Can there be a market for cheap-talk information?: some experimental evidence March 2018

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Introduction: motivation

- Acquisition of information relevant to trades in markets is typically costly.
- Information is often of common interest to traders.
  - incentive for exchange/sale of information
- But: information has also often "rival" nature
  - incentives for manipulating information.

Introduction: questions

- Is information traded in the market, or does market break down?
- What is the market structure?: Are there many, or only few sellers/buyers? Which type of information is traded?
- How truthful is the information transmitted (when quality is not contractible)?
- Is the market efficient? What does it depend on? Do regulatory restrictions (e.g. firewalls) improve efficiency?
- Multiple equilibria – coordination, market may implode.
- Preference for truth-telling – might ease coordination, market even more efficient than in theory.

Related literature

- **Theory**
  - Admati and Pfleiderer (1988, 1990): sale of verifiable information, partially revealed by equilibrium prices.
  - Crawford and Sobel (1982): strategic information transmission via "cheap talk" messages.
  - Morgan and Stocken (2003): reputation/rents trade-off in the reporting decisions of financial advisers.
  - Cabrales and Gottardi (2014).

Related literature

- **Experiments**
  - Early papers, with good convergence to separation if interests align well: Dickhaut et al. (1995), Blume et al. (1998, 2001), and Kawagoe and Takizawa (1999).
  - Gneezy (2005), Sánchez-Pagès and Vorsatz (2007), Kawagoe and Takizawa (2005), Cai and Wang (2007), and Wang et al. (2008) observe more truth-telling than Crawford-Sobel would predict in games where interests do not align well, and can explain by a truth-telling norm.

The Model

- One object for sale, of type $v \in \mathcal{K} = \{1, .., K\}$ owned by a Seller (with no utility for it).
- N potential buyers: $B_i,\ i \in N$ only care for type $\theta_i \in \mathcal{K}$
- $\{\theta_i\}_{i \in N}$ and v i.i.d over $\mathcal{K}$, all elements of K have same probability 1/K
- utility of B_i : $u_{B_i} = I_v - cI_c - P_{B_i}$
  - $I_v = 1$ if B_i gains object and $\theta_i = v$, 0 otherwise
  - $I_c = 1$ if B_i acquires directly information
  - P_{B_i} : sum of net payments by B_i in the market for information and the auction

The Model

- Object sold via second price auction.
- Before the auction, any trader can learn value of v; by paying cost c; and sell report to other traders over his information, at price p.
- In the base treatment, which we call "soft" information report is not verifiable, in the alternative treatment, reports are forced to be true.

Timing of game

1. Each buyer decides (in sequence) whether to acquire information directly.
2. Each informed buyer (after learning v) posts a price to sell a report.
   a) In the base, or "soft" treatment report can be false or uninformative, which we call "blank".
   b) In the alternative treatment, the report must be true.
3. Each uninformed buyer chooses (again, in sequence) whether to purchase information, or to acquire information directly.
4. Informed buyers report to buyers of information.
5. A second price auction for the object takes place.

Theoretical benchmark

- A perfect Bayesian equilibria of the "soft" game:
  1. Reporting strategies with maximal truthfulness:
     a) each seller of information tells the truth if he does not like the object, he sends the uninformative message, when he does.
  2. Truthful bidding behavior: the bid of each buyer equals his expected value of the object, conditional on winning the auction
     a) Informed buyer bids 1 (if he likes object) and 0 if not.
     b) Buyer of info bids 1 if told he likes object, bids 0 if told he does not like it, and bids 1/K, if sent uninformative message.

Theoretical benchmark

- There is an equilibrium like this, with only one buyer purchasing information directly and selling it to all other buyers $p = \min\left\{\frac{1}{K}\left(\frac{K-1}{K}\right)^{N-1}, c\right\}$
- There is a region of costs with another equilibrium with two sellers of info at $p = 0$.
- If c is high, nobody buys info in equilbrium.
- The "soft" game also has continuum of equilibria with intermediate degrees of information between babbling and most informative one above.

