Communication and Deception in Games

Communication

Communication in double auctions

Testing if deception is costly

Promises

Communication in Prisoners' Dilemma Games and Bargaining

Many studies show that communication between ”players” increase cooperation and improve bargaining outcomes.

A meta-analysis of prisoner's dilemma experiments from 1958 to 1992 for instance show that communication is the single most important explanatory factor for the rate of cooperation (Sally Rationality and Society 1995).

Often considered a paradox; as communication is typically considered to be ”cheap talk” (i.e. have no commitment value and therefore should have no effect on behavior).

Why Does Communication Work?

Some possible explanations:

Reputation (if repeated trials with the same subjects or communication reveals the identity of subjects)

Coordination (if multiple equlibria; social preferences and prisoners' dilemma games)

Identification (communication increases sympathy/empathy; "identifiable victim effect")

Argumentation (communication affects preferences/norms; e.g. fairness norms)

Commitment value (individuals have a psychological cost of lying)

Double Auctions

Sealed bid double auction:

One buyer (b) randomly draws a value from a uniform distribution between 0-1; this value (v_b) is private information

One seller (s) randomly draws a cost from a uniform distribution between 0-1; this cost (v_s) is private information

The buyer (offer price; p_b) and seller (asking price; p_s) simultaneously submit bids.

Trade if $p_b \geq p_s$; $p=(p_b+p_s)/2$; buyer payoff=v_b-p; seller payoff=$p-v_s$

No trade if $p_b<p_s$; zero payoffs for both buyer and seller

Chatterje and Samuelson (Operations Research 1983) linear equilibrium:

$P_b(v_b)=(2/3)v_b + (1/12)$

$P_s(v_s)=(2/3)v_s + (1/4)$

Trade if: $v_b \geq v_s+(1/4)$

Efficiency: not full efficiency as low value trades are not realized.

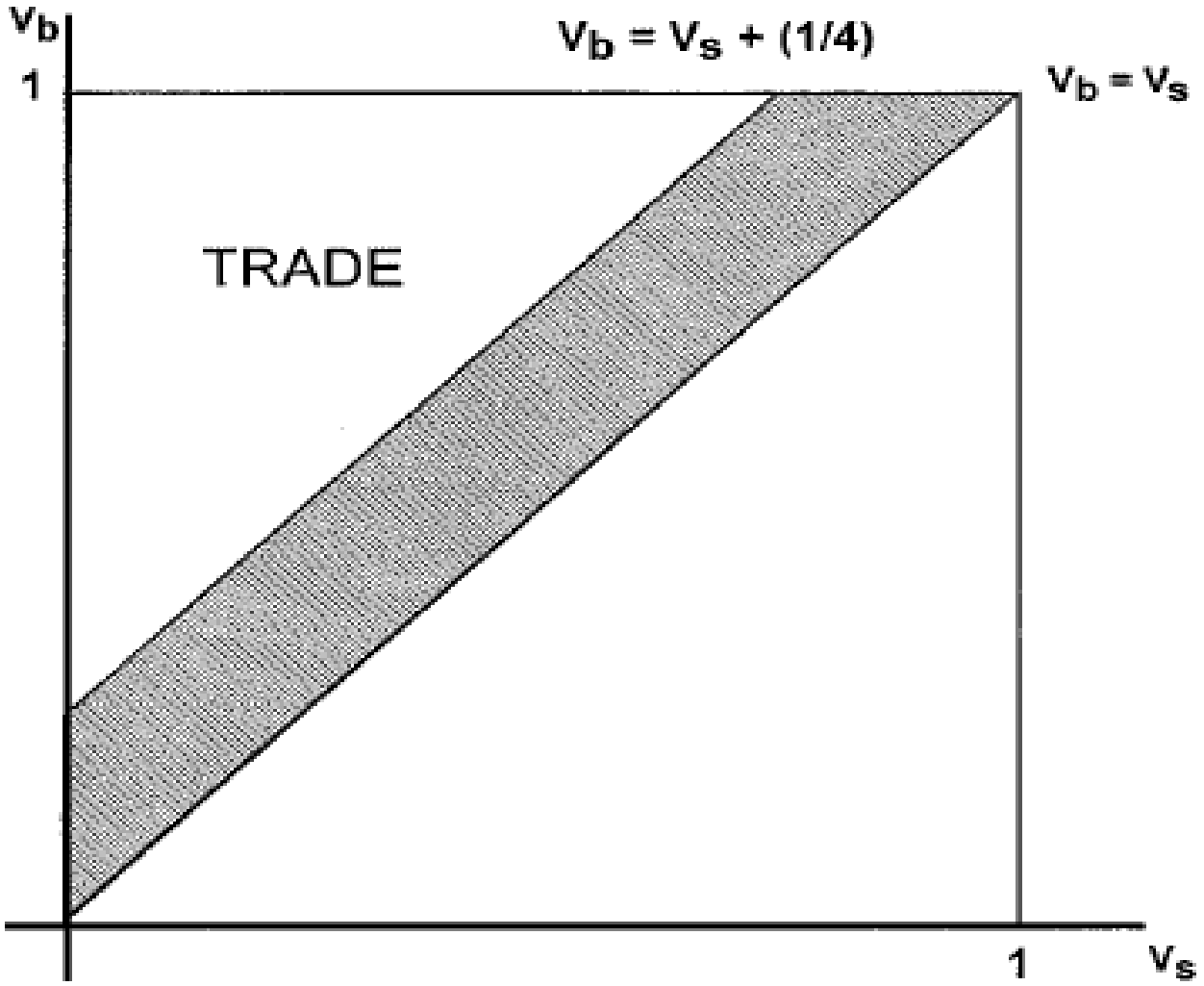

FIG. 2. Chatterjee-Samuelson linear equilibrium.

Communication in Double Auctions (Valley et al GEB 2002)

Setting: Sealed bid double auction with values/costs randomly drawn from a uniform distribution between $0 and $50. Subjects played seven trials each with new partners in every trial (3 trials were randomly selected for real payment).

