COMMUNICATION AND COORDINATION: EXPERIMENTAL EVIDENCE FROM FARMER GROUPS IN SENEGAL

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MOTIVATION (1)

- **Small-scale farming**
  - High fixed transaction costs
  - Barriers to market access
  - Market access is a potential pathway out of poverty
  - For the past five years, research in Senegal on relaxing barriers.

- **Potential solution: Aggregation**
  - Many small farmers can behave *as if* they are one large farmer and overcome such costs
  - Rationale for farmer groups, aka rural producer organizations (RPOs).

MOTIVATION (2)

- **Aggregation is a form of coordination:**
  - Coordination is not always easy!
  - Why not?
    - Because others' actions are not predictable (strategic uncertainty).

- **Our context – a small-scale farmer who seeks a price premium has two options:**
  - Sell individually to a trader that comes to the farm gate
    - Fixed agreed upon payoff of $\mathcal{M}$
  - Sell through RPO (with others), for example to a buyer (negotiated contract)
    - Payoff is uncertain. If others sell as expected, $\mathcal{H} > \mathcal{M}$. If not, $\mathcal{L} < \mathcal{M}$.

MOTIVATION (3)

- Aggregation is coordination:
  - It is strategically uncertain
    - Stag-hunt game
  - Coordination failure
  - Survey evidence supports this:
    - Majority of groups do not sell collectively
    - Members do not believe other members are sufficiently committed

- How to reduce coordination failure?
  - Theory and lab experiments suggest communication (cheap talk)
  - Crawford, Farrell, van Huyck et al., Rabin…

- This paper:
  - Subgroups of pre-existing farmer groups in rural Senegal play neutrally framed coordination games
    - Can we replicate coordination failure in the lab?
  - Introduce communication as an institution to reduce coordination failure
    - Field lab?
    - Real-life institution (NFEs, RCTs)

SOME THEORY (1)

- Early theoretical and/or experimental literature on coordination:
  - Bryant (1983)
  - Cooper and John (1988)
  - Van Huyck et al. (1990)

- Baseline Game (Stag-hunt)
  - $\mathcal{N}$ players play a simultaneous-move coordination game
  - Each player has an endowment $\mathcal{E}$ of which s/he can contribute $\mathcal{A}$ to the $\mathcal{N}$-player pool and keep the remainder $\mathcal{E}$-$\mathcal{A}$ for her/himself
  - $\mathcal{A}$ earns a monetary payoff of $\mathcal{H}*\mathcal{A}$ if and only if the players jointly contribute more than some threshold $\mathcal{T}$
  - Otherwise, $\mathcal{A}$ earns a monetary payoff of , $\mathcal{L}*\mathcal{A}$ where $\mathcal{L}<\mathcal{H}$
  - $\mathcal{E}$-$\mathcal{A}$ earns a certain monetary payoff of $\mathcal{M}*(\mathcal{E}$-$\mathcal{A})$, where $\mathcal{L}<\mathcal{M}<\mathcal{H}$
  - $\mathcal{A}$ is driven by one's belief about others' contributions (strategic uncertainty)
  - Asymmetric equilibria: coordination or failure.

SOME THEORY (2)

Model it as a two-player game between Player i
and the average other Player $-i$

		Player						
		0	1	2	3	4	5	6
Player	0							
	1	Bad Equilibria: Coordination failure						
	2							
	3							
	4							
	5					Good Equilibria: Coordination		
	6							

Illustration of approximate equilibria—not precise

SOME THEORY (3)

- Early theoretical literature on communication/ cheap talk:
  - Crawford and Sobel (1982) – signaling
  - Farrell (1987) – coordination
  - Cooper et al. (1992) – coordination
  - Rabin (1998) – coordination

  - Communication Game
    - Baseline game

      +

    - $\mathcal{N}$-way preplay communication (cheap talk) in the form of intended group contribution, $\mathcal{A}'$
    - A la Farrell:
      - If the average other player indicates that her intention $\mathcal{A}'$ will lead to "good" equilibria, coordinate!
      - If not, there may still be a range where players see achievement of the threshold as feasible
      - Outside of the range, do not coordinate!