Theoretical benchmark

- In the game with verifiable information, “hard”, the seller does not sell inforvation when he likes the good and sells it, charging higher Price than in “soft”, when he does not.
- Same welfare as in the “soft” game with the informative equilibrium.

Experimental design

- $K = 2$ ("orange" and "green") and two treatments: with $N = 3$ "soft" and "hard".
- Value of object v = 200 ECU if your preferred color and $v = 100$ ECU, otherwise.
- $c = 20$ so an equilibrium exists, with price of info
  - $p = 100/8 = 12.5$ ECU (max info price 20 ECU).
- Initial endowment = 250 ECU per period.
- Played 20 periods, of which 4 are selected at random for payment.

Results: auction

		Soft		*Hard*	
		Rounds 1-10	*Rounds 11-20*	*Rounds 1-10*	*Rounds 11-20*
Informed players	*Color - Yes* [Prediction: 200]	152.87	203.22	153.48*	200.87
	Color - No [Prediction: 100]	91.75	116.51	93.05	120.12
Uninformed players	[Prediction: 150]	115.81	145.22	112.21	143.58

Behavior of the informed and uninformed players in the auction is basically right in the end.

Results: auction

		Soft		*Hard*	
		Rounds 1-10	*Rounds 11-20*	*Rounds 1-10*	*Rounds 11-20*
Buyers of report	Content: *Color - Yes* [Prediction: 200]	135.06	180.14	142.57	206.80^
	Content: *Color - No* [Prediction: 100]	105.53	136.37	74.37	140.00
	Content: 0 [Prediction: 150]	93.94	167.5	N/A	N/A

Behavior of report buyers in auction: for soft treatment, adjustment to poorer information quality. Fort hard treatment a bit of overbidding under “No”.

Behaviour in information market

Table 4. Behavior in information markets in Soft and Hard treatment – Absolute number of observations and relative frequencies (% over total row)

	periods 1 -10			Periods 11 – 20		
	Uninformed	Informed	Buy a report	Uninformed	Informed	Buy a report
Soft	128 (25.10)	**333 (65.29)**	49 (9.61)	**256 ^^^ (50.20)**	228 ^^ (44.71)	26 ^^ (5.10)
Hard	146 (30.42)	**239 *** (49.79)**	95 *** (19.79)	177 (36.88)	**212 (44.17)**	91 *** (18.96)

Soft vs Hard: Mann Whitney test significance at *** p<0.01, ** p<0.05, * p<0.1
Periods 1-10 vs 11-20: Signed-Ranks test significance at ^^^ p<0.01, ^^ p<0.05, ^ p<0.1

- Market for reports never very big, collapses at the end in Soft treatment.
- It is a bit smaller than theory in the Hard treatment, but it is larger than if Soft and persistent.

Behaviour in message subform

Table 5. Content of the sent report by type of seller (interested in the object or uninterested) in the Soft treatment

Seller	*0 report*	*False report*	*Truthful report*	*Total*
Uninterested	8 (25.00)	10 (31.25)	**14** **(43.75)**	32 (100)
Interested	9 (23.08)	7 (17.95)	**23** **(58.97)**	39 (100)
Total	17 (23.94)	17 (23.94)	**37** **(52.11)**	71 (100)

- Sender garbles when he does not like the object in Soft, why?. We will see.
- Sender sometimes tells the truth when he likes the object, non-selfish/norm-based behavior, in accordance with previous evidence.
- Too few observations – will do another game.

Behaviour in information market

Table 7. Minimum asking price in the market for reports

	Periods 1 - 10	Periods 11 – 20
Soft	8.23	6.49^^
Hard	11.29***	11.40***
	Uninterested	Interested
Soft	7.67	7.30
Hard	11.33 ***	11.40 ***

Table 8. Accepted price and Acceptance rate in the market for reports

		Periods 1 - 10	Periods 11 – 20
Accepted Price	Soft	8.35	4.96
	Hard	11.19*	11.40***
Acceptance Rate	Soft	0.24	0.19
	Hard	0.55***	0.56***

- Price of information low (but quality also low) and going down over time in Soft. Still too high given its quality.
- The price is “right” given its content in Hard treatment.