Treatments (the treatments also varied with respect to if any feedback was given after each trial):

1. No communication (anonymous)

2. Written communication (anonymous exchange of written messages during a 13-minute communication period)

3. Face-to-face communication (6 minute communication period)

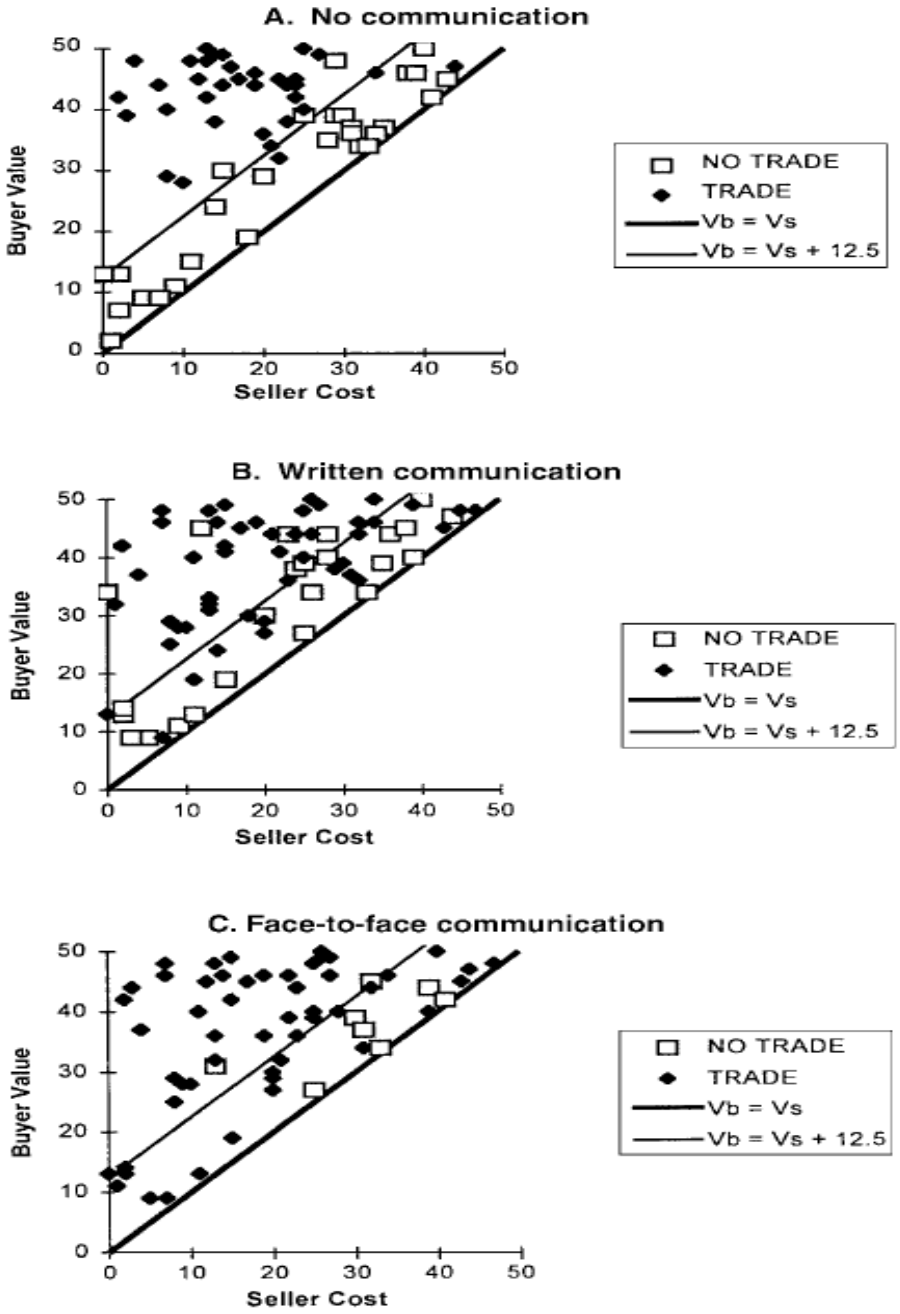

FIG. 3. Trade outcomes (GFT > 0).

TABLE 1
Trade Outcomes by Communication Treatment

	$v_b > v_s + 12.5$	$v_s < v_b < v_s + 12.5$	Total
	No communication treatments (with and without feedback)		
No trade	4 (11%)	25 (89%)	29 (46%)
Trade	31 (89%)	3 (11%)	34 (54%)
Total	35	28	63
	Written treatments (with and without feedback)		
No trade	6 (17%)	19 (56%)	25 (36%)
Trade	30 (83%)	15 (44%)	45 (64%)
Total	36	34	70
	Face-to-face treatments (with and without feedback)		
No trade	2 (6%)	7 (26%)	9 (15%)
Trade	30 (94%)	20 (74%)	50 (85%)
Total	32	27	59

Price coordination and honest revelation/deception in Valley et al

	Communication		
	No	Written	Face-to-face
Price coordination (% of pairs)	5	40	76
Mutual revelation of values (% of pairs)	-	18	31
Deception (% of subjects)	-	44	24

Relationships and Communication in Double Auctions (Ellingsen et al EJ 2009)

Setting: A prisoners' dilemma (PD) game followed by a sealed bid double auction (subjects did not know that they would participate in the double auction when they played the PD). Written communication in the PD game (subjects could send two messages each on a communication sheet).

Treatments:

1. No communication in the double auction.
2. Written communication in the double auction (8 minutes communication over the computer with a chat program).

Subjects: 344 subjects (one trial for each pair).

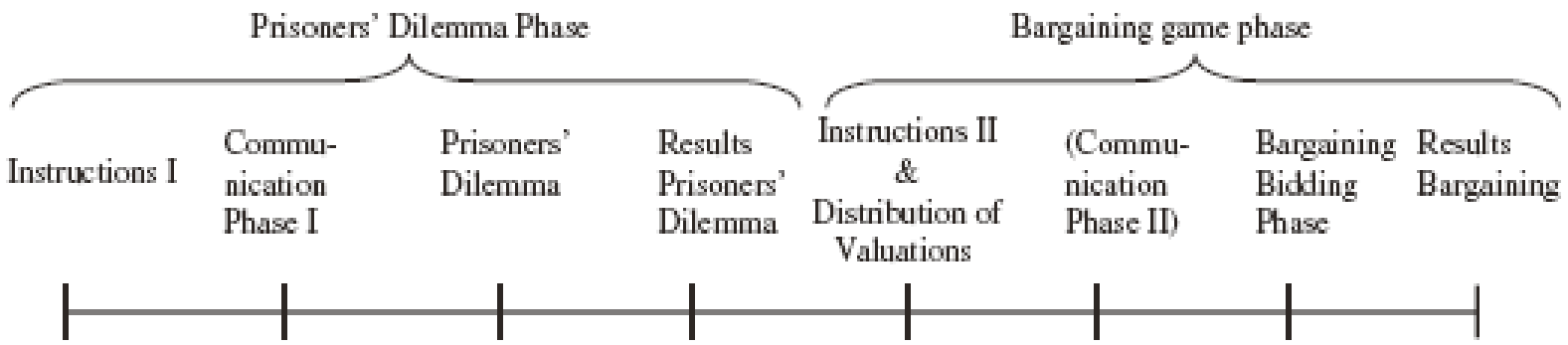

Fig. 1. *Timing*

	Player B: Cooperation	Player B: Non-Cooperation
Player A: Cooperation	40 40	50 0
Player A: Non-Cooperation	0 50	10 10