Model it as a two-player game between Player i
and the average other Player $-i$

		Player						
		0	1	2	3	4	5	6
Player	0							
	1		Bad Equilibria:					
	2		Coordination failure					
	3							
	4							
	5							
	6							

Communication

Good Equilibria:
Coordination

Model it as a two-player game between Player i
and the average other Player $-i$

		Player						
		0	1	2	3	4	5	6
Player	0							
	1		Bad Equilibria: Coordination failure					
	2							
	3					?		
	4							
	5					Good Equilibria: Coordination		
	6							

SOME THEORY (6)

- **General**
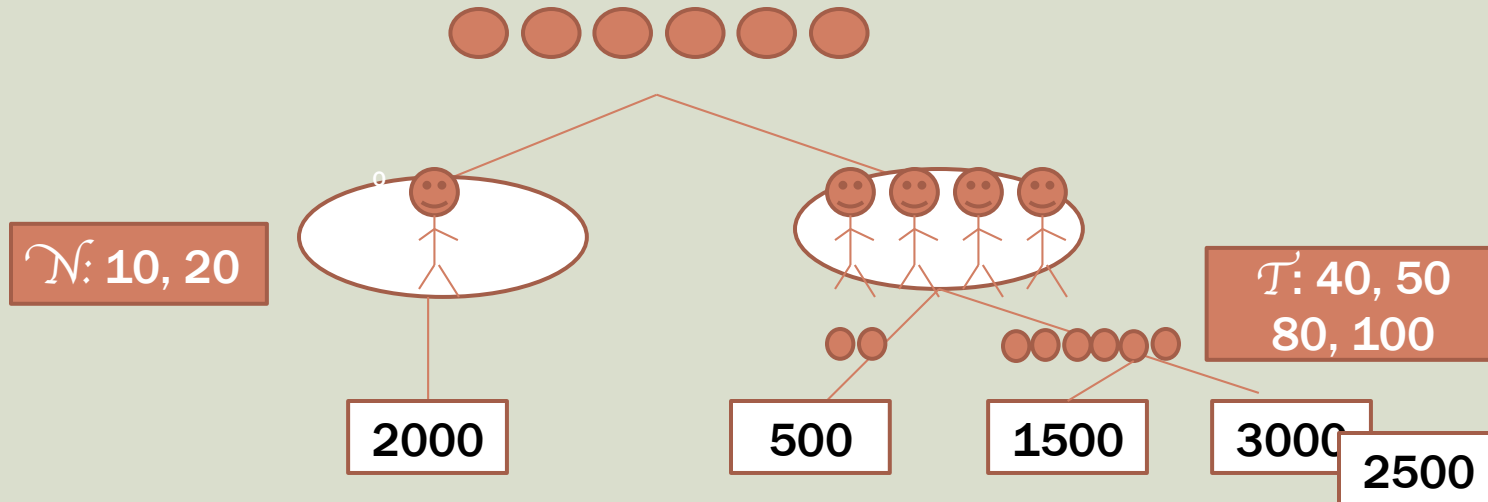 - H1: Communication affects actions.
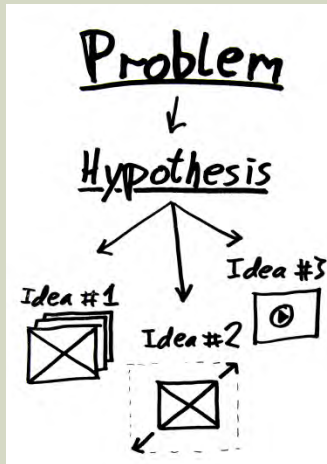
- **Mechanisms**
  - H2a: Communication impacts actions through changes in strategic uncertainty
  - H2b: Communication impacts actions through perceptions of norms
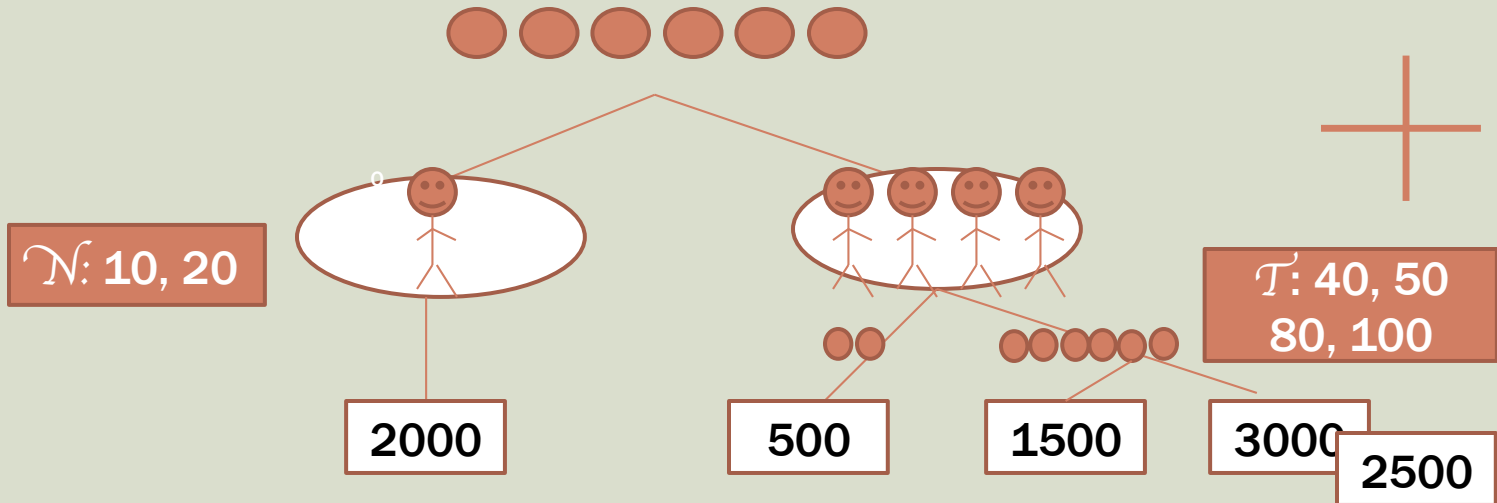
- **Other checks**
  - H3: Cheap talk may interact with other factors (threshold, premium, group size, external uncertainty)
  - H4: Role of pre-existing beliefs, trust

