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Cheap talk with an exit option: The case of discrete action space[☆,☆☆]

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HIGHLIGHTS

- We analyze a cheap talk model where an exit option is available for the sender.
- An informative equilibrium exists if the sender's bias is sufficiently large.
- A large bias makes the sender's exit more likely.
- This gives the receiver an incentive to choose an action desirable for the sender.
- In turn, this gives the sender an incentive to send an accurate information.

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ABSTRACT

We consider a cheap talk model with the sender's exit option. We show that in the case of discrete action space, it can be the case that there exists an informative equilibrium if and only if the sender's bias is sufficiently small or *sufficiently large*. The latter case is sharply contrasting with the existing results of cheap talk.

1. Introduction

Cheap talk models have been used in considering the information transmission problem within relationships and organizations.[1] A player with informational advantage about the state of the world, called a sender, tries to transmit information about the state to another player, called a receiver, sending a cheap talk message, based on which the receiver makes a decision affecting both players' payoffs.

It is assumed in many cheap talk models that the sender has no other action than sending cheap talk messages. In many real situations, however, the sender has an exit option to terminate the relationship or withdraw from the organization. If a customer complained to a producer about her dissatisfaction with a good or service, but the customer cannot see any quality improvement, she may stop purchasing from the producer. If a worker complained to a manager about bad conditions at the workplace, but the manager does not give an appropriate remedy, the worker may quit the job.[2] I believe it is important to analyze how the existence of the exit option affects information transmission via cheap talk for an understanding of relationships and organizations.

Shimizu (2008) deals with a variant of the Crawford and Sobel (1982) cheap talk model where the sender has an exit option

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[1] See Gibbons et al. (2012) for the survey.

[2] These examples are taken from a so-called "exit–voice framework" initiated by Hirschman (1970, 1987). Banerjee and Somanthan (2001) and Shimizu (2008) identify "voice" as activity of information transmission. See Shimizu for details.

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and shows that the existence of the sender's exit option may increase the informativeness of cheap talk no matter how large the sender's bias is. This note presents a much stronger result; in the case of discrete action space, it can be the case that there exists an informative equilibrium if and only if the sender's bias is sufficiently small or *sufficiently large*. The latter fact is new in the literature.

The model is as follows: Nature randomly chooses a state, which is observed only by the sender. The sender sends a costless message to the receiver. Based on the received message, the receiver chooses an action relevant to both players. After the sender observes the action, he chooses whether to exercise an exit option or not. When the exit option is chosen, both players receives payoffs independent from state and action. On the other hand, when the exit option is not chosen, both players' payoff functions are quadratic functions dependent upon state and action where the sender's bliss point differs from the receiver's. The difference is called the sender's bias.

In this model, a large sender's bias implies that the sender is likely to choose an exit option unless the receiver chooses a desirable action for the sender. Then, it gives the receiver an incentive to do so as long as the receiver is sufficiently averse to the sender's exit, which in turn gives the sender an incentive to send an accurate information to the receiver.

This is a sharply contrasting result with the existing results of cheap talk. Crawford and Sobel (1982) shows that the smaller the sender's bias is, the more informative an equilibrium cheap talk is in a so-called uniform-quadratic model, and similar results also hold in most of the variations of the uniform-quadratic model.

Chiba and Leong (2012) is closely related to this note. They deal with a cheap talk model with the receiver's exit option and demonstrate a non-monotonic effect of the bias as in this note. However, the underlying logic is different. In their model, a more biased sender may transmit more accurate information in order to deter the receiver's exit. On the other hand, it is *the receiver* who is afraid of the partner's exit in my model. Since a more biased sender is more likely to exercise his exit option, the receiver is more likely to choose a desirable action for the sender, which in turn, enables the sender to transmit more accurate information to the receiver without anxiety.[3]

In another setting than the cheap talk model, Hori (2008) obtains the result that an agent with a more different objective is more beneficial for the principal. Che and Kartik (2009) also obtains the result that an adviser with a more different opinion (prior) is more beneficial for the decision maker. However, their results are common in that some kind of incongruence is beneficial in terms of giving the agent/advisor more incentive to acquire information, which is irrelevant to our result.

