Let's talk: How communication affects contract design

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The setting

- Trade between a buyer and seller in which:

    the seller may suffer a negative cost shock after committing to trade (agreeing to a contract)

    the seller makes a quality decision during production

- (Formal) Contracts cannot:

    - be state-contingent

    - specify the seller's quality choice

Two types of contracts are possible

- **Rigid**: Traders fix a price before observing the cost-shock (*ex ante*) and they cannot change this price

- **Flexible**: After fixing a base price (*ex ante*), the buyer can raise this payment (after observing the cost shock)
  (The contract cannot specify how to adjust.)

What do we study?

- Whether communication affects the choice between rigid and flexible, comparative efficiency and earnings

- How chat content differs between rigid and flexible and the effects on outcomes (content analysis).

Motivation

- Clear agreements -- smooth relationships

- Business practitioners advocate "keep plans simple"
- Especially when communication is difficult

  Rigid is simple

- Broader objectives: understand contracting costs
  - predict contract incompleteness

Background

- Theory in **Hart Moore QJE 2008**

  ("Contracts as Reference Points")

  - Rigid contracts fix entitlements (if competitively determined)
  - If seller feels entitled to more than buyer pays, seller aggrieved and produces inferior quality
  - Flexible contracts leave room for disagreement ($\rightarrow$inefficiency)

  Experimental support **Fehr, Hart, Zehnder** (a,b,c)

Why do we do what we do?

- Traders should look for a way to avoid the inefficiency!

- The natural way is **communication**: clarify plans/obligations, discuss and adjust entitlements (reference points) to try and make them compatible

  - Cf. HM theory

- **Informal agreements** may affect entitlements (reference pts?)
  - can "complete" flexible contracts
  - complementary with flexible contracts

Basic Game

- 2 players – B & S – with material payoffs:
- $\Pi_B = \Pi_S = 5$ if take outside options
- $\Pi_B = 5 + v(x) - T$ and $\Pi_S = 5 + T - C - |x|$

where

- $v(x) = 10, 30, 45$, when $x = -1, 0, 1$, resp.
- T: transfer from B to S
- $C = 0$ or 20 with equal probabilities

Timing

Stage 1: B can propose a contract type, *rigid* or *flexible*, together with a base price P

Stage 2: S accepts or rejects (ending game with 5 each)

Stage 3: Computer randomly determines S's cost C (C = 0 or 20, equiprobable), observed by both B and S.

Stage 4: If contract is flexible, B can set an additional transfer Q.

