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Deal or no deal? The effect of alcohol drinking on bargaining☆

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ABSTRACT

Alcohol drinking during business negotiation is a very common practice, particularly in some East Asian countries. Does alcohol consumption affect negotiator's strategy and consequently the outcome of the negotiation? If so, what is the mechanism through which alcohol impacts negotiator's behavior? We investigate the effect of a moderate amount of alcohol on negotiation using controlled experiments. Subjects are randomly matched into pairs to play a bargaining game with adverse selection. In the game, each subject is given a private endowment. The total endowment is scaled up and shared equally between the pair provided that they agree to collaborate. It is found that a moderate amount of alcohol consumption increases subjects' willingness to collaborate, thus improving their average payoff. We find that alcohol consumption increases neither subjects' preference for risk nor altruism. A possible explanation for the increase in the likelihood of collaboration is that subjects under the influence of alcohol are more "cursed" in the sense of Eyster and Rabin (2005), which is supported by the estimation results of a structural model of quantal response equilibrium.

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> Kissinger: I think if we drink enough Mao Tai (a famous Chinese liquor with high alcohol content) we can solve anything.
> Deng: Then when I go back to China, I must increase production of it.
> (From a conversation between former Chinese leader Xiaoping Deng and Henry Kissinger, former Secretary of State, April 14, 1974, *The Kissinger Transcripts.*)

1. Introduction

Alcohol consumption has at least a history of 10,000 years (Gatetly, 2008). In many cultures around the world, drinking is an important part of social life, and is believed to be an essential element of building personal relationships. Drinking is also

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a common business practice in negotiations in many countries, especially in East Asia. For example, in China, negotiations often begins after rounds of toasts. In Japan, significant business meetings are frequently preceded by hours of whiskey, at which point drinking becomes more of a duty than pleasure. Korea is well-known for its aggressive drinking culture: refusing to drink without an obvious excuse can be considered rude and insulting, leading to a breakdown in negotiation. Heavy alcohol consumption is also common in Russia and Scandinavia (Schweitzer and Kerr, 2000). Given that the harmful effect of drinking on immediate decision-making and long-term health is well understood, it is puzzling that aggressive drinking is so prevalent in the business world. In this paper, we use the formal approach of controlled experiments to shed light on this puzzling observation. Our study investigates the effect of alcohol consumption on the negotiation behaviors and outcomes. We are particularly interested in the mechanisms through which alcohol generates its effects. Our findings are potentially useful for the design of guidelines for drinking in business negotiations. To the best of our knowledge, this is the first study to investigate the behavioral foundation of the effect of drinking alcohol on strategic behaviors, and our approach and findings can provide insights on other economic issues related to drinking.

In our experiment, two subjects are matched randomly to play a simple bargaining game with incomplete information. Each subject receives an endowment independently and uniformly drawn between 1 and 10. After privately learning their respective endowments, each subject simultaneously decides whether to participate in a joint project. If both of them participate, the joint project is implemented. In this case, each subject is entitled to half of the project's payoff, which scales up the sum of their respective endowments. If anyone of them decides not to participate, then the joint project is not started and each subject keeps their respective endowments. The game played here captures some essential features of real-world bargaining. First, each party has private knowledge on her contribution to the collaboration. In our game, the endowment can be interpreted as the party's quality or ability. Second, a party is uncertain about the potential contribution of the business partner. Third, a party can partially infer the partner's private information from the action taken/offer made.

The strategic consideration in the bargaining game is as follows: as each player is sharing her endowment with her partner if the joint project is started, she participates if and only if her endowment is relatively small. If she expects her partner to undergo the same reasoning, the fact that her partner is willing to participate is a "bad news": her gain from sharing the partner's endowment is likely to be small. As a result, she participates only if her own endowment is very low. Therefore, the bargaining game is one of a two-sided lemons problem: only "lemons" take part in the joint project. In our theoretical analysis, we show that the game admits a unique Bayesian Nash equilibrium (BNE) in which each player follows a symmetric cutoff strategy: she participates if and only if her endowment is below a certain threshold.

An extensive psychology literature documents that alcohol intoxication impairs the drinker's information processing ability. The survey by Steele and Josephs (1990) concludes that alcohol intoxication (i) consistently restricts the range of cues that we can perceive in a situation; and (ii) reduces our ability to process and extract meaning from the cues and information we do perceive. Specifically, alcohol intoxication restricts our ability to abstract and conceptualize (e.g., Tarter et al., 1971), the ability to use several cues at the same time (Moskowitz and DePry, 1968), as well as the cognitive elaboration needed to encode meaning from incoming information (Birnbaum et al., 1980). In short, when we are drunk, we are worse at paying attention to and learning from the information available to us.

Based on these findings in psychology, we hypothesize that alcohol consumption reduces our ability to extract information content from the actions of other players in a strategic interaction. The notion of cursed equilibrium proposed by Eyster and Rabin (2005) provides an appropriate theoretical framework for our study. Specifically, their solution concept generalizes BNE by taking into account that each player may not fully recognize the information content contained in other players' action. Each cursed equilibrium is characterized by a cursedness parameter χ, which describes the extent to which players under-estimate the connection between their partners' equilibrium action and information. If $\chi = 0$, we are back to BNE; if $\chi = 1$, each player entirely ignores the correlation between the partner's action and information: the equilibrium is said to be fully cursed. In the language of the cursed equilibrium, our hypothesis is that alcohol consumption increases the value of χ in the subsequent play of the game.

In our theoretical analysis, we show that in the bargaining game, the equilibrium cutoff is increasing in χ: the more cursed the players are, the more willing they are to participate. The reason is quite intuitive. Recall participation in the joint project indicates a low endowment. A "cursed" player does not fully appreciate this connection, and interprets the partner's participation decision too favorably. As a result, she is more willing to participate herself. Our hypothesis therefore implies that if the bargaining game is played under the influence of alcohol, subjects would adopt a higher cutoff strategy, and the joint project is more likely to be started. Furthermore, in the bargaining game, subjects' belief plays a crucial role in determining her strategy and consequently the bargaining outcome. Specifically, if a subject believes that alcohol consumption can alleviate the lemons problem by making her partner more inclined to join the project, then the subject is more inclined to join herself, even if she is NOT intoxicated. This consideration leads to the hypothesis of a positive placebo effect of alcohol consumption on facilitating bargaining.

