Economics Letters 117 (2012) 490–492

Contents lists available at SciVerse ScienceDirect

Economics Letters

journal homepage: www.elsevier.com/locate/ecolet

A strategic mediator who is biased in the same direction as the expert can improve information transmission

Lydia Mechtenberg [a,b,*], Johannes Münster [c,1]

[a] University of Hamburg, Department of Economics, Von-Melle-Park 5, D-20146 Hamburg, Germany
[b] WZB, Reichpietschufer 50, D-10785 Berlin, Germany
[c] University of Cologne, Albertus-Magnus Platz, D-50923 Cologne, Germany

ARTICLE INFO

Article history:
Received 27 February 2012
Received in revised form
17 May 2012
Accepted 29 June 2012
Available online 4 July 2012

JEL classification:
C72
D82
D83

Keywords:
Communication
Information
Cheap talk
Mediation

ABSTRACT

We model strategic mediation of the communication between an informed expert with a discrete type space and an uninformed decision maker. A strategic mediator can improve communication even when he is biased into the same direction as the expert.

1. Introduction

Recent research has shown that a strategic mediator can improve upon communication in a Crawford and Sobel (1982) setting, if his and the expert's bias point in opposite directions. Ivanov (2010) demonstrates that communication between a positively biased expert and the decision maker can be improved by a strategic mediator with a negative bias. In fact, a strategic mediator with a specific negative bias can achieve as much information transmission in equilibrium as the optimal non-strategic mediator characterized by Goltsman et al. (2009). Ivanov (2010) also shows that, when the mediator is either unbiased or biased in the same direction as the expert, but to a *lesser* degree, the mediator cannot improve upon direct communication.[2] This leaves open the question, however, of whether a *more* biased mediator may improve communication. In a simple setting with a finite number of types, we show that indeed he may.

2. The argument

Consider the following model: Nature chooses the state of the world θ from the uniform distribution over the set $\{0, 1, 2, 3\}$. The expert learns θ and sends a message $s \in \{0, 1, 2, 3\}$ either directly to the decision maker (in the direct-communication game) or to the mediator (in the mediated-communication game). In the latter case, the mediator learns s (but not θ) and sends a message $m \in \{0, 1, 2, 3\}$ to the decision maker. With direct communication, the decision maker observes s (but not θ). With mediation, she observes m (but neither s nor θ). Finally, the decision maker chooses an action $a \in \mathbb{R}$. The payoffs of the expert, mediator, and decision maker are, respectively,

$$u_E = -(a - (\theta + b))^2,$$
$$u_M = -(a - (\theta + b_M))^2,$$
$$u_D = -(a - \theta)^2.$$

The bias of the expert, b, is strictly positive and commonly known. The bias of the mediator, b_M, is his private information and takes

* Corresponding author at: University of Hamburg, Department of Economics, Von-Melle-Park 5, D-20146 Hamburg, Germany. Tel.: +49 40 42838 9484; fax: +49 30 25491 442.

E-mail addresses: lydia.mechtenberg@wiso.uni-hamburg.de, mechtenberg@wzb.eu (L. Mechtenberg), johannes.muenster@uni-koeln.de (J. Münster).

1 Tel.: +49 221 4704411.

2 Other papers that study strategic mediators are Ambrus et al. (2011a,b) and Li and Madarasz (2008).

0165-1765/$ – see front matter © 2012 Elsevier B.V. All rights reserved.
doi:10.1016/j.econlet.2012.06.050

value $b_M = 0$ with probability $p \in (0, 1)$ and $b_M = \beta > 0$ with probability $1 - p$. Note that the biases of the expert and the mediator point in the same direction. The solution concept is Perfect Bayesian Equilibrium. For simplicity, we focus on pure strategy equilibria.[3]

We say that mediated communication is *more informative* than direct communication if and only if the expected payoff of the decision maker is strictly higher in at least one equilibrium of the mediated-communication game than in any equilibrium of the direct-communication game.