BASELINE PROTOCOL AND VARIATIONS

$\mathcal{N}$: 10, 20

$\mathcal{T}$: 40, 50 80, 100

2000

500

1500

3000

2500

A	0	0	6	3000	9000	18000
B	1	2000	5	2500	7500	15000
C	2	4000	4	2000	6000	10000
D	3	6000	3	1500	4500	9000
E	4	8000	2	1000	3000	6000
F	5	10000	1	500	1500	3000
G	6	12000	0	0	0	0

COMMUNICATION PROTOCOL

$\mathcal{N}$: 10, 20

$\mathcal{T}$: 40, 50
80, 100

2000

500

1500

3000

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A	0	0	6	3000	9000	18000
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F	5	10000	1	500	1500	3000
G	6	12000	0	0	0	0

Board	
Pseudo	CT
1.	4
2.	3
3.	1
4.	2
5.	0
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EXPERIMENT IN ACTION (1)
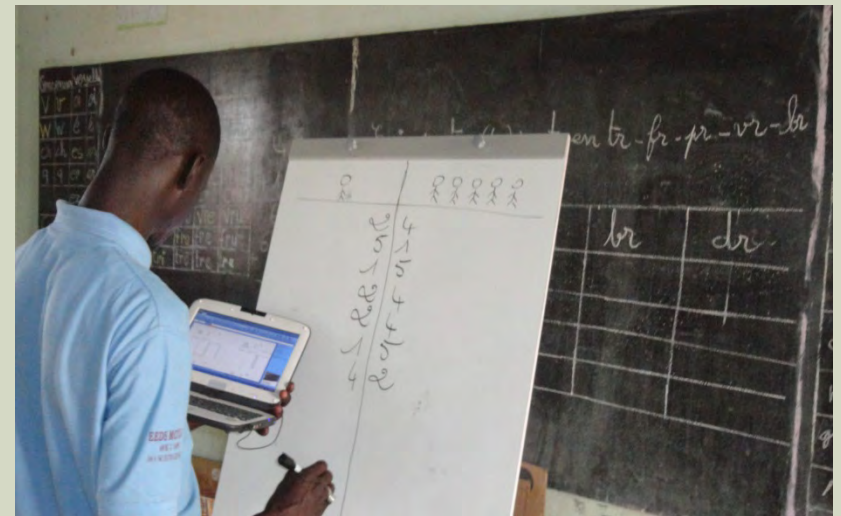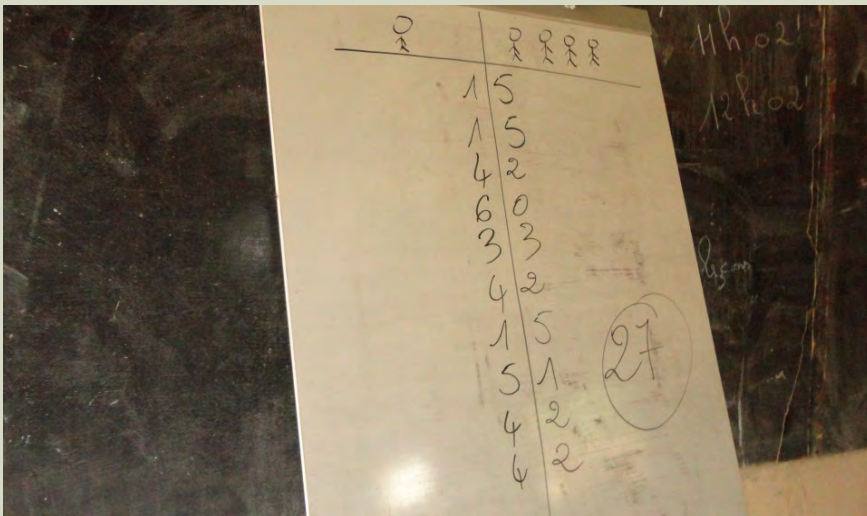
EXPERIMENT IN ACTION (2)

PROTOCOL AND SAMPLING

- **Variations**