Stage 5: S sets quality level $x = -1$, $x = 0$ or $x = 1$

Theory on Rigid vs. Flexible

- Flexible in principle seems better but…

- Rigid contracts are simple: once accepted, no room for disagreement

- Flexible contracts leave room for disagreement
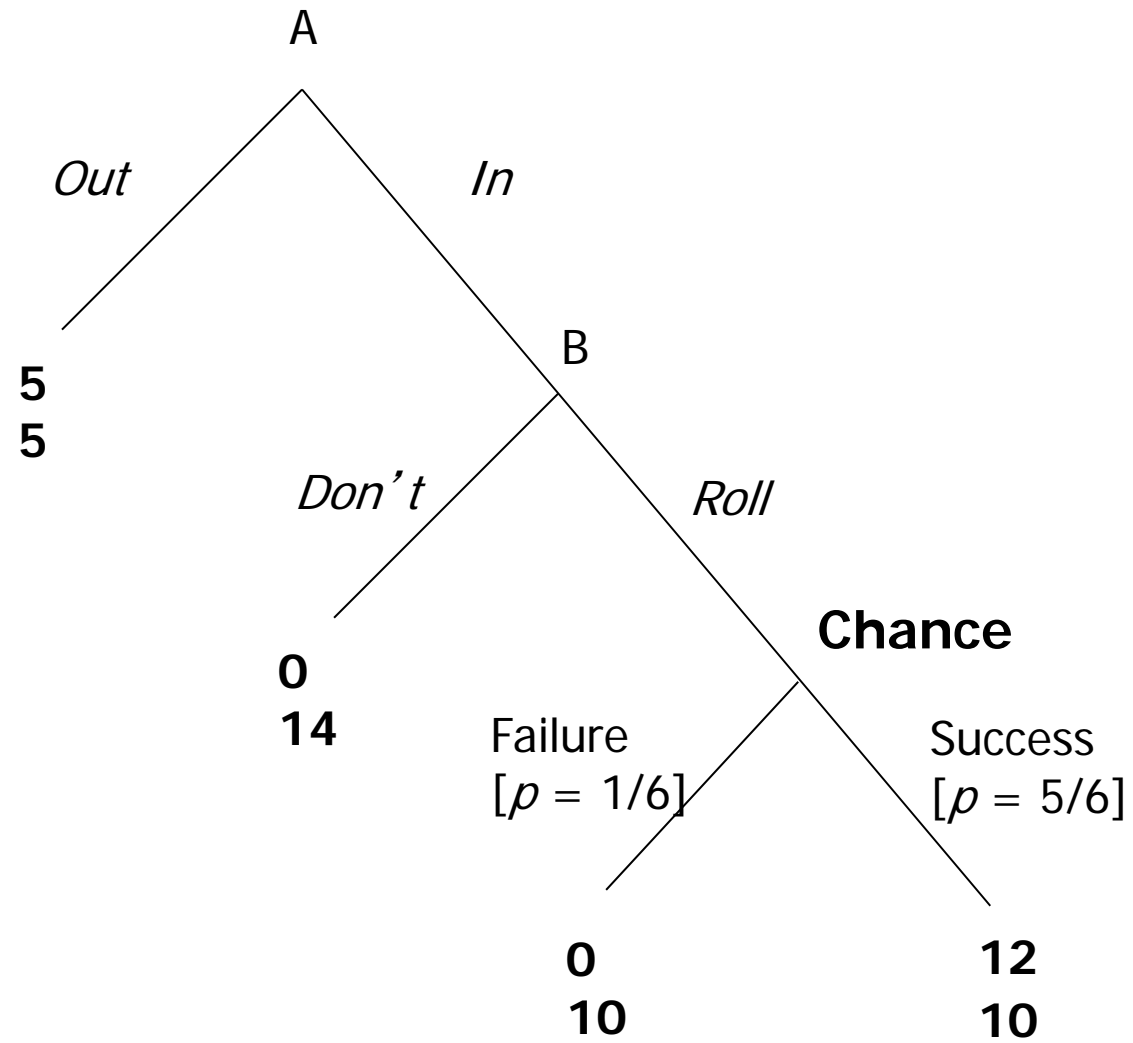 - unless chat enables clarification of intended plans

Previous Experiments on Communication

- Many

Charness (2000)

Player 2

	A	B
A	7, 7	8, 1
B	1, 8	9, 9

Player 1

$p(B) = 35\%$

$p(B|s(B)) = 94\%$

Why might bilateral agreements shift feelings of entitlement?

- If seller agreed to rigid contract, people could say:

"you chose to accept that price -- you can't complain now!"

- General norm: *accept the consequences of one's actions*
  - E.g. "you made your bed – now lie in it!"

- Flexible (no-chat): ambiguity excuse

Behavior in the no-communication treatments

Category	Endogenous Rigid	Endogenous Flexible	Exogenous Rigid	Exogenous Flexible
Frequency*	243 (55.4%)^	196 (44.6%)^	440 (100%)	440 (100%)
Rejections	79 (32.5%)	65 (33.2%)^	152 (34.9%)	119 (27.2%)
Average P (all offers)	13.28 [0.41]	11.13 [0.37]^	13.91 [0.31]	12.38 [0.28]
Average P (accepted offers)	15.74 [0.43]	12.58 [0.46]^	16.28 [0.33]	14.21 [0.31]
Average Q, cost shock	-	3.35 (0.49)	-	4.18 (0.67)
Average Q, no cost shock	-	1.58 (0.30)^	-	3.21 (0.37)
Inferior quality	51 (31.1%)	53 (40.5%)^	86 (30.3%)	108 (33.9%)
Normal quality	107 (62.2%)	74 (56.5%)^	183 (64.4%)	174 (54.5%)
Superior quality	6 (3.7%)	4 (3.0%)^	15 (5.3%)	37 (11.6%)
Avg. quality, cost shock	-0.32 [0.06]	-0.45 [0.06]	-0.31 [0.04]	-0.41 [0.05]
Avg. quality, no cost shock	-0.22 [0.06]	-0.26 [0.08]^	-0.21 [0.06]	-0.04 [0.05]
Avg. buyer earnings	10.80 [0.58]	8.84 [1.09]^	10.46 [0.46]	10.13 [0.48]
Avg. seller earnings	7.81 [0.59]	7.96 [1.22]^	9.92 [0.47]	10.59 [0.57]
Avg. total earnings	18.61 [0.88]	16.80 [0.99]^	20.37 [0.69]	20.73 [0.79]