Fig. 2. *The Prisoners' Dilemma Game*

Table 2

Trade Outcomes by Relationship and Communication Treatment

	High value trade zone Number of trades (%)	Low value trade zone Number of trades (%)	Total Number of trades (%)
CC relationships:			
No communication	13/15 (87)	3/14 (21)	16/29 (55)
Communication	5/6 (83)	13/15 (87)	18/21 (86)
p-value	0.844	<0.001	0.022
CD/DC relationships:			
No communication	9/13 (69)	0/6 (0)	9/19 (47)
Communication	8/10 (80)	1/7 (14)	9/17 (53)
p-value	0.560	0.335	0.738
DD relationships:			
No communication	2/3 (67)	0/0 (–)	2/3 (67)
Communication	4/4 (100)	1/3 (33)	5/7 (71)
p-value	0.212	–	0.880

'*CC* relationships' are pairs in which both subjects cooperated in the Prisoners' dilemma; '*CD/DC* relationships' are pairs in which one subject cooperated and the other defected in the Prisoners' dilemma; '*DD* relationships' are pairs in which both subjects defected in the Prisoners' dilemma. The p-value is estimated for the difference between communication and no communication (using a contingency table Pearson chi-square test).

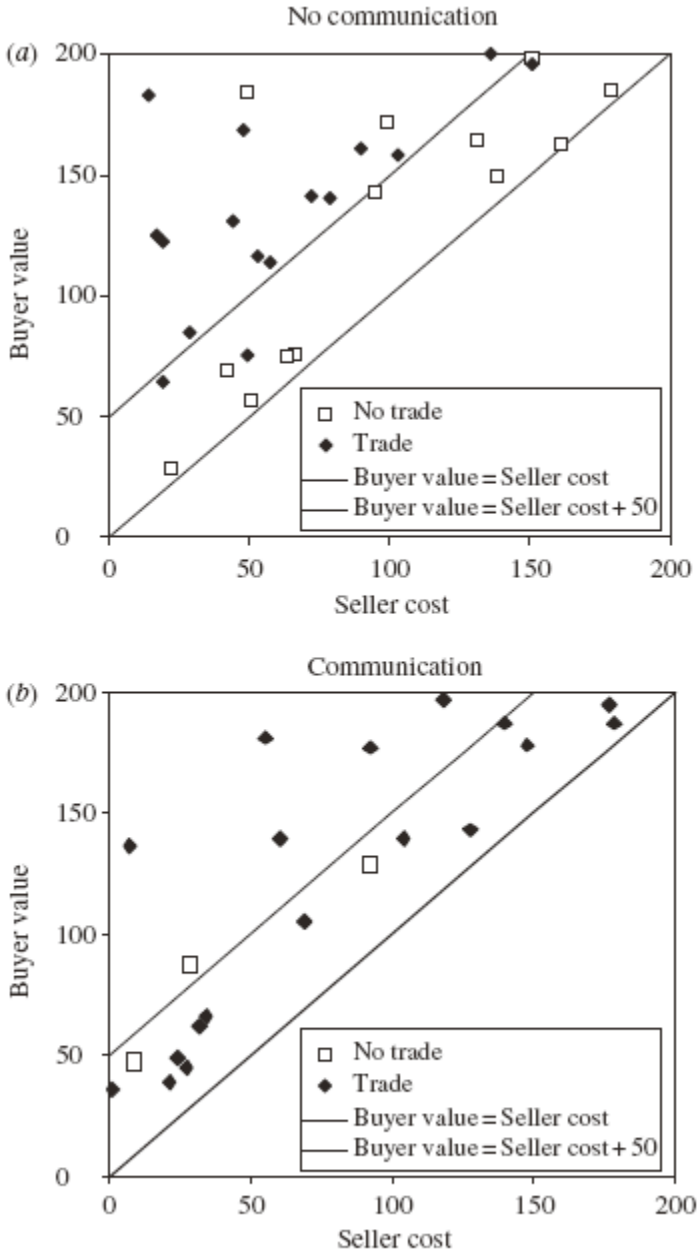

Fig. 4. *Trade Outcomes in Positive (CC) Relationships*

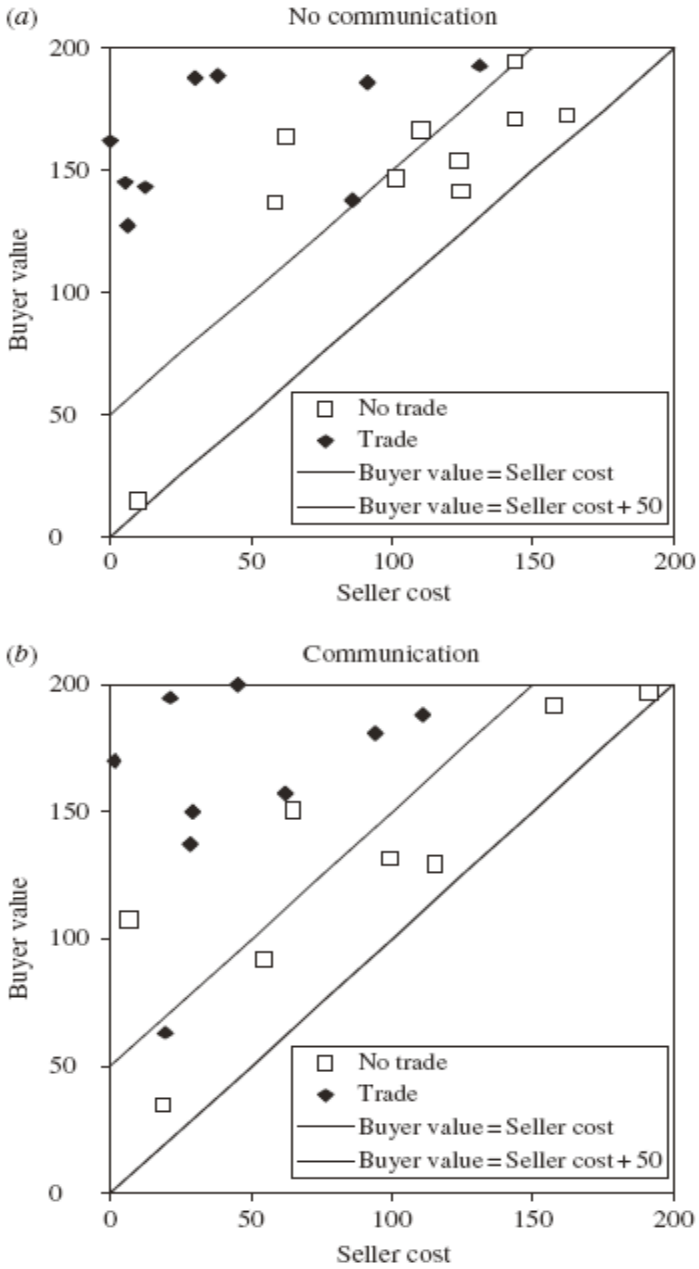

Fig. 5. *Trade Outcomes in Negative (CD/DC) Relationships*