  - Cheap talk (0,1; between-subjects); Threshold (40, 50, 80, 100); Premium (2500/3000); Uncertainty (Threshold payoff was 1500 or Premium with equal chance); Size (10 or 20)
- **Pre-questionnaire paid 12,000 FCFA (~USD 25). Equivalent to value of six chips, which is $\mathcal{E}$.**

  - Four rounds were played with no feedback and one randomly selected for payment.
  - Post-questionnaire included questions on risk, time, and social preferences.
  - Experiments conducted in typical lab style with trained experimenter and live translation.

- **Sampled from a complete listing of members from 28 pre-existing farmer groups.**
- **Average earnings: 9500 FCFA (~ USD 20) for a three-hour session relative to daily 'wage equivalent' of 5000 FCFA (~ USD 10)**
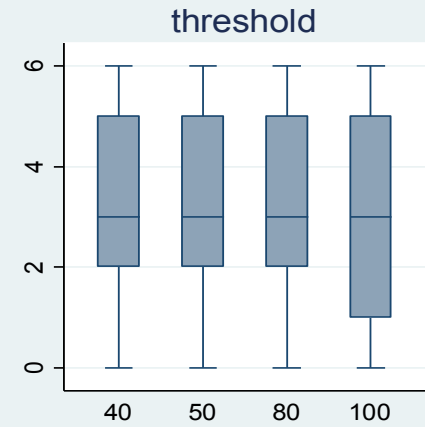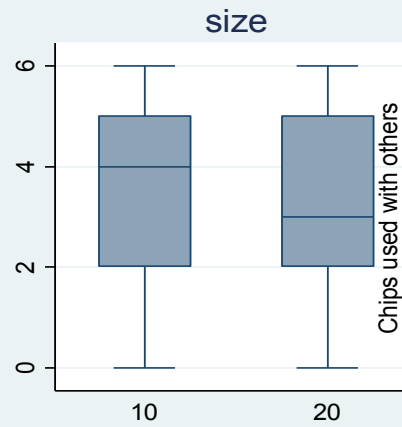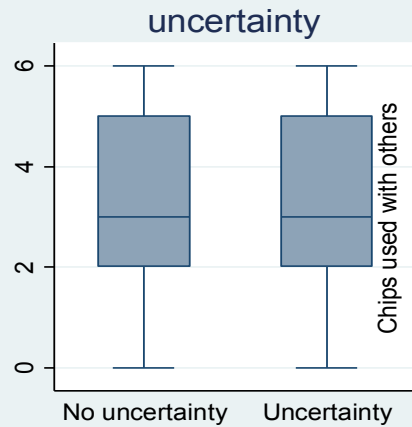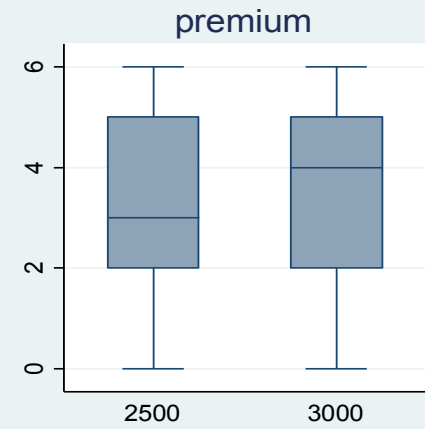
TREATMENT ASSIGNMENT