* No contract was offered on one occasion. ^We exclude one case in which the buyer received a very large negative payoff (in the final period). Average buyer, seller, total earnings, and P (all offers) refer to all offered contracts. All other values refer to accepted offers. Standard errors are in brackets.

Behavior in the communication treatments

Category	Endo Rigid	Endo Flexible	Exo Rigid	Exo Flexible	Restricted Rigid	Restricted Flexible
Frequency*	111 (25.3%)	327 (74.7%)	438 (100%)	440 (100%)	68 (15.5%)	371 (84.5%)
Rejections	20 (18.0%)	12 (3.7%)	61 (13.9%)	18 (4.1%)	32(47.1%)	111(29.9%)
age P (all offers)	22.76 [0.83]	16.91 [0.37]	23.04 [0.46]	13.14 [0.31]	10.79[0.82]	8.94[0.31]
age P (accepted)	25.22 [0.72]	17.22 [0.47]	25.38 [0.41]	13.46 [0.30]	15.31[0.97]	10.37[0.39]
ge Q, cost shock	-	13.08 [0.66]	-	15.89 [0.55]	-	3.27[0.44]
e Q, no cost shock	-	7.25 [0.66]	-	8.44 [0.44]	-	2.82[0.32]
ferior quality	13 (14.3%)	20 (6.3%)	63 (16.7%)	50 (11.8%)	16 (44.4%)	122 (41.2%)
ormal quality	33 (36.3%)	61 (19.4%)	124 (32.9%)	85 (20.1%)	17 (47.2%)	150(50.7%)
perior quality	45 (49.4%)	234 (74.3%)	190 (50.4%)	287 (68.0%)	3 (8.3%)	24(8.1%)
uality, cost shock	0.19 [0.10]	0.63 [0.05]	0.28 [0.05]	0.53 [0.05]	-0.53(0.12)	-0.38(0.06)
quality, no shock	0.52 [0.11]	0.73 [0.04]	0.40 [0.05]	0.60 [0.05]	-0.21 (0.16)	-0.29(0.05)
buyer earnings	12.66 [0.99]	17.02 [0.56]	12.58 [0.54]	16.58[0.49]	9.03 [1.30]	11.69 [0.61]
seller earnings	16.68 [1.16]	20.95 [0.46]	17.44[0.62]	19.03[0.47]	6.91 [1.11]	8.12 [0.55]
total earnings	29.34 [1.72]	37.97 [0.84]	30.02[0.83]	35.61[0.78]	15.94[1.69]	19.81 [0.77]

* No contract was offered on two occasions with Exo Rigid. Average buyer, seller, total earnings, and P (all

