information gathering and decision making to mitigate information asymmetry are less likely to experience escalation behavior.

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