	Cheap Talk	No-cheap talk	Total
# sessions (s)	28	28	56
# rounds (r)	110	112	222
# players (i)	410	429	839
# observations	1600	1716	3316

	Cheap-talk	Group size	Threshold	Premium	Uncertainty
Cheap-talk	1.00				
Group size	-0.08	1.00			
Threshold	-0.05	0.51*	1.00		
Premium	0.00	0.00	0.00	1.00	
Uncertainty	0.04	-0.02	-0.01	-0.00	1.00

* correlation significantly different from 0 at 5% level

RESULTS (1)
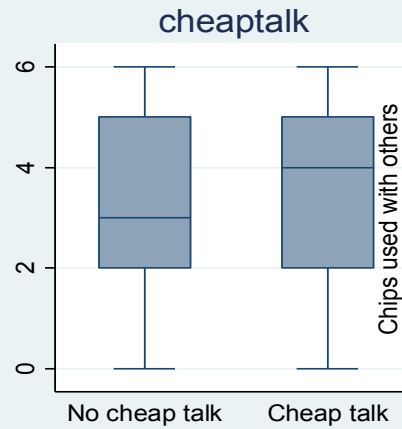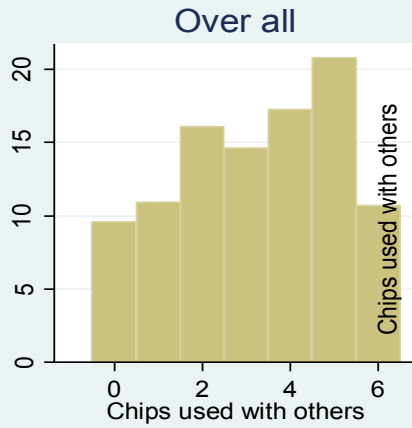
Estimating Equation to test H1 and H3:

$$A_{sri} = \alpha + \beta C_s + \tau T_{sr} + \gamma X_{sri} + \rho R_r + \mu S_s + \omega_s + \varepsilon_{sri}$$

- $A_{sri} \in \{0,1,2,3,4,5,6\}$, **chips played with others**
- C_s **= dummy for between-subjects cheap talk assignment**
- T_{sr} **= set of dummies for other treatments**
- X_{sri} **= individual-level characteristics**
- R_r **and** S_s **= controls for round and session order**

Exploit panel nature of the data (i.e. 4 obs/ind) through random effects model.

Standard errors are clustered at the session level.