In order to test these hypotheses, we adopt a between-subject experiment design and run three treatments distinguished by the drink offered and the information given before the bargaining game begins. In the *Nonalcohol treatment*, each subject is asked to drink a glass of nonalcoholic beer, without being explicitly told whether the drink is alcoholic or nonalcoholic. In the *Alcohol treatment*, each subject is asked to drink a glass of alcoholic beer, without being explicitly told whether the drink is alcoholic or nonalcoholic neither. In the *Nonalcohol-Announced treatment*, each subject is asked to drink a glass of nonalcoholic beer, and is told explicitly the drink is nonalcoholic. The only difference between Nonalcohol treatment and Alcohol treatment is the existence of alcohol in the drink, and the comparison of these two treatments identifies the *alcohol* *effect*. On the other hand, the only difference between Nonalcohol and Nonalcohol-Announced treatments is the information conferred to the subjects: in the former treatment, they are only told the drink is a beer, without explicit information on the alcohol content. The contrast of these two treatments aims to identify the *placebo effect*.

Our experiments provide strong supportive evidence for the alcohol effect: alcohol consumption at the beginning of the experiment significantly increases subjects' willingness to participate in the joint project. However, there is limited evidence for the placebo effect, except that subjects in the Nonalcohol treatment display a higher level of cursedness, compared with the Nonalcohol-Announced treatment. Finally, we provide robustness tests to rule out alternative explanations such as changes in mood, altruism and risk aversion.

Our study is the first to investigate the effect of alcoholic consumption on strategic interactions using controlled experiments. Previous studies on the effect of alcohol have focused on its effect on individual preference and decision-making. Corazzini et al. (2015) study the effect of alcohol consumption on risk preferences, time preference and altruism. They find no effect on risk preference and a negative relationship between alcohol consumption and altruism.[1] The question on the effect of alcohol consumption on negotiation outcomes have been investigated using experiments in Schweitzer and Gomberg (2001). The negotiation process they employ is a lot more complicated: it involves face-to-face discussion between subjects on structuring a hypothetical job offer for a previously interviewed candidate. In contrast, we adopt a much simpler negotiation game, and subjects do not engage in any form of communication. The simplistic design allows us to abstract away from considerations such as the effect of alcohol on verbal communications, as well as the ability to understand the game. Moreover, we arrive at a drastically opposite result: whereas they find alcohol consumption harms bargaining efficiency, we find that it can be efficiency enhancing.

Holt and Sherman (1994) conduct experiments on the lemons model of Akerlof (1970) and show that people often underestimate the information content contained in the acceptance of an offer. Our bargaining game can be viewed as a "two-sided lemons market": on both sides of the transaction, only lemons agree to the deal. It captures some key features of real-life bargaining absent in the one-sided lemons model. First, both parties have some private information affecting the outcome of the collaboration. Second, the game involves strategic decision-making for every player. Specifically, it is in each player's interest to take into account the partner's decision rule mapping from their private endowment to her participation decision. Belief about the partner's decision rule can be affected by whether it is commonly known that the bargaining is conducted under the influence of alcohol or not: a proposition we test by manipulating the disclosure of information on the alcohol content.

The economic literature on alcohol use has been primarily concerned with its effect on labor market outcomes. Bray (2005) finds that light to moderate drinking has a positive effect on human capital accumulation, but heavy drinking reduces this gain. Relatedly, Ziebarth and Grabka (2009) shows that in Germany, drinking cocktail improves earnings in urban areas; whereas drinking beer improves earnings in rural areas. They attribute this finding to the positive effect of drinking on developing one's social networks.[2] Using the idea that drinking makes some people (unwillingly) tell the truth, Haucap and Herr (2014) proposes a signaling model in which social drinking improves the accumulation of social capital. They show that there exists a separating equilibrium in which only high-productivity agents engage in social drinking, thus facilitating the matching process in social contact games. In contrast to these studies, our focus is on the effect of alcohol consumption on a standalone negotiation, rather than an individual's long-term income.[3] Moreover, in our model, efficiency improvement does not arise from signaling, as players do not choose whether to drink or not.

The structure of the paper is as follows. In Section 2, we set up the theoretical model of the bargaining game to be studied, and solve for its BNE and cursed equilibrium. The experimental design and procedures are described in details in Section 3. Experimental findings are reported in Section 4. Section 5 concludes. Instructions for the experiments can be found in Appendix.

2. Model

Two risk-neutral entrepreneurs decide whether to engage in a joint project or not. Each entrepreneur $i \in \{1, 2\}$ has a private endowment θ_i, independently distributed according to function F, with support $[l, u]$. The private endowment captures the ability or the quality of each entrepreneur. Thus, the output of the joint project, denoted by $V(\theta_1, \theta_2)$, is increasing in both θ_1 and θ_2. Each of them simultaneously decides whether to join the project or not. Consent from both sides is necessary for the joint project to be started. If started, each entrepreneur is entitled to half of the joint output.

Entrepreneur i's payoff, if the project is started, is given by $\frac{1}{2}V(\theta_1, \theta_2)$. If not started, the entrepreneur keeps his endowment θ_i. Assume V is a symmetric function, i.e., $V(x, y) = V(y, x)$, and satisfies the property that for all θ_j, $1 < \frac{\partial}{\partial \theta_i} V(\theta_i, \theta_j) < 2$. These properties ensure that (i) higher endowment is more efficient in the joint production, and (ii) each entrepreneur uses

[1] See also Lane et al. (2004) and Breslin et al. (1999).

[2] The positive effect of moderate drinking on wages has been identified by MacDonald and Shields (2004) in England, Peters and Stringham (2006) in USA, and Sato and Ohkusa (2003) in Japan, Tekin (2004) in Russia.