Payoffs

Table 9. Average earnings by treatment, type of available information and periods

	Soft treatment	
	Periods 1 - 10	Periods 11 – 20
Uninformed	256.60	251.63
Informed	246.85*	240.26^^^
Buyers of reports	245.90	250.54
	Hard treatment	
	Periods 1 - 10	Periods 11 – 20
Uninformed	259.23	246.69
Informed	259.33	240.35^^^
Buyers of reports	252.61	242.54

Soft vs Hard: Mann Whitney test significance at *** p<0.01, ** p<0.05, * p<0.1

Periods 1 -10 vs 11 – 20: Signed-Ranks test significance at ^^^ p<0.01, ^^ p<0.05, ^ p<0.1

- Towards the end average payoffs very similar.

Behaviour in information market

	Treatment Soft		Treatment Hard	
	Buying a report (1)	**Posting a price (2)**	**Buying a report (3)**	**Posting a price (4)**
	Buying a report/Posting a price equation			
Cons	-1.1201*** (0.4187)	1.5592 (.9677)	0.6963 (1.0740)	-0.8929** (0.3513)
round	-0.0443* (0.0240)	-0.0815*** (0.0272)	-0.0204 (0.0260)	-0.0039 (0.0117)
inf_tot	0.2596* (0.1527)	-0.1670 (.2438)	0.6469** (0.3039)	0.2137 (0.2673)
env|np	0.5528 (0.3968)	0.0634 (0.4436)	-0.6505** (0.3142)	0.5802*** (0.2102)
risk	0.0106 (0.0492)	0.1712 (0.1246	-0.0164 (0.2439)	0.1391** (0.0603)
askmin	-0.0702*** (0.0269)		-0.0632*** (0.0245)	
true_cum	0.2250** (0.1029)			
noint		-0.1883 (0.4737)		1.4870*** (0.4612)
*noint*env|np*		0.4786 (0.4285)		-0.6594** (0.3299)
*noint*risk*		-0.0216 (0.0900)		-0.2086 (0.1316)
Rho	0.8241*** (0.2479)	0.1859 (0.7809)	-0.0918 (1.7796)	0.2788 (0.4410)
N. Obs.	969	969	912	912

- Report purchases go down over time (*period*) for Soft.
- They are sensitive to the minimum asking price (*askmin*).
- They are also sensitive to quality of information (*last*).
- Pro-sociality matters for the decision to post a price.

Message subform expanded

- ***New experiment***. Sender knows object type, his type and that of receiver (black- white). Sends a message about type.
- Receiver upon seeing message can take one of three actions.
- Payoffs below. 40 players, 40 periods, fixed pairs.

Table 7. Payoffs in the simplified game (in each cell: player 1's payoff, player 2's payoff)

Player 2's choice	Left	Center	Right	Left	Center	Right
Player 1 not interested	20, 20	20, 60	20, 100	20, 160	20, 120	20, 50
Player 1 interested	20, 30	70, 90	120, 120	20, 60	70, 50	120, 40
	Player 2 not interested			*Player 2 interested*		

Message subform expanded

- In "preferred" equilibrium:
  - sender tells the truth when he does not like object.
  - Sender lies when he likes the object.
  - Receiver chooses "Sinistra" when told he likes the object and "Destra" when told he does not.

Table 7. Payoffs in the simplified game (in each cell: player 1's payoff, player 2's payoff)

Player 2's choice	Left	Center	Right	Left	Center	Right
Player 1 not interested	20, 20	20, 60	20, 100	20, 160	20, 120	20, 50
Player 1 interested	20, 30	70, 90	120, 120	20, 60	70, 50	120, 40
	Player 2 not interested			*Player 2 interested*		

Message subform expanded

- In "babbling" equilibrium:
  - Sender randomizes over both messages in all states.
  - Receiver chooses "Centro" otherwise.
- The two equilibria coincide qualitatively with full game equilibria.