RESULTS (3)

	group	group	group	group	group	group	group	group
Communication	0.476	0.474	0.421	-0.173	0.861	2.209	1.460	1.720
	(0.210)**	(0.211)**	(0.174)**	(0.845)	(1.247)	(0.758)***	(0.706)**	(1.466)
Threshold		-0.004	-0.004	0.003	0.018	0.001		
		(0.003)	(0.003)	(0.003)	(0.009)**	(0.003)		
Premium		0.301	0.296	0.311	0.123	0.400	0.175	0.655
		(0.099)***	(0.099)***	(0.136)**	(0.147)	(0.190)**	(0.203)	(0.344)*
Uncertainty		-0.079	-0.133	0.002	0.110	-0.023	-0.176	0.134
		(0.211)	(0.177)	(0.216)	(0.457)	(0.251)	(0.270)	(0.426)
Size		0.018	-0.062	-0.528				
		(0.244)	(0.207)	(0.254)**				
Communication*								
Threshold				-0.013	-0.043	-0.009		
				(0.005)***	(0.018)**	(0.005)*		
Premium				-0.028	0.299	-0.230	-0.059	-0.450
				(0.196)	(0.242)	(0.250)	(0.224)	(0.478)
Size				0.940				
				(0.385)**				
Uncertainty				-0.209	0.451	-0.650	-1.069	-0.031
				(0.339)	(0.598)	(0.377)*	(0.372)***	(0.573)
N	3,316	3,316	3,312	3,312	1,120	2,192	1,200	992
Controls	N	N	Y	Y	Y	Y	Y	Y
Size	Pooled	Pooled	Pooled	Pooled	10	20	20	20
Threshold	Pooled	Pooled	Pooled	Pooled	Pooled	Pooled	40,50	80,100

RESULTS (4)

- Testing H2a and H2b
- Model suggested that cheap talk should lead to differences between actions and intentions:
  - Change dependent variable from A_{sri} to $\Delta_{sri} = A_{sri} - A'_{sri}$

  - H2a
    - Test: Effect of cheap talk varies with the distance between aggregate intention (A') and threshold (T):
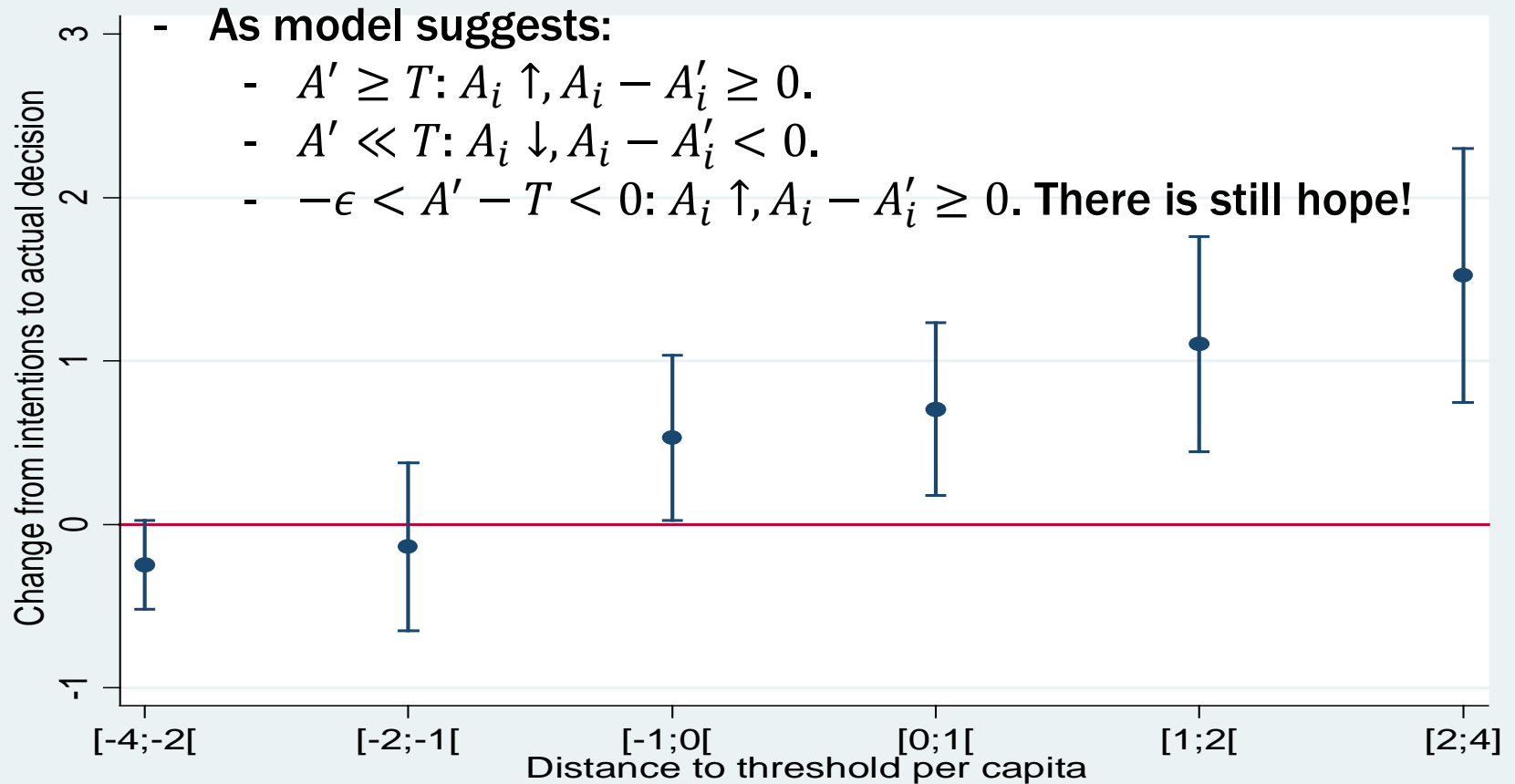 $$dist^T = (A' - T)/N$$
  - H2b
   - Test: Effect of cheap talk varies with distance between one's intention and median intention:
    $$dist^{Med} = A'_{sri} - med(A'_{sr})$$