[3] Our finding points to a novel channel by which drinking is associated with higher income. As drinking facilitates bargaining, business drinking becomes a norm in some countries, so alcohol-tolerant agents are in higher demand in the labor market.

a cutoff strategy. To see (ii), denote by A the set of θ_j such that entrepreneur j joins the project. Entrepreneur i's net payoff of joining the project is given by

$$E_{\theta_j}\left[\frac{1}{2}V(\theta_i,\theta_j)|\theta_j \in A\right]-\theta_i.$$

It is easy to show that the net payoff of joining is decreasing in θ_i:

$$\frac{\partial}{\partial\theta_i}\left\{E_{\theta_j}\left[\frac{1}{2}V(\theta_i,\theta_j)|\theta_j \in A\right]-\theta_i\right\}=\frac{1}{2}E_{\theta_j}\left[\frac{\partial}{\partial\theta_i}V(\theta_i,\theta_j)|\theta_j \in A\right]-1<\frac{1}{2}(2)-1=0.$$

In our experimental implementation, we impose that V is linear in the total endowment, and that F is a uniform distribution. For the rest of the analysis, we impose that F is uniform on $[l, u]$, and that $V(\theta_i, \theta_j) = a(\theta_i + \theta_j)$ for some $a \in (1, 2)$. These additional structure ensures that there exists a unique BNE and χ-cursed equilibrium. Details follow in the subsequent subsections.

2.1. Bayesian Nash equilibrium

By the discussion above, it is optimal for each entrepreneur to adopt a cutoff strategy. Denote the cutoff of entrepreneur j by $\theta_j^* \in [l, u]$. Then entrepreneur $i \neq j$ finds it optimal to participate if and only if

$$E_{\theta_j}\left[\frac{a}{2}(\theta_i+\theta_j)|\theta_j \le \theta_j^*\right] \ge \theta_i \Leftrightarrow \theta_i \le \frac{a}{2(2-a)}(l+\theta_j^*).$$

Define the best response function by $\psi(\theta_j^*) \equiv \min\left\{\frac{a}{2(2-a)}(l+\theta_j^*), u\right\}$.[4] In a BNE, it is necessary that $\theta_i^* = \psi(\theta_j^*)$ for $i \neq j$, i.e., they must have the same cutoff strategy. It is straightforward algebra to show that $\psi(\cdot)$ has a unique fixed point. Moreover, the unique fixed point lies in the interval (l, u) if and only if $\frac{a}{2(2-a)}(l+u) < u$. In this case, the unique equilibrium cutoff, denoted by θ^{BNE} is $\frac{a}{4-3a}l$. If the condition does not hold, then $\theta^{BNE} = u$, i.e., every entrepreneur participates regardless of her private endowment. Finally, note that the assumption $a > 1$ implies that it is always efficient to have the joint project started.

In our experiment implementation, we set $a = 1.2$, $l = 1$, and $u = 10$.[5] The unique equilibrium cutoff is 3.

2.2. Cursed equilibrium

Now we apply the solution concept of cursed equilibrium proposed by Eyster and Rabin (2005). This equilibrium concept assumes players do not fully take into account the information content conveyed by other players' action. In our setting, if entrepreneur i with endowment θ_i does NOT recognize the fact that her partner joins the project if and only if her partner's endowment is low, then her perceived expected payoff from the project is $E_{\theta_j}\left[\frac{1}{2}V(\theta_i,\theta_j)\right]$. Since this is greater than $E_{\theta_j}\left[\frac{1}{2}V(\theta_i,\theta_j)|\theta_j \le \theta^*\right]$ for all $\theta^* < u$, the entrepreneur overestimates the expected payoff of joining the project whenever her partner employs a cutoff less than u.

More precisely, in a χ-cursed equilibrium, each entrepreneur's perceived expected payoff from the project is given by

$$(1-\chi)E_{\theta_j}\left[\frac{1}{2}V(\theta_i,\theta_j)|\theta_j \in A\right]+\chi E_{\theta_j}\left[\frac{1}{2}V(\theta_i,\theta_j)\right], \quad (1)$$

where A is the set of endowment with which entrepreneur j joins the project in equilibrium, and $\chi \in (0, 1)$ measures the common "cursedness" of the players. If $\chi = 1$, we have a fully cursed equilibrium: players completely ignore the information content of other players' actions. If $\chi = 0$, players are fully rational, and we are back to the BNE.

As an entrepreneur's perceived expected payoff (1) is increasing in θ_i at a rate less than 1, it remains optimal to follow a cutoff strategy. Denote the cutoff of entrepreneur j by $\theta_j^* \in [l, u]$. Then entrepreneur $i \neq j$ finds it optimal to participate if and only if

$$(1-\chi)E_{\theta_j}\left[\frac{a}{2}(\theta_i+\theta_j)|\theta_j \le \theta_j^*\right]+\chi E_{\theta_j}\left[\frac{a}{2}(\theta_i+\theta_j)\right] \ge \theta_i \Leftrightarrow \frac{a}{2(2-a)}[l+(1-\chi)\theta_j^*+\chi u] \ge \theta_i.$$

Define the best response function by $\psi(\theta_j^*) \equiv \min\left\{\frac{a}{2(2-a)}[l+(1-\chi)\theta_j^*+\chi u], u\right\}$. In a χ-cursed equilibrium, it is necessary that $\theta_i^* = \psi(\theta_j^*)$ for $i \neq j$, i.e., they must have the same cutoff strategy. Again, it is straightforward to see that ψ has a unique fixed point, which lies in the interval (l, u) if and only if $\frac{a}{2(2-a)} < \frac{u}{l+u}$. In this case, the unique χ-cursed equilibrium cutoff is given by $\theta^\chi \equiv a\frac{l+\chi u}{4-3a+\chi a}$. If the condition does not hold, then $\theta^\chi = u$. It is immediate that $\theta^\chi \ge \theta^{BNE}$.

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[4] Note that $\psi > l$ because of the assumption that $a > 1$.

[5] Specifically, we discretize the uniform distribution on $[1, 10]$ to one on $\{1, 1.1, 1.2, \ldots, 9.9, 10\}$.