Table 4

Dyadic Strategies

	Price coordination Number (%)	Mutual bidding of values Number (%)	Mutual revelation of values Number (%)
CC relationships:			
No communication	3/29 (10)	0/29 (0)	
Communication	10/21 (48)	3/21 (14)	13/21 (62)
p-value	0.003	0.036	
CD/DC relationships:			
No communication	0/19 (0)	0/19 (0)	
Communication	2/17 (12)	0/17 (0)	0/17 (0)
p-value	0.124	–	
DD relationships:			
No communication	0/3 (0)	0/3 (0)	
Communication	3/7 (43)	0/7 (0)	0/7 (0)
p-value	0.175	–	

Relationships are defined as in Table 2. The p-value is estimated for the difference between communication and no communication (using a contingency table Pearson chi-square test). 'Price coordination' means that the buyer and the seller made the same bid; 'Mutual bidding of values' means that the buyer bid her value and the seller bid her cost; 'Mutual revelation of values' means that both the buyer and the seller truthfully communicated their value or cost.

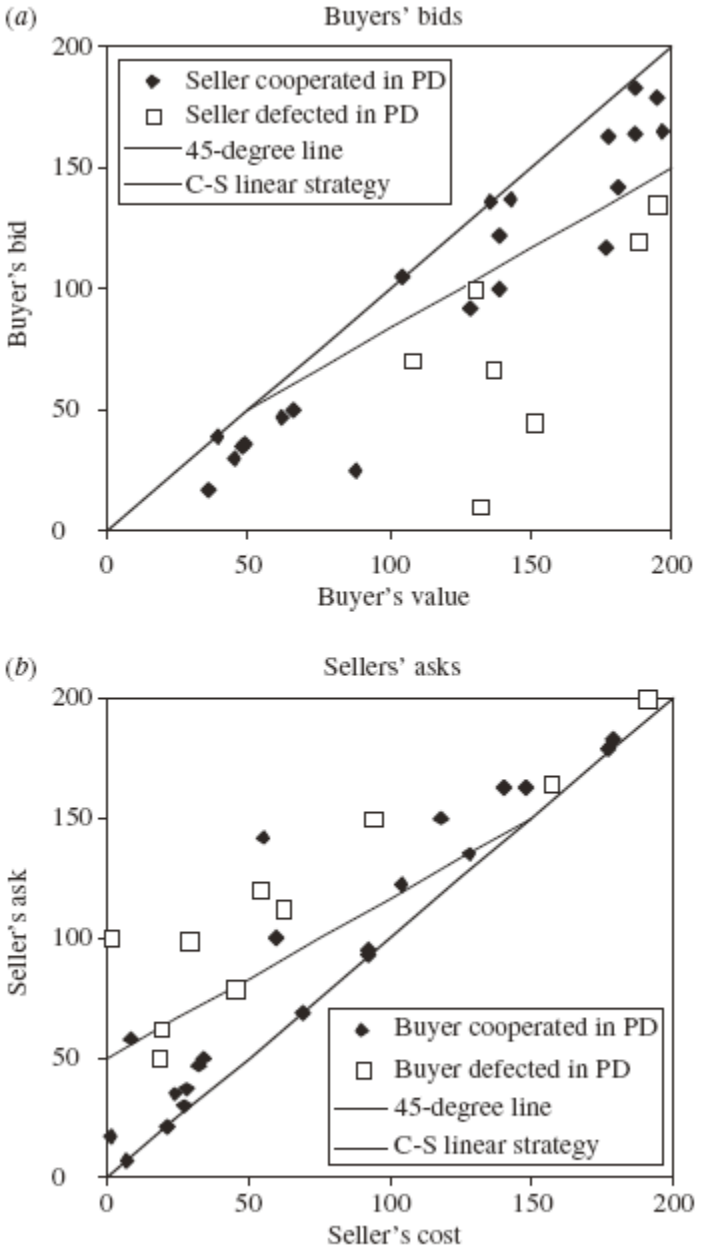

Fig. 7. *Bidding Strategies of Cooperators in the Prisoners' Dilemma (PD) With Communication*

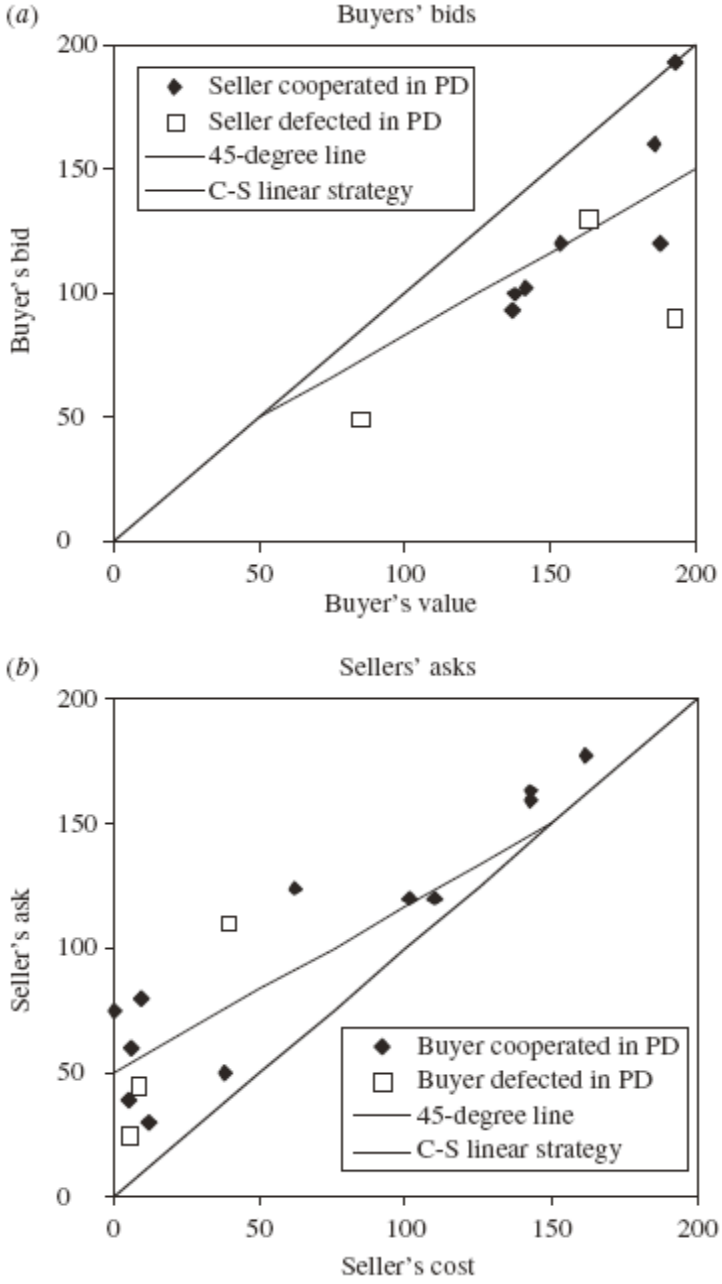

Fig. 8. *Bidding Strategies of Defectors in the Prisoners' Dilemma (PD) Without Communication*