RESULTS (5)

- As model suggests:
  - $A' \geq T$: $A_i \uparrow, A_i - A'_i \geq 0$.
  - $A' \ll T$: $A_i \downarrow, A_i - A'_i < 0$.
  - $-\epsilon < A' - T < 0$: $A_i \uparrow, A_i - A'_i \geq 0$. **There is still hope!**

y-axis: Change from intentions to actual decision

x-axis: [-4;-2[[-2;-1[[-1;0[[0;1[[1;2[[2;4] Distance to threshold per capita

Specification similar to third column of basic regression estimate. Sub-sample of sessions where Cheap-Talk was implemented. Added independent variable include dummies for categories of distance to threshold per capita (0 means « at threshold), and control for individual's intention.
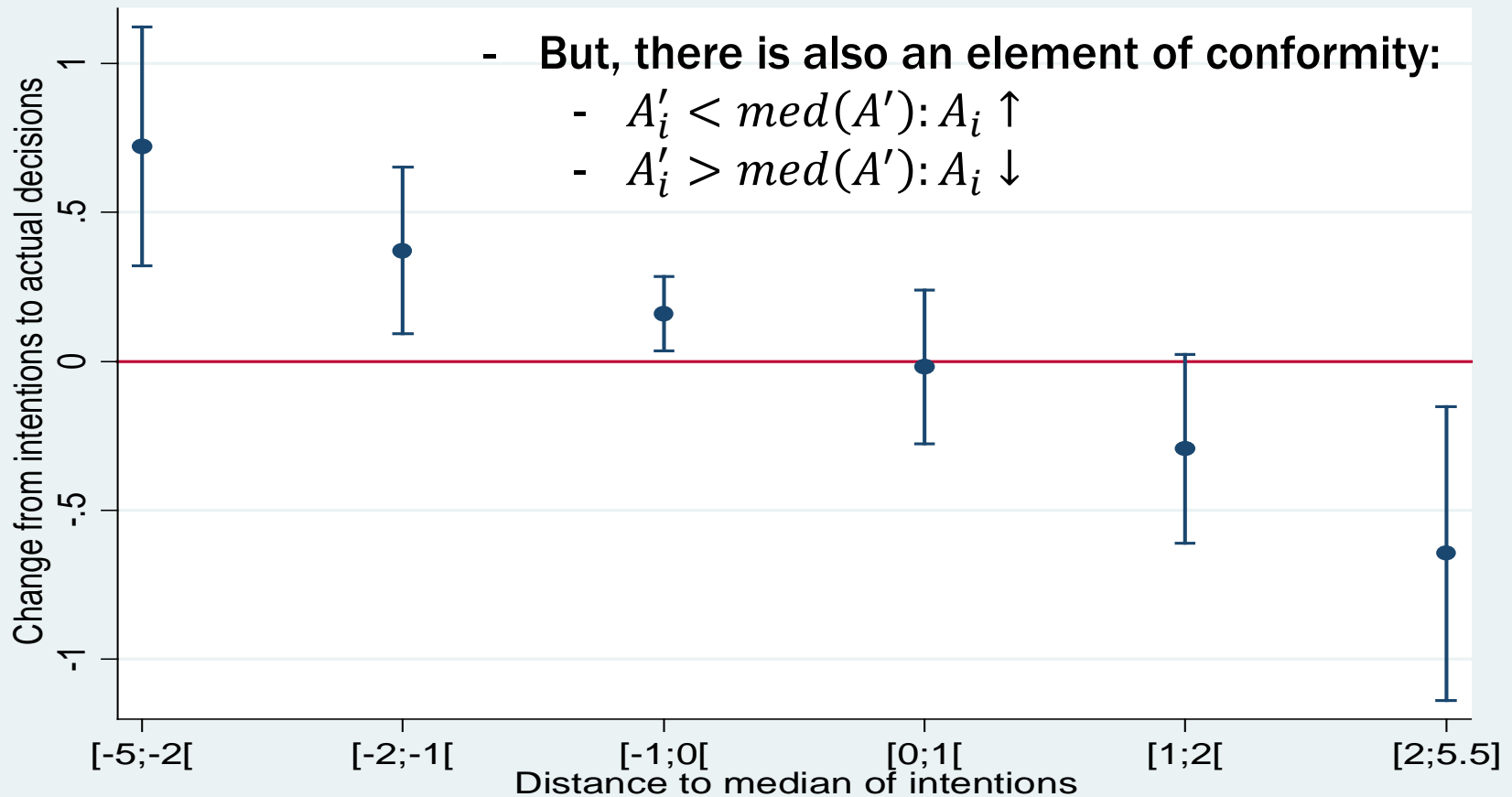
- But, there is also an element of conformity:
  - $A_i' < med(A'): A_i \uparrow$
  - $A_i' > med(A'): A_i \downarrow$

Specification similar to third column of basic regression estimate. Sub-sample of sessions where Cheap-Talk was implemented. Added independent variable include dummies for categories of distance to median intention, and control for individual's intention.

HINT OF EXTERNAL VALIDITY

	#numbers of chips played through groups		
Commercialisation	-0.108 (0.296)	0.516 (0.225)**	0.541 (0.292)*
Cheaptalk	0.411 (0.177)**	0.387 (0.177)**	0.317 (0.239)
Threshold	-0.004 (0.003)	-0.004 (0.003)	-0.008 (0.004)**