In our experiment implementation with a choice of parameter $a = 1.2$, $l = 1$, and $u = 10$, the χ-cursed equilibrium cutoff θ^{χ} is given by

$$\theta^{\chi} = \frac{3(10\chi + 1)}{3\chi + 1}. \tag{2}$$

If subjects play according to the prescription of a χ-cursed equilibrium, then they would adopt a cutoff strategy with the cutoff given by (2). This is our first hypothesis:

Hypothesis 1a. Each subject employs a cutoff strategy: join if and only if θ_i lies below a certain threshold.

In practice, subjects may not have a full and complete understanding of the incentive structure of the game, or they may be unsure of the optimal cutoff, at least in the first few rounds of the experiments. Allowing for the possibility of mistakes, a prediction weaker than the cutoff strategy is that the probability that a subject chooses to participate is decreasing in her given endowment θ_i.[6]

Hypothesis 1b. The higher the endowment is, the less likely a subject participates.

It is apparent from (2) that the cutoff is strictly increasing in χ: the more cursed the players are, the higher equilibrium cutoff, which in turn implies a higher likelihood of the joint project being started. If alcohol consumption increases the bias of subjects in processing information, subjects in the treatment with alcohol consumption are expected to have a higher value of cursedness χ. This leads us to the following hypothesis on the effect of alcohol consumption:

Hypothesis 2. Alcohol consumption increases the probability of participation, and hence the probability that the joint project is started.

Finally, note that the function ψ defined above is increasing. This implies that the choice of cutoff features strategic complementarity: if an entrepreneur expects the partner to adopt a higher cutoff, then it is also optimal for her to raise her cutoff. Thus, if an entrepreneur believes her partner to be intoxicated, thus having a high cursedness χ, she should raise her own cutoff, making the joint project more likely to be started. Note that the effect relies only on subject's belief: it arises even if the subjects are not intoxicated. This is thus a placebo effect.

Hypothesis 3. Expectation that the partner is intoxicated increases the probability of participation, and hence the probability that the joint project is started.

3. Experimental design and procedures

3.1. Treatments

In all treatments, each subject is asked to consume one can of beer (volume: 350 ml) at the beginning of the session. The beer is served in an unlabeled plastic cup. The content of the beer, as well as the subjects' information about its content differ across treatments. We randomly assign subjects into the following three treatments:

- Alcohol treatment: subjects are asked to drink one can of strong beer (8.8% alcohol by volume (ABV), Carlsberg, Pilsener).
- Nonalcohol treatment: subjects are asked to drink one can of nonalcoholic beer without mentioning that the beer is nonalcoholic (less than 0.5% ABV, Krombacher, Pilsener).
- Nonalcohol-Announced treatment: subjects are asked to drink one can of nonalcoholic beer, and are told explicitly in the experiment instruction that the beer is nonalcoholic (less than 0.5% ABV, Krombacher, Pilsener).

The comparison between the Alcohol and Nonalcohol treatments identifies the pure alcohol effect on decision making since the only difference between the two treatments is that the actual alcohol content in the drink. It provides a basis for testing Hypothesis 2. The only difference between the Nonalcohol and Nonalcohol-Announced treatments concerns subjects' knowledge on the alcohol content of the drink. In both treatments, the drinks are identical. Comparing the two treatments allow us to test Hypothesis 3.

3.2. Experimental procedures

The experiments were conducted using *z*-tree (Fischbacher, 2007) in Nanyang Technological University (NTU) in Singapore. Students with no prior experience with our experiments were recruited from the graduate population in NTU.[7] Our recruitment emails were sent to students of all disciplines, and the recruited subjects had diverse backgrounds. The participants included graduate students from a board mix of disciplines including pure sciences, engineering, social sciences,

[6] A structural model on the likelihood of mistakes based on the notion of quantal response equilibrium is analyzed in Section 4.

[7] This includes both master and PhD students.

arts, business, international studies, etc. We do not expect them to have any familiarity with game theory in general. We conducted nine sessions with three sessions for each treatment.

In our recruitment emails, we explicitly stated that the experiment involved a mild to moderate amount of alcohol consumption. The following requirements on experiment participation were imposed: (i) participants must be above 21 years old; (ii) participants must present their identity card with date of birth printed on it at the beginning of the experiment; (iii) participants must have previously consumed alcoholic drink (beer/wine) in their life without experiencing any health problem; (iv) the physical and mental conditions of the participants did not advise them against consumption of a moderate amount of alcohol.

Each session consisted of 3 stages. In the first stage, subjects played the bargaining game discussed in Section 2; the second and the third stages were designed to solicit their altruism and risk aversion respectively. Upon their arrival at the laboratory, subjects were instructed to sit at separate computer terminals, and each received a copy of the instructions for stage one of the experiment. The instructions for stage 1 were then read out aloud. Next, each subject was asked to finish one glass of beer in 6 min. After finishing the drink and before the formal experiment begins, subjects were given two rounds of practice before commencing the 20 formal rounds. A random matching protocol was used for each round.

In each round of stage 1, each subject was randomly and anonymously matched with another subject. Each was given an endowment that was randomly generated between 1 dollar[8] and 10 dollar (with one decimal place) according to a uniform distribution. The endowment was each subject's private information. Next, they chose whether to participate in a joint project or not. If either one subject in the matched pair declined to participate in the joint project, they kept their respective endowments. If both of them agreed to start the joint project, the total output of the project was equally divided between them. The project's total output was determined by the following formula: $1.2 \times$ sum of the paired subjects' endowment.

In the Alcohol treatment, after finishing the first 10 rounds, we tested the blood alcohol content (BAC) of each subject using a BACTRACK S80 Breathalyzer. In the Nonalcohol treatment and the Nonalcohol-Announced treatment, subjects were given a 1-min break instead. After finishing the second 10 rounds of stage 1, each subject's earning was displayed on the screen. The experimenter randomly selected two rounds to calculate cash payment: one from the first 10 rounds and one from the second 10 rounds.

After stage 1 concluded, stage 2 of the experiment began. The rule was first shown on the computer screen. In this stage, each subject was randomly matched with an anonymous partner. She decided how much money (up to 5 dollar) to give up, *without knowing the partner's decision*.[9] This amount was then doubled (by the experimenter) and received by the partner, regardless of the partner's decision. The money given up by each subject is thus effectively a gift she offers to a randomly drawn and anonymous participant. If a subject is completely self-interested, she would give up zero dollar in this stage. The amount given up can thus serve as a measure of subjects' altruistic preference. This measure allows us to investigate whether the effect of alcohol on bargaining efficiency takes place through changes in altruism.