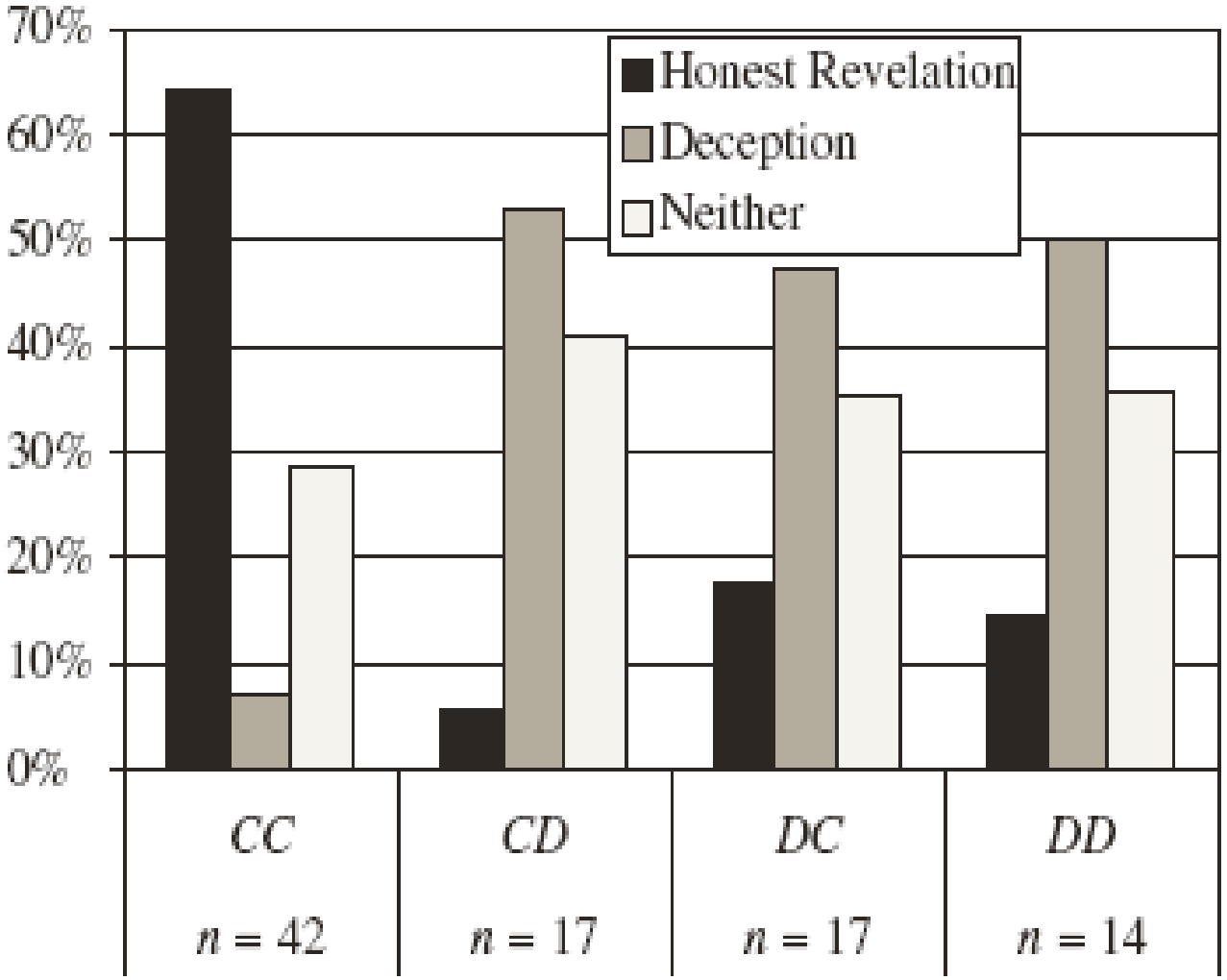

Fig. 10. *Individual Communication Strategies*

Is Lying Costly? (Gneezy AER 2005)

”Deception game”: Two players (1 and 2). Player 2 choose between option A and B, without knowing the payoff consequences of each option. Player 1 knows the payoff consequences of each option and sends one out of two possible messages to player 2 before the choice (”Option A will earn you more money than option B.” or ”Option B will earn you more money than option A.”)

”Dictator game”: Same payoffs as above but player 1 choose between the options knowing that the choice will be implemented with 80% probability and the alternative allocation with 20% probability (the probability that player 2 in the deception game follow the sender’s message).

Treatments for both games (differences in payoffs):

1. Option A: $5 to player 1 and $6 to player 2.
   Option B: $6 to player 1 and $5 to player 2.

2. Option A: $5 to player 1 and $15 to player 2.
   Option B: $6 to player 1 and $5 to player 2.

3. Option A: $5 to player 1 and $15 to player 2.
   Option B: $15 to player 1 and $5 to player 2.

TABLE 2—THE FRACTION OF PLAYER 1S WHO CHOSE ALLOCATION B

	Allocations		
Game	5, 6 versus 6, 5	5, 15 versus 6, 5	5, 15 versus 15, 5
Deception	0.36	0.17	0.52
Dictator	0.66	0.42	0.90

Notes: All differences between the dictator game and the deception game for a given distribution of payoffs are statistically significant at $P < 0.01$. Differences between the different allocations within the dictator game are also statistically significant at the 0.01 level.

Note: To compare the effect of the payoff consequences on the propensity to lie, the conditional probabilities (the fraction that lies out of the fraction that preferes the selfish choice) should be compared between the three treatments/allocations: they are 0.545 (0.36/0.66), 0.405 (0.17/0.42), and 0.578 (0.52/0.90).

Promises and Threats (Ellingsen and Johannesson; EJ 2004)

Setting: A seller and a buyer. The seller decides whether to invest SEK 60 or not to create a benefit of SEK 100. If investment the buyer makes a take it or leave it price offer of how to split the SEK 100. The seller accepts or rejects. If rejection both get zero (leading to a net loss of SEK 60 for the seller). A hold-up game.