Proposition 1. *There exists a positive measure set of parameters with $\beta > b$ such that mediated communication is more informative than direct communication.*

We prove Proposition 1 constructively by explicitly characterizing a set of parameters (b, β, p) such that mediation improves communication. Intuitively, if b is small, mediation is unnecessary, whereas if b is too big, mediation doesn't help. Similarly, β must be neither too low nor too high so that mediation can improve communication. (1) and (2) below provide sufficient conditions. Let

$$\frac{1}{2} < b < \min\{b_0(p), b_1(p)\}, \quad (1)$$

where $b_0(p)$ is the unique solution of

$$-pb^2 - (1-p)(p-b)^2 = -p(p-b)^2 - (1-p)\left(\frac{6-p}{3-p} - b\right)^2,$$

and

$$b_1(p) = \frac{1}{2}\left(p + \frac{6-p}{3-p}\right) - 1.$$

Fig. 1 plots $b_0(p)$ and $b_1(p)$. Inequality (1) is satisfied in the shaded area.

Let

$$b_1(p) \le \beta \le b_1(p) + 1. \quad (2)$$

Note that (1) and (2) describe a positive measure set of parameters with $\beta > b$. Furthermore, (1) implies $1/2 < b < 1$. We proceed to show that, with direct communication, in the equilibrium that is best from the decision maker's point of view only two different actions are taken with positive probability (Lemma 1), whereas with mediation, a three-action equilibrium exists such that the decision maker has a higher expected payoff (Lemma 2).

Lemma 1. *Consider direct communication and suppose that* $1/2 < b \le 1$. (a) *There exists an equilibrium where type* $\theta = 0$ *separates himself, types* $\theta = 1, 2, 3$ *pool on some other message, and the decision maker's expected payoff is* $-1/2$. (b) *There is no equilibrium where the decision maker has a higher expected payoff.*[4]

Proof. See the Appendix. □

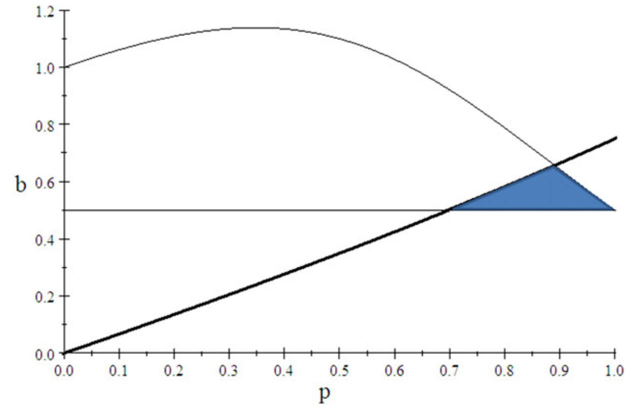

Fig. 1. $b_0(p)$ (thin line), $b_1(p)$ (thick line), and $b = 1/2$.

Lemma 2. *Given* (1) *and* (2), *with mediated communication, there is an equilibrium where the decision maker takes three different actions with positive probability and receives the expected payoff*

$$-\frac{1}{4}\left(p(1-p) + (1-p)\left(\frac{6-p}{3-p} - 1\right)^2 + \sum_{\theta=2,3}\left(\frac{6-p}{3-p} - \theta\right)^2\right) > -\frac{1}{2}. \quad (3)$$

Proof. See the Appendix. □

Proposition 1 is a direct implication of Lemmas 1 and 2. Whenever b satisfies (1), some information can be transmitted with direct communication. However, if $b > 1$, the direct-communication game only has babbling equilibria. In this case, it is easy to show that the mediator does not improve communication in our setting.[5] We conclude that a strategic mediator with a bias pointing in the same direction as the expert's *can* improve information transmission, but *only if* at least *some* information can already be transmitted via direct communication.

To gain some intuition for Proposition 1, note that without mediation there is no equilibrium where types 0 and 1 fully reveal themselves: since $b > 1/2$, type 0 would have an incentive to mimic type 1. With mediation, however, there is an equilibrium where types 0 and 1 fully reveal themselves to the mediator, while types 2 and 3 pool. Type 0 has no incentive to mimic type 1, since by doing so, he risks that the mediator distorts his message upwards to the message sent by types 2 and 3, leading to an action that is too high from type 0's point of view. The mediator introduces noise into the communication, but the more informative behavior of the expert dominates this countervailing effect and leads to a higher payoff of the decision maker.