At the beginning of the third stage, instructions were distributed and read out aloud. In this stage, subjects completed the well-known measure of risk aversion introduced by Holt and Laury (2002). Each subject made nine choices between a safe option (a certain payment of 3 dollar) and a risky option (payment of 0 or 9 dollar), in which the probability of high payment in the risky options vary across choices. The "switching point" measured the risk aversion of each subject. One out of the nine choices was randomly selected by the experimenter, and a further random draw (based on the subject's decision for that lottery) determined the subject's earning for this stage. Measuring subjects' risk aversion allows us to investigate whether the effect of alcohol on bargaining efficiency takes place through changes in risk aversion.

Finally, subjects were asked to fill out a questionnaire. The whole experiment lasted around 75 min. Subjects were paid a show up fee of 5 Singapore dollar. On average they earned 23.08 Singapore dollar for the whole experiment.

4. Experimental findings

In total, we have 114 subjects, with 40, 38, and 36 in the Alcohol, Nonalcohol-Announced, and Nonalcohol treatments respectively. The summary statistics of the subjects are presented in Table 1. In order to see whether the control variables are different in any systematic ways, we test the difference of these variables across treatments. All, but one, of the Wilcoxon rank-sum tests show that the control variables are not significantly different across treatments (Alcohol vs Nonalcohol and Nonalcohol-Announced vs Nonalcohol). The exception is the volunteer time for the subjects in the Alcohol and the Nonalcohol treatments, with a p-value equal to 0.066.[10] In Alcohol treatment, the blood alcohol content (BAC) measure varies among subjects with a mean and median 0.0406 and 0.0415, and a standard deviation of 0.0137.[11]

[8] All dollar refers to Singapore dollar (SGD). 1 SGD is equivalent of 0.8 US dollar (USD) approximately.

[9] As they were each paid a show up fee of 5 dollar, they would never run into a deficit.

[10] In the regression analysis, we control for the impact of volunteer time.

[11] To put it into context, the legal BAC driving limit is 0.05 in many European countries, and 0.08 in Canada and the United States. Most countries have a limit below 0.08. It is 0.02 and 0.03 in China and India respectively.

Table 1
Summary statistics of main variables and individual characteristics.

Treatment	Stat.	Obs. num.	Participate rate	Participate decision	Trade outcome	Endowment	Alcohol test
Nonalcohol-Announced	Mean	38	0.625	0.632	0.368	5.71	
	Med.		0.6	1	0	5.45	
	Std.		0.155	0.489	0.489	3.06	
Alcohol	Mean	40	0.701	0.775	0.6	5.08	0.0406
	Med.		0.7	1	1	4.6	0.0415
	Std.		0.136	0.423	0.496	2.34	0.0137
Nonalcohol	Mean	36	0.608	0.583	0.389	5.39	
	Med.		0.6	1	0	5.5	
	Std.		0.144	0.5	0.494	2.55	
Total	Mean	114	0.646	0.667	0.456	5.39	
	Med.		0.65	1	0	5.15	
	Std.		0.15	0.473	0.5	2.65	

		Happiness	Risk aversion	Altruism	Volunteer time	Charity giving	Charity amount
Nonalcohol-Announced	Mean	7.45	5.82	1.74	2.61	5.74	87
	Med.	7.5	6	1.65	2	5	27.5
	Std.	2.33	1.52	1.66	2.35	6.29	127
Alcohol	Mean	7.6	5.42	2	3.08	3.3	37.4
	Med.	8	5.5	1	2	2	15
	Std.	2.46	2.21	1.86	2.57	3.06	40.6
Nonalcohol	Mean	7.69	5.61	2.1	3.39	5.31	92.4
	Med.	8	5	2	1.5	3	13.5
	Std.	2.59	2	1.82	6.83	9.44	230
Total	Mean	7.58	5.61	1.95	3.02	4.75	71.3
	Med.	8	6	1.85	2	3	20
	Std.	2.44	1.93	1.78	4.32	6.7	151

		Eating time	Weight	Gender	Drink addiction	Drink age	Drink amount
Nonalcohol-Announced	Mean	2.74	4	0.816	0.974	16.9	3.13
	Med.	2	4	1	1	18	3
	Std.	2.41	1.16	0.393	0.162	3.92	2.13
Alcohol	Mean	3.46	4	0.725	0.925	17.3	3.02
	Med.	2.25	4	1	1	19	2
	Std.	3.74	1.18	0.452	0.267	5.55	1.78
Nonalcohol	Mean	2.84	3.94	0.778	0.972	17.3	3.06
	Med.	2.35	4	1	1	18	2.5
	Std.	1.88	1.33	0.422	0.167	4	2.33
Total	Mean	3.03	3.98	0.772	0.956	17.1	3.07
	Med.	2	4	1	1	18	2.5
	Std.	2.82	1.21	0.421	0.206	4.55	2.06

4.1. Cutoff strategy and participation

We first investigate whether the subjects understand the structure and incentives of the game by studying their strategies during the experiment. In particular, we check whether they adopt a cutoff strategy as the theory predicts (Hypothesis 1a), and whether their probability of participation decreases with endowments (Hypothesis 1b).

If a subject adopts a cutoff strategy, she chooses participation if and only if her endowment is below a certain threshold. To check whether subjects adopt a cutoff strategy, we rank the endowments of each individual in all 20 periods, and identify the switching points from nonparticipation to participation. The cutoff endowment is then calculated as the mean of the two endowments where a subject switches. If a subject has multiple switching points, we take the mean of the cutoff values. Among the 114 subjects, 50 subjects have a single switching point; 38 and 14 subjects have two and three switching points.