2. Model and result

There exist two players: Sender (he) and Receiver (she). A game proceeds as follows:

- Nature randomly chooses a state t according to the uniform distribution on $[0, 1]$. The realization of the state is only observed by Sender.
- Based upon the realized state, Sender sends a costless message $m \in M = A$. We consider the case where $A = \{a_1, a_2\}$ where $0 \le a_1 < a_2 \le 1$.
- Based upon the received message, Receiver chooses an action $a \in A$.
- After observing a, Sender chooses whether he stays or exits. Both players' payoffs when Sender chooses to exit are normalized to 0. When Sender chooses to stay, Player i's payoff $v_i(t, a)$ is

  $$v_i(t, a) = D^i - (t + b_i - a)^2 \quad i = \mathrm{S}, \mathrm{R}.$$

  Without loss of generality, we assume $b_{\mathrm{S}} := b > 0$ and $b_{\mathrm{R}} = 0$. We call b sender's bias. D^i is the degree of i's aversion to S's exit option. We focus on the situation where $D^{\mathrm{S}} > 0$ and $D^{\mathrm{R}} > 0$.

We define the informative equilibrium as an equilibrium where there exists a boundary point $t_1 \in (0, 1)$ such that

- when Sender observes $t < t_1$, she sends $m = a_1$,
- when Sender observes $t > t_1$, she sends $m = a_2$, and
- when Receiver receives $m = a_i$, he chooses $a = a_i$ for $i = 1, 2$.

Let $\bar{a} = \frac{a_1+a_2}{2}$. Since Sender must be indifferent between sending $m = a_1$ and $m = a_2$ at t_1, $t_1 = \bar{a} - b$ must be satisfied in the informative equilibrium. Note that $t_1 \in (0, 1)$ if and only if $b < \bar{a}$.

Consider the environment without an exit option, or equivalently, the case of sufficiently large D^{S}. There exists the informative equilibrium if and only if there is an incentive for Receiver to choose $a = a_2$ instead of $a = a_1$ when he receives $m = a_2$. This condition is

$$\int_{t_1}^{1} \left(D^{\mathrm{R}} - (t - a_2)^2\right) dt \ge \int_{t_1}^{1} \left(D^{\mathrm{R}} - (t - a_1)^2\right) dt,$$

which is equivalent to $b \le 1 - \bar{a}$. This implies that there exists the informative equilibrium if and only if the bias is sufficiently small. Throughout the rest of the section, we assume the above inequality does not hold, in other words, b is not sufficiently small to guarantee the existence of informative equilibrium in the environment without exit.

Let us turn to the environment with an exit option. In this environment, we can show that the *larger b* is, the more likely it is for there to exist informative equilibrium.

Proposition 1. *We assume $\bar{a} > \frac{1}{2}$. Suppose*

$$D^{\mathrm{R}} \ge (a_2)^2 + \max\{1 - 2a_1, 0\}, \tag{1}$$

$$1 - \bar{a} < b < \bar{a}. \tag{2}$$

In the environment without an exit option, there exists no informative equilibrium. In the environment with an exit option, there exists a function $\delta(b, D^{\mathrm{R}})$ strictly increasing in b such that there exists the informative equilibrium if and only if $\sqrt{D^{\mathrm{S}}} \le \delta(b, D^{\mathrm{R}})$.

We relegate the proof to the Appendix. Here let me present an intuition. Consider the case where $1 - a_1 + b > \sqrt{D^{\mathrm{S}}} > 1 - a_2 + b$. Now suppose that some $t > t_1$ is realized. If both players follow the equilibrium strategies, S sends $m = a_2$ and R chooses $a = a_2$. (2) guarantees that $v_{\mathrm{S}}(t, a_2) > 0$. In other words, if R would choose $a = a_2$, S would never exercise an exit option. On the other hand, $v_{\mathrm{S}}(t, a_1) < 0$ if and only if

$$t > a_1 - b + \sqrt{D^{\mathrm{S}}}. \tag{3}$$

In other words, when R would choose $a = a_1$, S would choose an exit option for t satisfying (3).

Keeping this in mind, consider the effects of an increase of b. It directly increases the R's incentive to deviate from the equilibrium action $a = a_2$ because her estimated mean becomes closer to a_1. The increase of b, however, has another effect, which can be named the *exit inducement effect*. In other words, it increases R's perceived probability that S would choose an exit option in response to R's deviation, while it does not affect S's exit behavior if R would follow the equilibrium action. This exit inducement effect overwhelms

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[3] Therefore, Chiba and Leong focus on the case where the sender's outside payoff is small and the receiver's outside payoff is large, while I focus on the opposite case, or one where the sender's outside payoff is large and the receiver's is small.