Premium	0.000 (0.000)***	0.000 (0.000)***	0.001 (0.000)***
Uncertainty	-0.132 (0.177)	-0.131 (0.175)	-0.149 (0.238)
Size	-0.051 (0.211)	-0.084 (0.214)	-0.107 (0.335)
FEGPAB vs CCPA		-0.841 (0.349)**	
N	3,312	3,312	1,632

*$p<0.1$; ** $p<0.05$; *** $p<0.01$

FINDINGS AND NEXT STEPS...

- Communication matters!
  - We confirm lab findings with a sample of pre-existing farmer groups.
- If intentions are near or above the threshold, communication gives rise to coordination.
  - However, if intentions are well below threshold, communication gives rise to coordination failure.
- Communication has a secondary effect—it gives rise to conformity.

- Next steps
  - Use findings to design RCTs with these and other farmer groups.
  - Game behavior correlates positively with past commercialization behavior.
  - Real-world parallel: Leader elicits "intentions" from members and calls meeting to reveal:
    - Distribution (anonymous, by name) and Aggregate.

SERVICES OFFERED BY GROUNDNUT RPOS

	% groups ever offered service	% members ever used service in groups offering service	% groups offering service last year	% members used service last year in groups offering service
Commercialization	39.7	59.5	26.1	65.0
Inputs	92.4	51.5	86.7	45.0
Credit	94.3	69.5	89.9	68.7