For subjects with multiple switching points (multiple-switcher), the mean and median cutoff endowment are 6.73 and 6.70, with a standard deviation of 1.65. The average and the median distance between the highest and the lowest switching point are 2.20 and 1.90 respectively. These statistics imply that most subjects switch in the upper end of the endowment distribution between 1 and 10. Based on these findings, multiple-switchers clearly understand the incentive structure of the game; they might be uncertain about where to switch, rather than switching randomly. Therefore, our approach of taking the average cutoff for multiple switcher is reasonable. In the regression analysis, we add the multiple-switcher dummy in order to capture the behavioral differences of different types of subjects, if any.

The distributions of subjects' cutoff values in different treatments are shown in Fig. 1. The cutoff values of subjects in the alcohol treatment are distributed more toward the right, compared to the two nonalcohol treatments. We conduct the Wilcoxon rank-sum (Mann–Whitney) test to investigate whether the distribution of cutoff strategies differ across treatments.

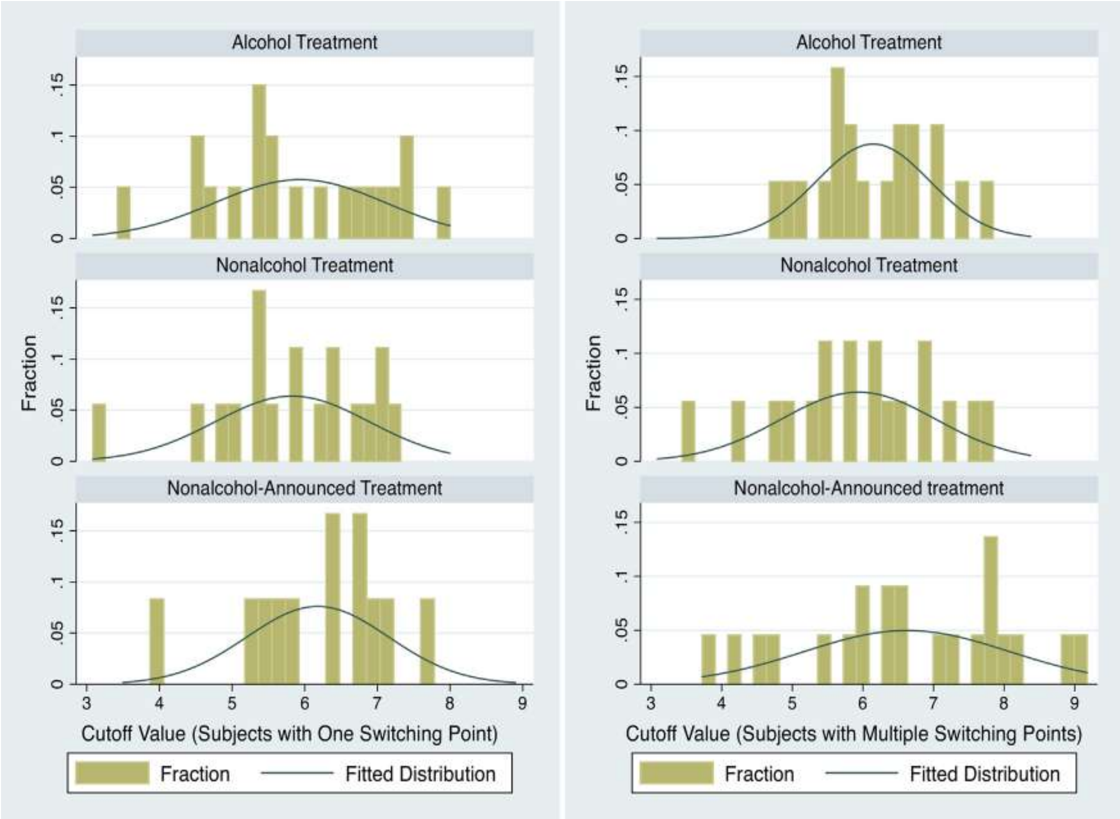

Fig. 1. Distribution of individual cutoff strategy by treatment.

The comparison of the Alcohol treatment against the Nonalcohol treatment gives a significantly positive statistics with a *p*-value of 0.0003. The comparison of the Nonalcohol treatment against the Nonalcohol-Announced treatment gives a positive statistics with a *p*-value of 0.0229. Considering only the subsamples of subjects with only one switching point, the *p*-value for the two tests are respectively 0.1808 and 0.0814. Thus, the tests cannot reject the null hypothesis that the distributions of cutoffs are equal across treatments at 5% level of significance.

Next, we consider how the proportion of subjects choosing to participate varies with their endowment. Fig. 2 shows that, in all treatments, the proportions of subjects participating in the joint project decrease with their endowment levels. When the endowment is between 1 and 4 dollars, almost all subjects participate in the alcohol treatment and a large proportion (around 90–95%) of the subjects join the project in the two nonalcohol treatments. When the endowment is above 8 dollars, the participation ratio drops to around 0.2.

Fig. 2 also shows that subjects in the alcohol treatment are more likely to join the project at almost all endowment levels, compared with their counterparts in the two nonalcohol treatments. The two nonalcohol treatments cannot be clearly ranked according to the figure.

The analysis above is summarized in the following finding.

Finding 1: About 44% of all subjects adopt a simple cutoff strategy with a single switching point; about 77% of subjects have no more than two switching points. Furthermore, the endowment level significantly reduces the likelihood that a subject would participate.

4.2. Treatment effect of alcohol use

In this subsection, we investigate the treatment effect of alcohol use. In particular, we are interested in finding out whether the alcohol effect (by comparing the Alcohol and Nonalcohol treatments) and the placebo effect (by comparing the Nonalcohol and Nonalcohol-Announced treatments) are present in our experiments.

According to Fig. 3, the proportions of successful agreements in all three sessions of the Alcohol treatment are higher than those in both nonalcohol treatments. Such an aggregate observation might not hold at individual-decision level, considering that endowment and other individual factors might affect both individual behavior and group outcome. We will further investigate the treatment effects using regression methods.