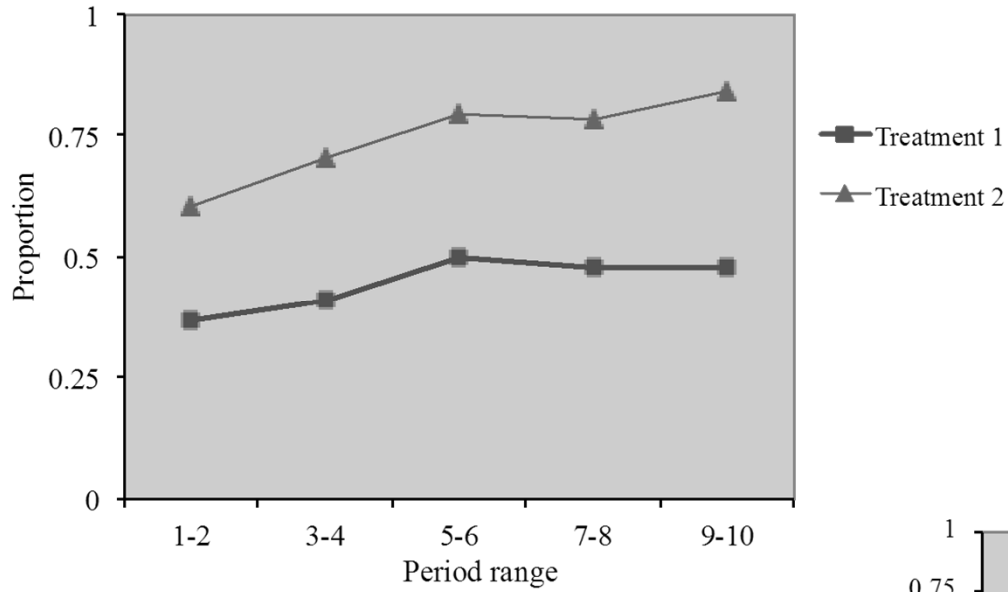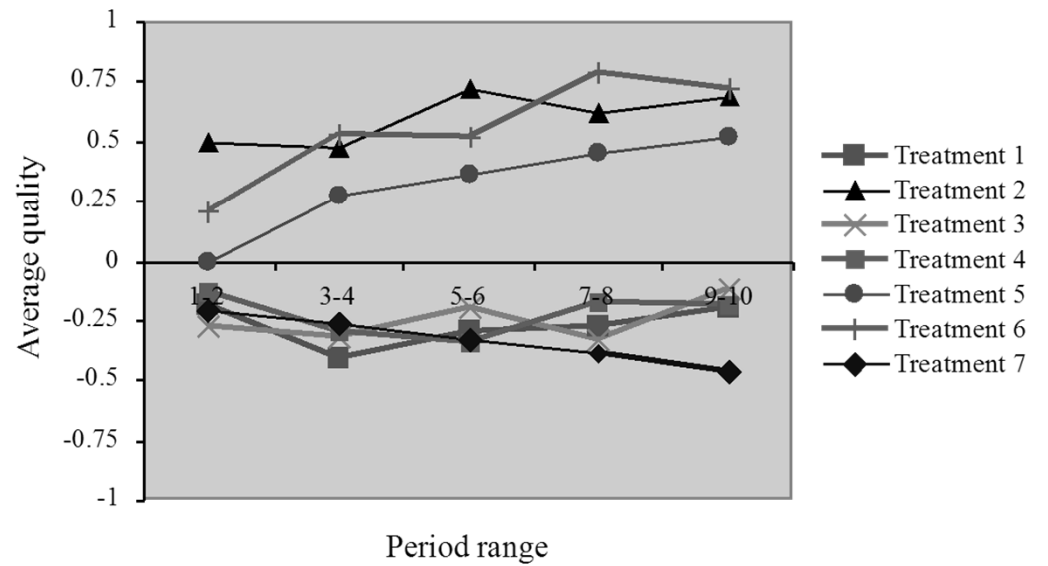**Figure 1: Proportion of endogenous flexible contracts over time**

Figure 2: Average quality over time

# What chat content leads to flexible doing better?

- Clarification of intentions? Good vibes (less social distance)?

- We had independent coders read all chat text and classify it according scheme with 3 content categories.

Focus: Effects of chat categories on earnings

Simple Wilcoxon Signed-rank tests:

- "Q-clarification" "Friendly" and "Promises over quality" **all** have a significant positive effect on buyer and seller earnings with a **flexible** contract.

- all three have **no** significant effect on earnings with **rigid** contracts.