Treatments:

1. No communication.
2. Seller communication (the seller can send one written message to the buyer together with the investment decision; threats possible).
3. Buyer communication (the buyer can send one written message to the seller before the investment decision; promises possible).

Table 1

Investment and Profit

	No communication	Seller communication	Buyer communication
Number of pairs	40	33	30
Proportion investors	0.35	0.64	0.53
Mean offer	48.57	63.33	70.00
Mean profit of investor	−12.86	−6.43	8.75

Table 2

The Probability that Two Treatments Yield Statistically Indistinguishable Averages

	Proportion investors	Offer	Profit
No comm. vs Seller comm.	0.015	0.125	0.562
No comm. vs Buyer comm.	0.125	0.017	0.033
Seller comm. vs Buyer comm.	0.407	0.229	0.048

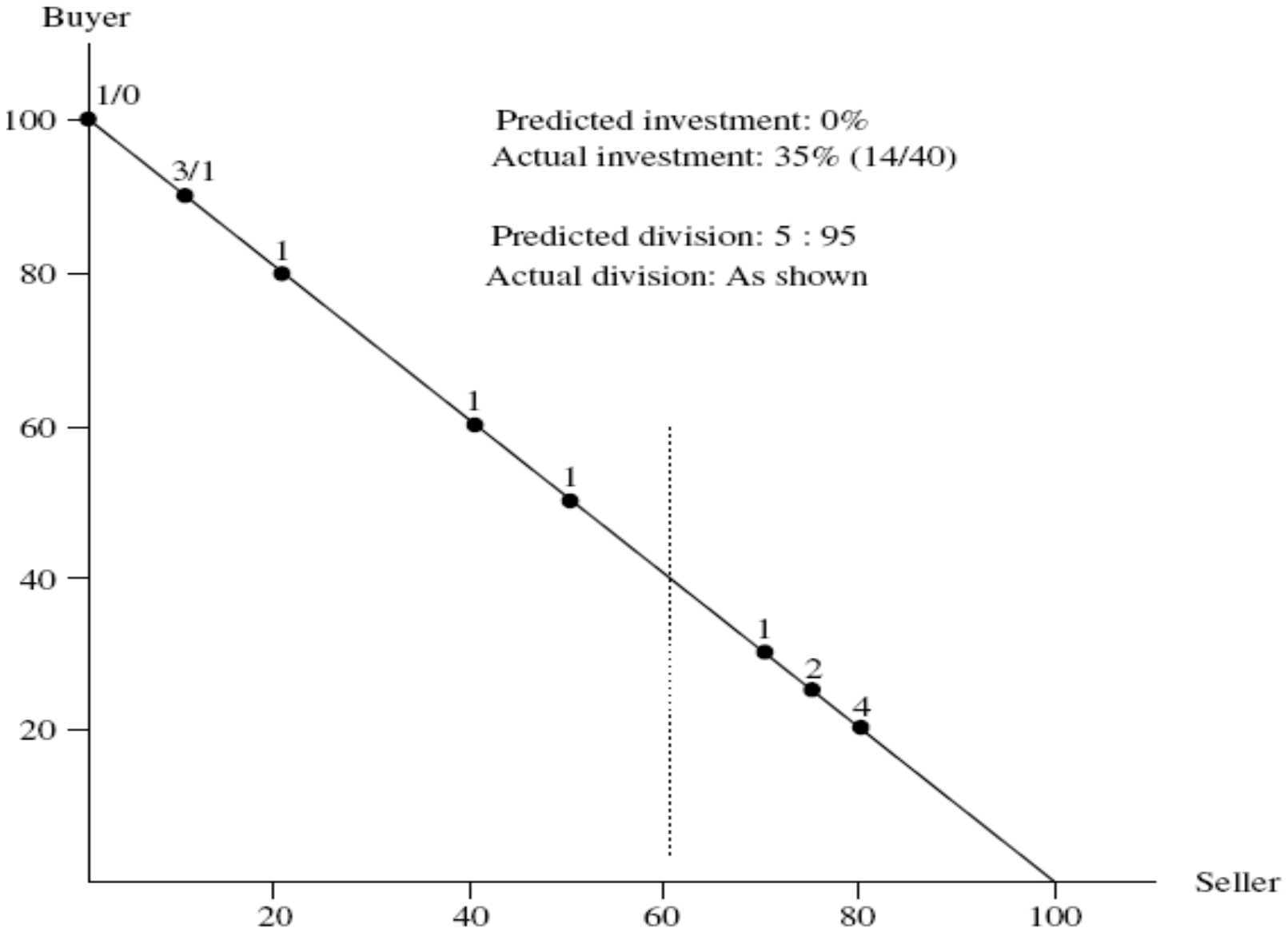

Fig. 1. *Bargaining without Communication*

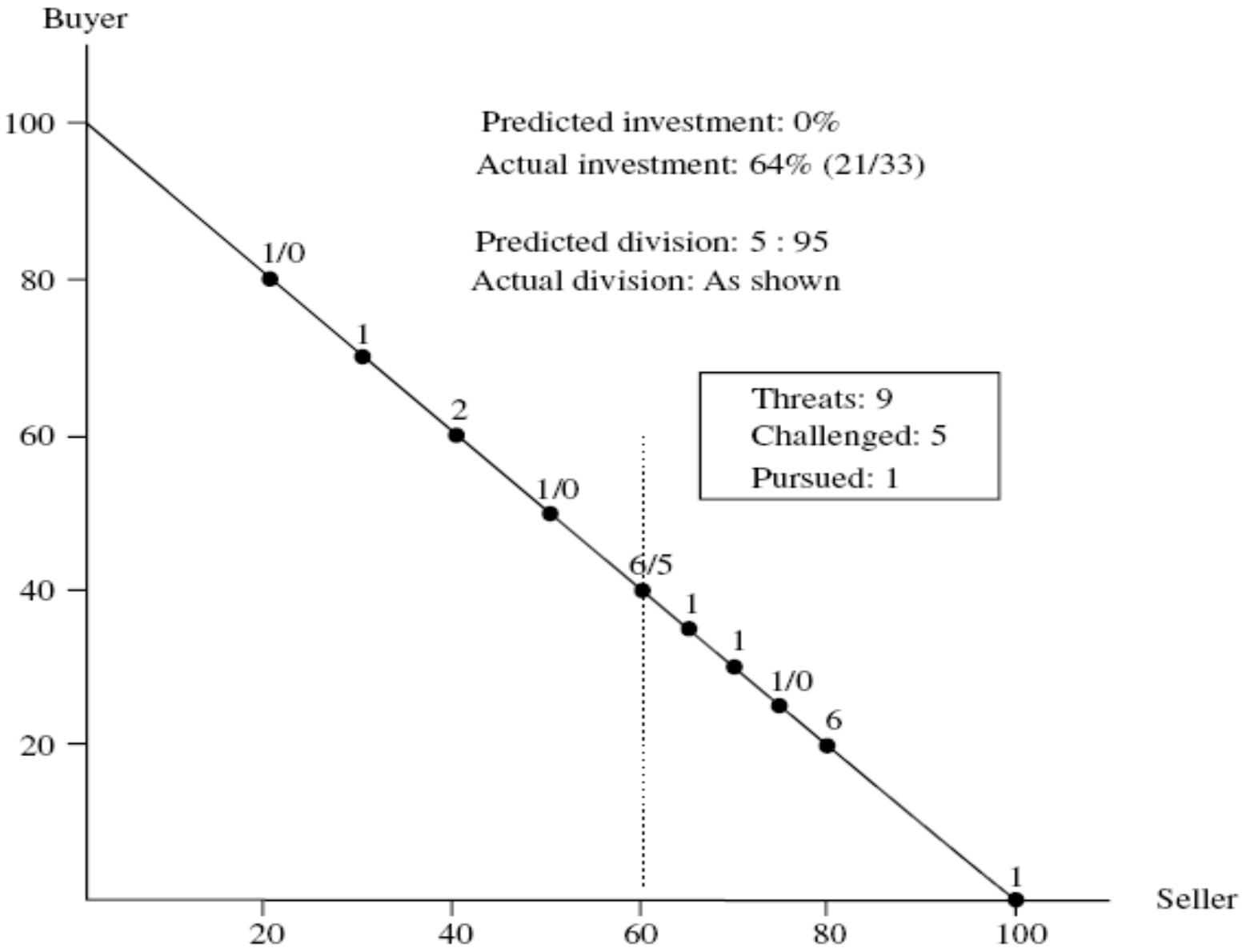

Fig. 2. *Bargaining with Seller Communication*