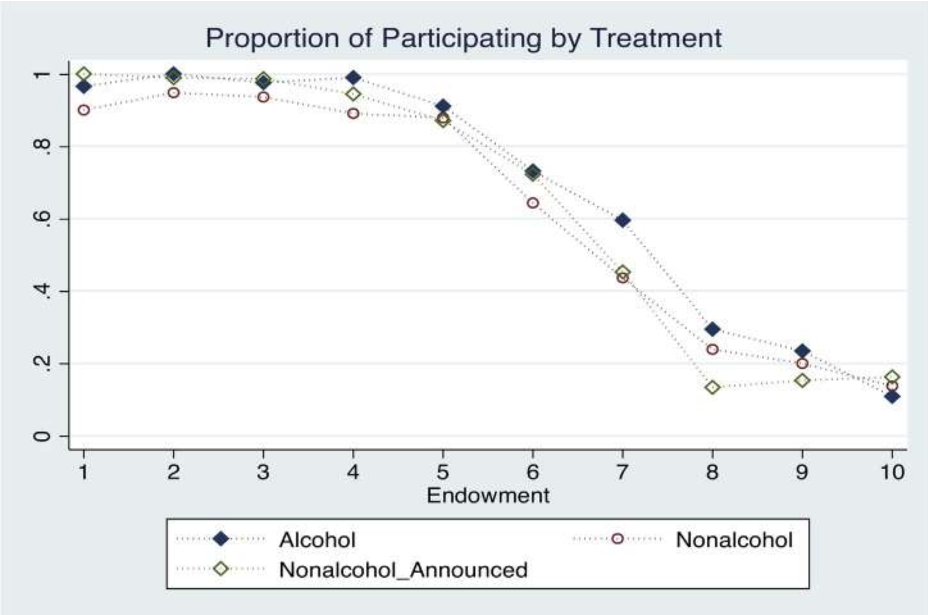

Fig. 2. Average participation from all periods. Obs. by endowment (1–10, rounded): 93, 277, 235, 234, 271, 253, 235, 267, 259, and 156.

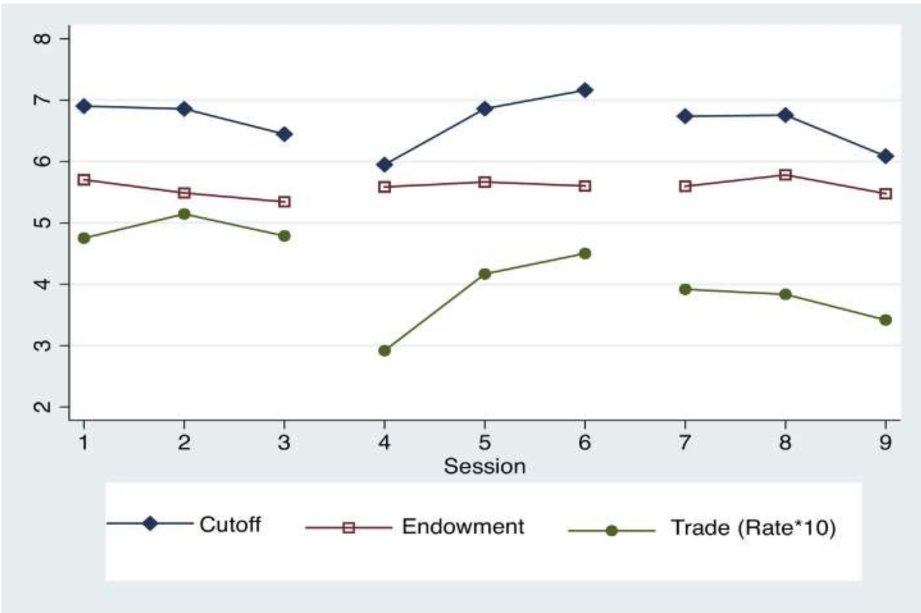

Fig. 3. Average cutoff, endowment, and trade by session. *Note*: Sessions 1–3, Alcohol; 4–6, Nonalcohol-Announced; 7–9, Nonalcohol treatment.

We begin our regression analysis by studying the participation rate at individual level. Table 2 shows the results on the determination of individual participation rate using linear probability model. The participation rate is significantly higher in the Alcohol treatment comparing to the default Nonalcohol treatment. The estimated rate varies between 9.29 and 14.9%. The placebo effect is not significant statistically. The last two columns of Table 2 report the estimation results of the effect of blood alcohol content (BAC) measures on the participation rate, for the subjects in the Alcohol treatment. The estimates are positive, but are neither significant nor robust across different specifications. As we have no direct control over subjects' BAC, the estimates cannot be interpreted as a causal effect, and they might be biased because of endogeneity problem.[12]

[12] There could be unobserved factors that are correlated with both the alcohol concentration measure and the participation rate. Also, the BAC measures might have measurement errors because of the use and the quality of testing tools.

Table 2
Determinants of participation rate: linear probability model.

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Alcohol	0.0929***	0.0938***	0.126***	0.149***		
	(0.0322)	(0.0319)	(0.0368)	(0.0334)		
Nonalcohol-Announced	0.0167	0.0158	0.0189	0.0442		
	(0.0348)	(0.0350)	(0.0360)	(0.0330)		
Endowment		0.00286	0.00100	3.07e−05	0.00218	−0.00187
		(0.00530)	(0.00556)	(0.00531)	(0.00854)	(0.0396)
Blood alcohol content					0.349	1.639
					(1.785)	(7.492)
Multiswitcher				0.0720**		−0.0100
				(0.0317)		(0.167)
Happiness				0.00401		0.0105
				(0.00690)		(0.0272)
Risk aversion				−0.0310		−0.00700
				(0.0226)		(0.0644)
Altruism				0.0172*		0.0249
				(0.00990)		(0.0301)
Eating time			−0.0106*	−0.00961		−0.00964
			(0.00541)	(0.00662)		(0.0171)
Weight			−0.0295**	−0.0219		−0.000279
			(0.0141)	(0.0153)		(0.0631)
Drink ability			0.00858	0.0108*		0.0126
			(0.00618)	(0.00636)		(0.0290)
Volunteer time			−0.00151	−0.00180		−0.0382*
			(0.00454)	(0.00480)		(0.0159)
Charity giving			0.00475	0.00601*		0.00535
			(0.00317)	(0.00348)		(0.0246)
Malaysia			0.333**	0.299*		
			(0.153)	(0.157)		
Other nationality			0.131	0.188*		−0.00161
			(0.0915)	(0.0959)		(0.267)
Constant	0.608***	0.593***	−17.15	−11.10	0.676***	−38.40
	(0.0240)	(0.0353)	(13.75)	(13.41)	(0.0832)	(57.30)
Observations	114	114	114	114	40	40

Notes: (1) Nonalcohol-Announced refers to the treatment with nonalcohol announced; the baseline (omitted) treatment is Nonalcohol treatment where subjects only know they are drinking beer. (2) Standard errors are in parentheses, clustered at session level. (3) Significance level: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

We have included the dummy variable for multiple switching in the regression analysis. It shows that multiple-switcher is more likely to participate in collaboration. However, the inclusion of this dummy variable has no significant impact on the estimated treatment effects among all specifications in the regression analysis.