Table 7. Payoffs in the simplified game (in each cell: player 1's payoff, player 2's payoff)

Player 2's choice	Left	Center	Right	Left	Center	Right
Player 1 not interested	20, 20	20, 60	20, 100	20, 160	20, 120	20, 50
Player 1 interested	20, 30	70, 90	120, 120	20, 60	70, 50	120, 40
	Player 2 not interested			*Player 2 interested*		

Message subform expanded

Table 8. Player 1's behavior. Frequency of true messages

	All Rounds	Rounds 21-40	All Rounds	Rounds 21-40
Player 1 not interested	0.6315 (0.4834) [228]	0.6111 (0.4897) [108]	0.6497 (0.4782) [197]	0.6593 (0.4765) [91]
Player 1 interested	0.7419 (0.4387) [186]	0.8085 (0.3955) [94]	0.3439 (0.4762) [189]	0.3551 (0.4808) [107]
	Player 2 not interested		*Player 2 interested*	

(Std. Dev.), [observations

- First line should be 1, in "preferred" equilibrium: data has less truth-telling when sender does not like the object.
- Second line should be 1, left; and 0 right. Data has more on right, so some truth-telling when there should be lie: as previous literature.
- This confirms the results of previous experiment, with more data.

Message subform expanded

Game (All payoffs in Euro)	*Distribution 1 self: other*	*Distribution 2 self: other*
(I) Pro-sociality	2: 2	2: 1
(II) Costly pro-sociality	2: 2	3: 1
(III) Envy	2: 2	2: 4
(IV) Costly envy	2: 2	3: 5

- Social preferences test: Bartling, Fehr, Maréchal and Schunk 2009.

	Weakly Envious	*Strongly Envious*	*Non envious*	*Total*
Weakly pro-social	6 (25.00) [100]	5 (20.83) [45.45]	13 (54.16) [56.52]	24 (100) [60.00]
Strongly pro-social	0 (0) [0]	0 (0) [0]	4 (100) [17.39]	4 (100) [10.00]
Non pro-social	0 (0) [0]	6 (50.00) [54.54]	6 (50.00) [26.08]	12 (100) [30.00]
Total	6 (15.00) [100]	11 (27.50) [100]	23 (57.50) [100]	40 (100) [100]

Message subform expanded

	Marginal effect of *Env* =1 vs. *Env* = 0 (by values of *Prosoc*, *Int1* and *Int2*)		Marginal effect of *Prosoc* =1 vs. *Prosoc* = 0 (by values of *Env*, *Int1* and *Int2*)	
	Prosoc = 0	*Prosoc* = 1	*Env* = 0	*Env* = 1
Int1 = 0 & *Int2* = 0	-0.2550** (0.1111)	-0.0883 (0.0795)	0.0392 (0.0905)	0.2058** (0.1017)
Int1 = 0 & *Int2* = 1	-0.3924*** (0.1175)	-0.0768 (0.0815)	-0.0419 (0.0928)	0.2736** (0.1098)
Int1 = 1 & *Int2* = 0	-0.4027*** (0.1103)	-0.1296* (0.0755)	-0.0557 (0.0766)	0.2173** (0.1102)
Int1 = 1 & *Int2* = 1	0.0036 (0.1133)	-0.0012 (0.0852)	0.1498 (0.0963)	0.1449 (0.1040)

- No envy and pro-sociality increase significantly the amount of truth-telling in 00, 01 and 10.

Summary

- Markets for information are viable, in theory. Less so in lab.
  - Information traded in markets often noisy in theory. This may generate allocational inefficiencies.
  - Noise is different in the lab. More lies when the seller of info should not care. And (as in other experiments) also more truthful when he cares.
  - We show envy and pro-sociality plays a role.
  - Bad quality of information and subsequent justified mistrust leads to a collapse of the information market. This does happen with "hard" information. It is a reason for intervention, either government or private, like certification.

Thanks!