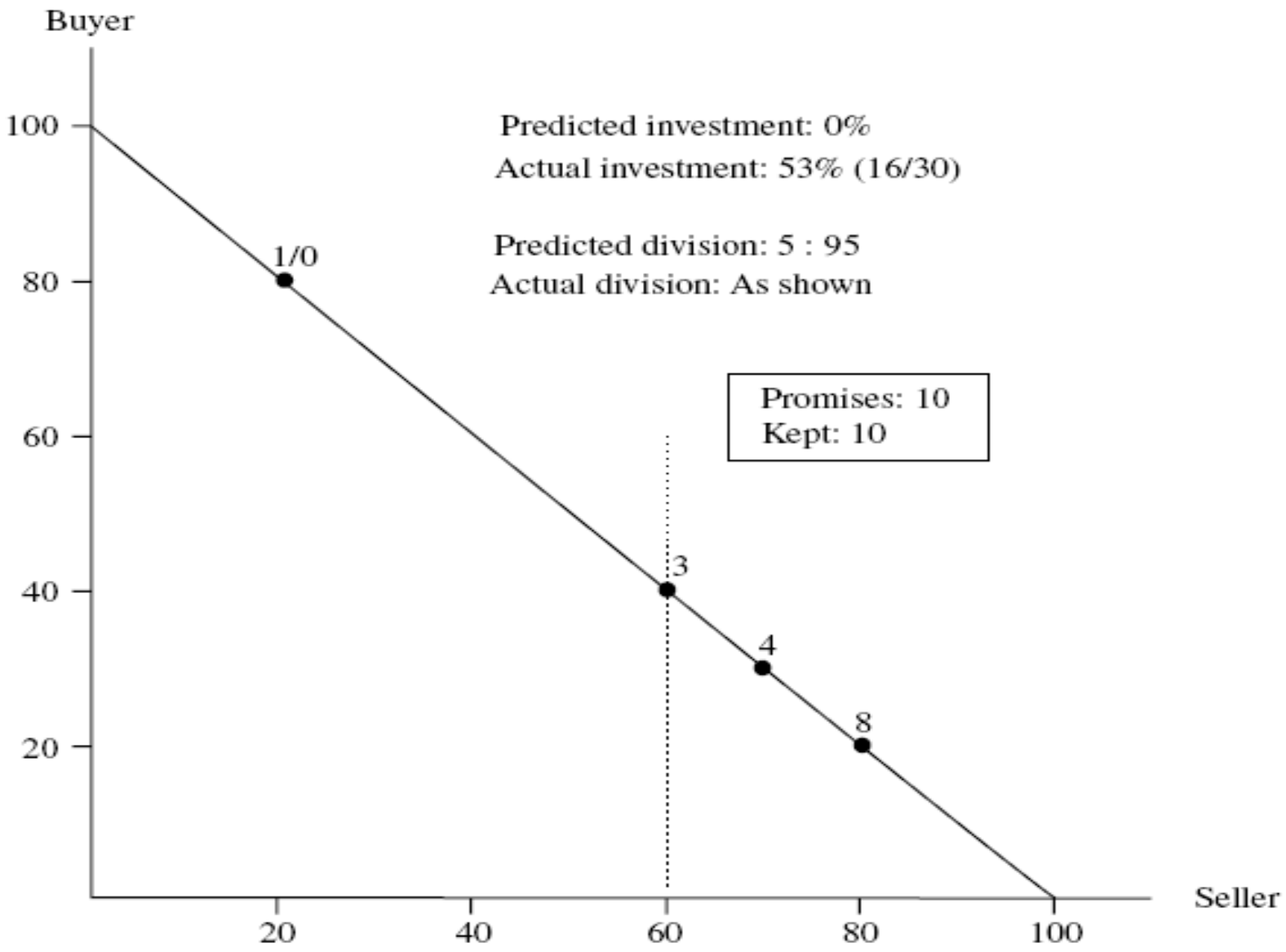

Fig. 3. *Bargaining with Buyer Communication*

Promises and Guilt Aversion (Charness and Dufwenberg; Econometrica 2006)

Setting: A trust game with hidden action with two players: A and B. Agent A choose between two actions: ”in” and ”out”. ”Out” gives a payoff of 5 to each player. If agent A choose ”in”, agent B choose between ”don’t roll” and ”roll”. ”Don’t roll” gives a payoff of 14 to B and 0 to A. For ”roll” there is a 1/6 probability of a payoff of 10 to B and 0 to A, and a 5/6 probability of a payoff of 10 to B and 12 to A.

Treatments:

1. No communication.
2. Player B sends a written anonymous message to A, before A decides between ”in” and ”out”.
3. Same as 1, but ”out” gives a payoff of 7 to each agent.
4. Same as 2, but ”out” gives a payoff of 7 to each agent.
5. Player A sends a written anonymous message to player B, before the choice of ”in” or ”out”.