Average friendliness over time
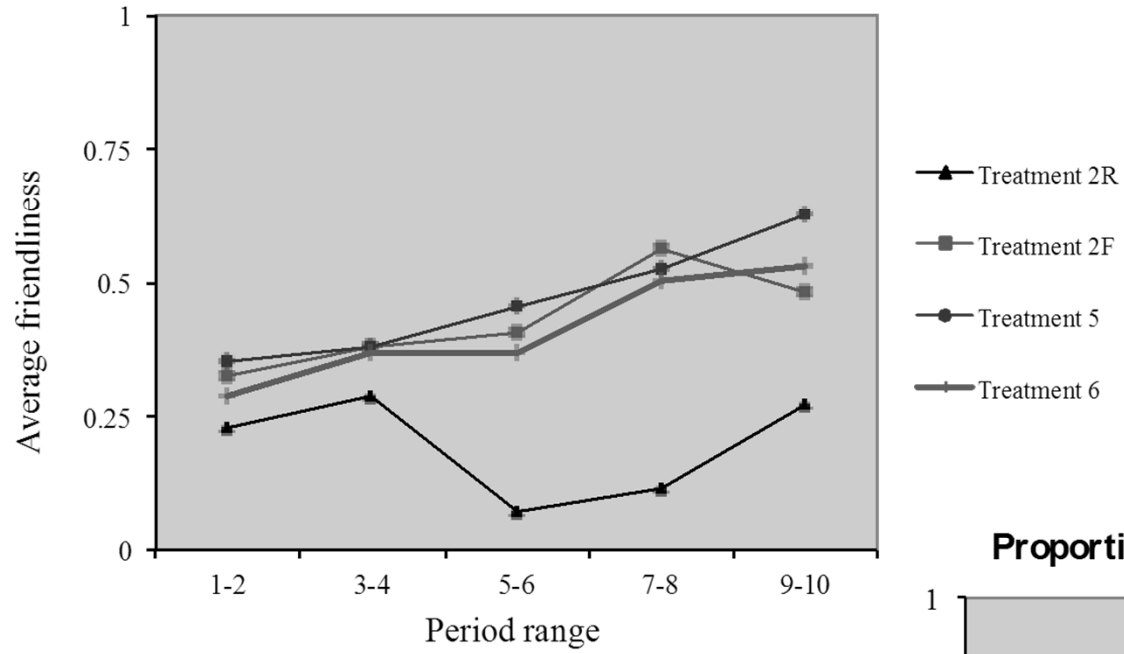
Proportion of qclarification over time
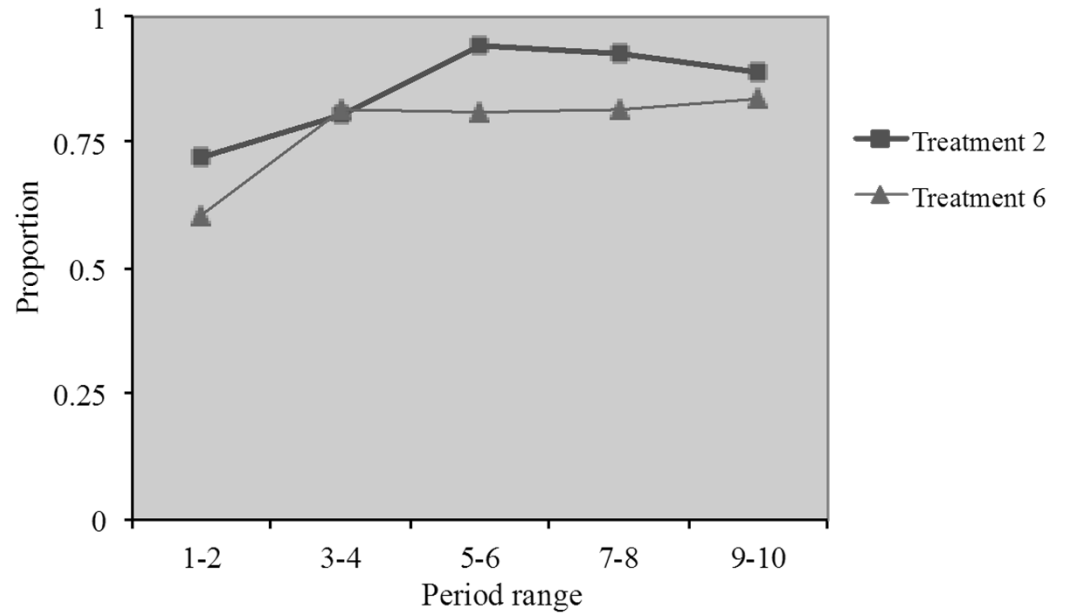
Chat combinations and quality