Our construction presupposes that the equilibrium with mediation is a three-action equilibrium. This also explains why we need at least a four-state distribution to make our point. A three-action equilibrium is impossible with a two-state distribution. With a three-state distribution, a three-action equilibrium requires that each type of the expert separates himself (at least partially), but then the second highest type would prefer to mimic the highest whenever $b > 1/2$. In this sense, our example is the simplest possible example where a mediator who is more biased than the expert improves communication.

3 It can be shown that our result holds also when allowing for mixed-strategy equilibria. See footnote 4 below.

4 Lemma 1(b) holds for mixed-strategy equilibria as well. It can be shown that, in any mixed-strategy equilibrium, types $\theta = 1, 2$, and 3 pool, i.e., they induce the decision maker to take the same action. When $3/4 < b < 1$, in addition to the equilibrium mentioned in Part (a) and the babbling equilibrium where no information is transmitted, there is a semi-pooling equilibrium where types 1, 2, and 3 send a message s_{123} while type 0 randomizes between s_{123} and another message s_0. The expected payoff of the decision maker, however, is lower than in the equilibrium described in Part (a). Details are available from the authors upon request.

5 The proof is available from the authors upon request.

Appendix. Proofs

Proof of Lemma 1. Part (a). Suppose that type 0 of the expert separates himself with a message s_0, and the remaining types pool on another message s_{123}. In this case, the decision maker chooses action 0 after s_0, and 2 after s_{123}, and receives an expected payoff of $-1/2$. Note that the most preferred action of type 0 of the expert is $b \leq (0+2)/2$, which is closer to 0 than to 2. Since the payoff function is single-peaked and symmetric around the most preferred action, this implies that type 0 prefers action 0 over action 2. The remaining types all prefer action 2 over action 0.

Part (b) will be established in five steps.

(i) Suppose that types θ and $\theta' > \theta$ send the same message s. Then any θ'' with $\theta < \theta'' < \theta'$ either also sends s, or sends a message that induces the decision maker to take the same action as after observing s. To see this, suppose that θ'' sends a message $s'' \neq s$. Denote the action taken by the decision maker after observing s by a, and the action taken after observing s'' by a''. Suppose that $a'' < a$. In order for type θ'' to prefer sending s'' over sending s, we must have $\theta'' + b \leq \left(a'' + a\right)/2$. But then $\theta + b < \left(a'' + a\right)/2$, i.e., type θ strictly prefers sending s'' over s, contradicting equilibrium. A similar argument rules out that $a'' > a$.

Therefore we can without loss of generality restrict attention to equilibria where the expert's types are partitioned into cells, any two types in the same cell send the same message, any two types belonging to different cells send different messages, and different messages that are used in equilibrium induce the decision maker to take different actions.

(ii) There is no equilibrium where two adjacent types θ and $\theta+1$ fully reveal their types by sending different messages s_θ and $s_{\theta+1}$. To see this, note that in any such equilibrium the decision maker would choose action θ after observing s_θ, and $\theta+1$ after observing $s_{\theta+1}$. Since $b > 1/2$, however, type θ of the expert prefers $\theta + 1$ over θ, contradicting equilibrium. In particular, no fully revealing equilibrium exists.

(iii) There is no equilibrium where two types pool and the remaining types separate themselves. By (i) and (ii), the only way this could occur is that types 1 and 2 pool on a message s_{12}, whereas types 0 and 3 send different messages s_0 and s_3. Then the decision maker chooses 3/2 after observing s_{12}, and 3 after s_3. But type 2 prefers 3 over 3/2, contradicting equilibrium.

(iv) There is no equilibrium where types 0 and 1 pool on a message s_{01}, and types 2 and 3 on another message s_{23}. In this case the decision maker would choose 1/2 after s_{01} and 5/2 after s_{23}, but type 1 prefers 5/2 over 1/2, contradicting equilibrium.

(v) There is no equilibrium where types 0, 1, and 2 pool while type 3 separates himself—type 2 would prefer to mimic type 3. There are, of course, babbling equilibria where no information is transmitted, the decision maker always takes the action $\sum_{\theta=0}^{3} \theta/4 = 3/2$, and has an expected payoff of $-5/4$. It follows that there is no equilibrium which is better for the decision maker than the equilibrium described in Part (a). □

Proof of Lemma 2. Consider the following strategies of expert and mediator. Type $\theta = 0$ of the expert sends a message s_0, $\theta = 1$ sends a different message s_1, and 2 and 3 pool on a third message s_{23}. The unbiased type of the mediator truthfully reports what he has received. The biased mediator distorts communication upwards: after seeing s_0, he reports s_1, and after seeing s_1 or s_{23}, he reports s_{23}.