Beliefs measured in all treatments to test guilt aversion (player A guess the proportion of B’s who chose ”roll” and player B guess the average guess made by A’s who chose ”in” (second order beliefs); monetary incentives for correct guesses).

Guilt aversion: individuals experience a loss in utility if they give less to another individual than the other individual expects to receive (and the loss in utility is proportional to the difference between the second order beliefs and the actual ”donation”).

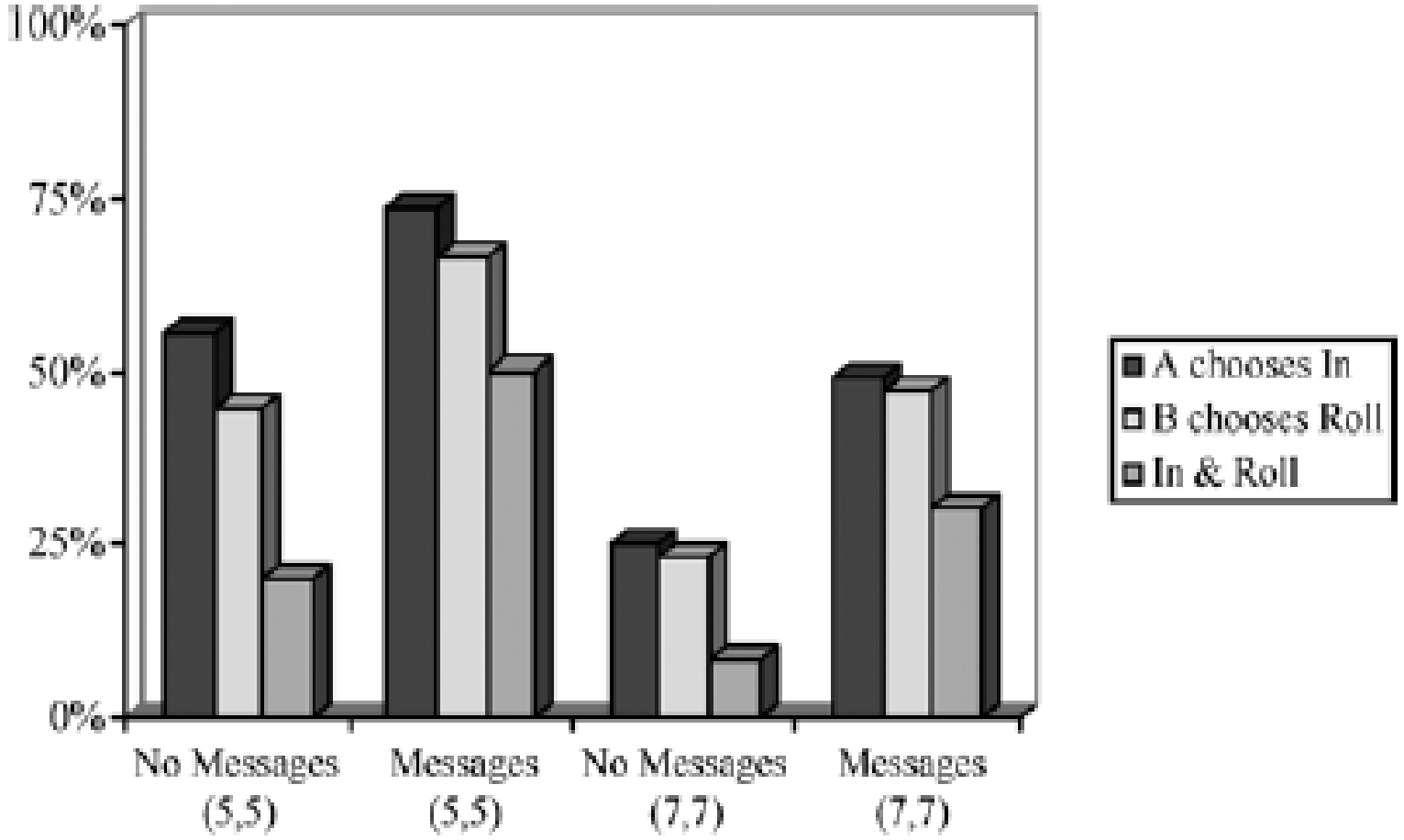

FIGURE 3.—The effect of messages from B.

TABLE III

PROMISES AND BEHAVIOR[1]

	A's *In* Rate			B's *Roll* Rate			(*In*, *Roll*)		
Treatment	P	NP	Z Stat	P	NP	Z Stat	P	NP	Z Stat
(5, 5)	22/24	9/18	3.04***	18/24	10/18	1.32*	16/24	5/18	2.49***
B messages	(92%)	(50%)		(75%)	(56%)		(67%)	(27%)	
(7, 7)	16/24	7/25	2.71***	20/24	4/25	4.71***	14/24	1/25	4.13***
B messages	(67%)	(28%)		(83%)	(16%)		(58%)	(4%)	
Pooled	38/48	16/43	4.07***	38/48	14/43	4.49***	30/48	6/43	4.73***
	(79%)	(37%)		(79%)	(33%)		(62%)	(14%)	

[1] P/NP means that a promise/no promise was sent or received. The Z stat reflects the test of proportions for the two populations compared. *, **, and *** indicate $p < 0.10, 0.05$, and 0.01, respectively, one-tailed tests.

TABLE II

BELIEFS AND BEHAVIOR[a]

Treatment	A's Average Guess			B's Average Guess		
	In	*Out*	Z Statistic	*Roll*	*Don't*	Z Statistic
(5, 5) no messages	51.3	28.2	2.55***	54.2	39.6	1.99**
(5, 5) B messages	65.4	42.5	2.02**	73.2	45.1	3.20***
(5, 5) A messages	56.7	35.4	2.65***	69.6	50.0	2.80***
(7, 7) no messages	35.7	31.8	1.06	69.4	41.7	3.08***
(7, 7) B messages	70.0	45.3	3.00***	66.9	36.9	3.52***

[a]The Z statistic reflects the Wilcoxon-Mann-Whitney rank sum test for the two populations compared (see Siegel and Castellan (1988)). *, **, and *** indicate $p < 0.10, 0.05$, and 0.01, respectively, one-tailed tests.

Does this imply that second order beliefs (”beliefs about beliefs”; B’s guess about the beliefs of A) causally increase the probability of chosing Roll as predicted by guilt aversion? No; B’s guesses may just reflect that subjects chosing Roll think that it is more likely that other subjects would also chose Roll (the ”false consensus effect”). For a proper test the second order beliefs need to be exogenously varied.