Chat combinations	Avg. quality Treatment 2R	Avg. quality Treatment 2F	Avg. quality Treatment 5	Average quality Treatment 6
(0, -1, 0)	-0.667 (0.167) [9]	0.000 (1.000) [2]	-0.667 (0.142) [12]	-0.625 (0.263) [8]
(0, 0, 0)	0.296 (0.117) [27]	0.375 (0.125) [16]	0.099 (0.080) [81]	0.438 (0.128) [16]
(0, 1, 0)	0.714 (0.125) [14]	0.778 (0.147) [9]	0.326 (0.079) [92]	0.800 (0.200) [5]
(0, -1, 1)	1.000 (0.000) [2]	- (-) [0]	- (-) [0]	0.000 (-) [1]
(0, 0, 1)	0.636 (0.203) [11]	0.667 (0.167) [9]	0.620 (0.071) [71]	0.562 (0.157) [16]
(0, 1, 1)	0.833 (0.112) [12]	0.800 (0.200) [5]	0.724 (0.056) [87]	0.750 (0.112) [16]
(1, -1, 0)	- (-) [0]	0.111 (0.309) [9]	-	-0.800 (0.133) [10]
(1, 0, 0)	0.000 (0.000) [3]	0.547 (0.086) [64]	-	0.365 (0.103) [52]
(1, 1, 0)	0.500 (0.500) [2]	0.895 (0.041) [57]	-	0.833 (0.062) [48]
(1, -1, 1)	-1.000 (-) [1]	-0.800 (0.200) [5]	-	-0.500 (0.500) [2]
(1, 0, 1)	0.667 (0.333) [3]	0.648 (0.084) [54]	-	0.690 (0.690) [84]
(1, 1, 1)	1.000 (-) [1]	0.902 (0.033) [82]	-	0.833 (0.043) [120]
Qclarify = 0	0.413 (0.081) [75]	0.561 (0.086) [41]	-	0.435 (0.086) [41]
Qclarify = 1	0.300 (0.213) [10]	0.708 (0.035) [271]	-	0.658 (0.035) [316]
Friendly = -1	-0.417 (0.229) [12]	-0.188 (0.228) [16]	-0.667 (0.142) [12]	-0.786 (0.088) [23]
Friendly = 0	0.386 (0.093) [44]	0.573 (0.053) [143]	0.342 (0.058) [152]	0.591 (0.050) [154]
Friendly = 1	0.759 (0.081) [29]	0.889 (0.025) [153]	0.520 (0.051) [179]	0.863 (0.044) [102]
Promises = 0	0.236 (0.093) [55]	0.637 (0.049) [157]	0.162 (0.056) [162]	0.355 (0.095) [76]
Promises = 1	0.700 (0.109) [30]	0.742 (0.044) [155]	0.677 (0.044) [158]	0.653 (0.070) [75]

The chat combinations reflect clarification values, friendliness values, and promise values, respectively. Thus, for example, (1, 0, 1) means clarification = 1, friendly = 0, and promises = 1. Numbers in parentheses refer to standard errors, while numbers in brackets reflect the number of observations. Qclarification was not mentioned in Treatment 5, so we code this as 0 for the chat combinations.

Frequency and timing of quality promises and friendliness

Category	Pre shock (T5)	Post shock (T5)	Pre shock (T6)	Post shock (T6)
Promise	216 (55.8%)	47 (12.1%)	85 (20.5%)	202 (48.7%)
No promise	168 (43.4%)	96 (24.8%)	25 (6.0%)	176 (42.4%)
Friendly	185 (47.8%)	71 (18.4%)	116 (28.0%)	169 (41.9%)
Neutral	179 (46.2%)	68 (17.6%)	261 (62.9%)	188 (46.6%)
Unfriendly	20 (5.2%)	4 (1.0%)	13 (3.1%)	21 (5.2%)

Notes: Post-shock percentages are based on the chats with accepted contracts. There were many cases with no post-shock discussion. T5 (T6) means Treatment 5 (6). The missing percentages reflect cases without conversation in the relevant timing. There were 3 (37) such cases pre-shock in Treatment 5 (6) and 244 (25) such cases post-shock in Treatment 5 (6).