Given these strategies, the decision maker infers from s_0 that $\theta = 0$ and thus chooses action 0. After receiving s_1, the decision maker believes that $\theta = 0$ with probability $1 - p$ and $\theta = 1$ with probability p, so he optimally chooses p. After observing s_{23}, the decision maker believes that $\theta = 1$ with probability $(1-p)/(3-p)$, and that $\theta = 2$ and $\theta = 3$ with probability $1/(3-p)$ each. His optimal choice of action in this case is $(6-p)/(3-p)$. In expectation, the decision maker's payoff is equal to the left-hand side of (3).

Consider the biased mediator. Suppose he receives the message s_0. Then he knows the state is $\theta = 0$ and his most preferred action is β. By (2), $\beta \geq b_1(p) > p/2$, therefore his most preferred action is closer to p than to 0, which implies he prefers sending s_1 over sending s_0. Similarly, $\beta \leq b_1(p) + 1$ implies he prefers sending s_1 over sending s_{23}. If the biased mediator receives s_1, his most preferred action is $1 + \beta$. Since $\beta \geq b_1(p)$, he prefers sending s_{23} over sending s_1 or s_0. If the biased mediator receives s_{23}, his most preferred action is $5/2 + \beta > 3$; therefore he prefers sending s_{23} over sending s_1 and s_0.

Consider the unbiased mediator. If he receives s_0, he gets his most preferred action 0 by sending s_0. If he receives s_1, his ideal action is 1. He prefers sending s_1 over sending s_0 or s_{23} since, for all $p \in (0, 1)$,

$$\frac{p}{2} < 1 < \frac{1}{2}\left(p + \frac{6-p}{3-p}\right).$$

A similar argument shows that he has no incentive to deviate whenever he receives s_{23}.

Finally, consider the expert. Type $\theta = 0$ is indifferent between sending s_0 and sending s_1 if $b = b_0(p)$. He strictly prefers sending s_0 for smaller b. Deviating to s_{23} is even less attractive. Therefore, $b \leq b_0(p)$ ensures he has no incentive to deviate. The ideal point of type $\theta = 1$ is $1 + b$. Since $b \leq b_1(p)$, he prefers action p over action $(6-p)/(3-p)$. This implies that he prefers sending s_1 over sending s_{23}. To see this, note that if he sends s_1, the decision maker chooses action p if the mediator is unbiased, and action $(6-p)/(3-p)$ otherwise; in contrast, if he sends s_{23}, the decision maker is sure to choose $(6-p)/(3-p)$. Moreover, he prefers both action p and action $(6-p)/(3-p)$ over action 0 since $1 + b > ((6-p)/(3-p))/2 > p/2$, implying that he prefers sending s_1 over sending s_0. Finally, it is straightforward to show that types $\theta = 2$ and $\theta = 3$ have no incentive to deviate.

It remains to prove inequality (3). Let $f(p)$ denote the expression on the left-hand side, considered as a function of p. Note that $f(0) = -1/2$ and

$$f'(p) = \frac{1}{4}\frac{p\left(2p^2 - 13p + 24\right)}{(3-p)^2} > 0.$$

Hence $f(p) > -1/2$ for all $p > 0$. □

References

Ambrus, A., Azevedo, E., Kamada, Y., 2011a. Hierarchical cheap talk, Working Paper.

Ambrus, A., Azevedo, E., Kamada, Y., Takagi, Y., 2011b. Legislative committees as information intermediaries: a unified theory of committee selection and amendment rules, Unpublished manuscript.

Crawford, V.P., Sobel, J., 1982. Strategic information transmission. Econometrica 50 (6), 1431–1452.

Goltsman, M., Hoerner, J., Pavlov, G., Squintani, F., 2009. Mediation, arbitration and negotiation. Journal of Economic Theory 144 (4), 1397–1420.

Ivanov, M., 2010. Communication via a strategic mediator. Journal of Economic Theory 145 (2), 869–884.

Li, M., Madarasz, K., 2008. When mandatory disclosure hurts: expert advice and conflicting interests. Journal of Economic Theory 139, 47–74.