Total earnings as a result of chat category usage

Treatment, category	Total earnings	Z-statistic	Treatment, category	Total earnings	Z-statistic
T2F, Q-clarification	39.07/33.84	2.184 (0.014)	-	-	-
T2F, Friendly	43.08/33.42	3.447 (0.000)	T5, Friendly	34.27/29.03	3.303 (0.005)
T2F, Promise	38.87/37.88	1.961 (0.025)	T5, Promise	38.03/26.95	4.890 (0.000)
T2R, Q-clarification	29.55/30.46	0.210 (0.834)	T6, Q-clarification	37.38/34.53	1.717 (0.043)
T2R, Friendly	41.27/24.93	3.210 (0.001)	T6, Friendly	42.27/30.40	5.129 (0.000)
T2R, Promise	37.74/27.09	1.852 (0.032)	T6, Promise	40.10/31.66	3.968 (0.000)

Notes: "x/y" refers to the total earnings with and without a positive value for the category. All test statistics are one-tailed except to. T2F, T2R, T5, and T6 refer to Treatment 2 with flexible contracts, Treatment 2 with rigid contracts, Treatment 5 and Treatment 6, respectively. *p*-values (all one-tailed except for T2R, Q-clarification) are in parentheses.

Regressions for the effect of chat-category values on total earnings

dependent variables	T2	T2	T2	T5	T5	T6	T6	T6
Period	0.497* (0.261)	0478** (0.241)	0.695*** (0.256)	0.493* (0.290)	0.420 (0.288)	1.240*** (0.273)	1.015*** (0.248)	1.200*** (0.263)
ce_paid	0.255** (0.106)	0.060 (0.102)	0.255*** (0.111)	0.799*** (0.086)	0.754*** (0.087)	0.188* (0.097)	-0.040 (0.091)	0.080 (0.096)
Clarification	6.186*** (1.727)	-	-	-	-	0.822 (1.833)	-	-
Friendliness	-	10.247*** (1.150)		3.582*** (1.317)	-	-	10.805*** (1.175)	-
Promises	-	-	3.337** (1.583)	-	6.133*** (1.635)	-	-	7.413*** (1.534)
Constant	22.720*** (3.155)	28.060*** (2.930)	24.458*** (3.177)	23.564*** (3.037)	8.111*** (2.413)	24.296*** (2.800)	27.747*** (2.453)	23.453*** (2.610)
N	422	422	422	387	387	415	415	415
R^2	0.065	0.208	0.045	0.254	0.266	0.072	0.230	0.120

Standard errors are in parentheses. ***, **, and * indicate significance at $p = 0.01, 0.05,$ and 0.10 (two-tailed tests), respectively. Clustering is at the individual level.

Conclusions (1)

- How does communication affect frequency and effectiveness of different contract forms? Ambiguity over interpretation of flexible contracts may make it useful for traders to tie their hands. Our results without communication qualitatively confirm and generalize this idea.

- Matters change dramatically with free-form communication. Natural feature, people can make agreements (removing ambiguity in flexible contracts) and promises (tend to be honored). Flexible contracts then emerge as the instrument that allows traders to raise efficiency.

Conclusions (2)

- Content analysis of chat data reveals clarification of transfer plan associated with better quality and earnings outcomes in flexible contracts. Not flexibility *per se* causing problems in, but rather the risk of ambiguity over how flexible contract terms are to be adapted to subsequent events.

- Free-form communication tends to resolve ambiguity while preserving adaptive benefits of flexibility. Overall, results point to big benefits from informal agreements when traders cannot write complete state-contingent (formal) contracts.

- Through informal agreements the parties can use flexible contracts to their advantage.