Table 3 shows the estimated treatment effects on the decision of participating in the joint project, using the random effects logit model. Comparing to the baseline Nonalcohol treatment in which subjects do not know they are drinking nonalcoholic beer, the estimated alcohol effect, i.e., the coefficient of the Alcohol dummy, is significantly positive. This implies that subjects are more likely to participate under the influence of alcohol. The placebo effect, i.e., the coefficient associated with the Nonalcohol-Announced dummy, is not significant. The estimated treatment effects on agreement reaches the same conclusions, as shown in Table 4.[13]

In Table 4, we also include the time trend in the estimation. It has a significant negative impact on the likelihood of participating in collaboration. In Model 2, 5 and 6, the effect of time trend was separated by treatments, and most of the time-trend effect happens in the Nonalcohol-Announced treatment, rather than in the Alcohol treatment. These findings may arise from a learning effect: over the course of the experiments, they gain a better understanding of the incentive structure of the game.[14] The findings are not supportive for a hypothesis of diminishing alcohol effect over time.

We conducted additional robustness checks and the findings are consistent. As shown in Tables 3 and 4, higher endowment leads to less participation and agreement, consistent with the theory's prediction (Hypothesis 1b). We also include additional control variables based on the post-experiment survey, including social, economic, and demographic information, as well as subjects' personal drinking history.[15]

[13] We have conducted robustness tests by considering only the first 10 rounds, as we conducted a breath test for BAC after the first 10 rounds in the Alcohol treatment, which may affect subjects' behavior. The robustness tests show no significant difference in our estimates.
[14] Recall the BNE predicts a low cutoff value of 3.
[15] We omitted the estimates that are not significant from the table because of the space restriction, but the complete results are available from the authors upon request.

Table 3
Determinants of participating decision (random effects).

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Alcohol	0.433***	0.876*	0.961**	1.095***	1.200**	1.357***
	(0.151)	(0.512)	(0.400)	(0.323)	(0.569)	(0.499)
Nonalcohol-Announced (NA)	0.0774	0.712	0.310	0.610*	0.832	1.158**
	(0.156)	(0.519)	(0.377)	(0.312)	(0.535)	(0.482)
Endowment		−1.149***	−1.142***	−1.140***	−1.144***	−1.143***
		(0.175)	(0.173)	(0.172)	(0.173)	(0.172)
Period			−0.0287**	−0.0279*		
			(0.0146)	(0.0146)		
Period*Alcohol		−0.0267			−0.0273	−0.0271
		(0.0199)			(0.0199)	(0.0197)
Period*NA		−0.0531**			−0.0543**	−0.0544**
		(0.0256)			(0.0253)	(0.0252)
Period*Nonalcohol		−0.00190			−0.00459	−0.00235
		(0.0277)			(0.0279)	(0.0277)
Multiswitcher				0.523*		0.533*
				(0.297)		(0.297)
Happiness				0.0856		0.0862
				(0.0679)		(0.0677)
Risk preference				−0.273		−0.269
				(0.183)		(0.184)
Social preference				0.242***		0.244***
				(0.0914)		(0.0910)
Eating time			−0.102**	−0.0712	−0.101**	−0.0704
			(0.0492)	(0.0527)	(0.0491)	(0.0525)
Weight			−0.348***	−0.315**	−0.346***	−0.312**
			(0.132)	(0.133)	(0.131)	(0.133)
DrinkingAge			−0.0669**	−0.0675**	−0.0676**	−0.0680**
			(0.0319)	(0.0300)	(0.0321)	(0.0301)
Volunteer time			0.0163	0.0171	0.0169	0.0177
			(0.0400)	(0.0403)	(0.0399)	(0.0402)
Year of birth			0.127*	0.0927	0.127*	0.0927
			(0.0687)	(0.0637)	(0.0689)	(0.0637)
Malaysia			3.938**	3.203**	3.888**	3.145**
			(1.739)	(1.469)	(1.722)	(1.450)
Other nationality			0.995*	1.706**	1.039*	1.761**
			(0.602)	(0.747)	(0.602)	(0.747)
Constant	0.463***	7.714***	−242.5*	−176.7	−242.5*	−176.8
	(0.107)	(1.224)	(136.0)	(126.1)	(136.4)	(126.1)
Observations	2280	2280	2280	2280	2280	2280

Notes: (1) Nonalcohol-Announced refers to the treatment with nonalcohol announced; the baseline (omitted) treatment is Nonalcohol treatment where subjects only know they are drinking beer. (2) Standard errors are in parentheses, clustered at individual subject level. (3) Significance level: * $p<0.1$, ** $p<0.05$, *** $p<0.01$.

Alcohol may affect subjects' behavior through other channels, such as their mood, altruism, and risk aversion. To control for these alternative explanations, we test whether there is any treatment effect on subjects' happiness level, altruism, and risk aversion, using data solicited from the questionnaire, the second and third stage of the experiment respectively. To construct a measure of happiness level, in the questionnaire, we asked subjects to self-report the happiness level experienced during the experiments, using a scale of 1–10. The giving (in dollars) in the second stage measures the subject's altruism. Finally, the switching point in the task of Holt and Laury (2002) in the third stage provides a measure of the subject's risk aversion.

We find that the differences in happiness level, altruism and risk aversion across treatments are not statistically different. As shown in Table 5, subjects' happiness level, altruism and risk aversion during the experiment are not affected by our treatments. These results are in line with Corazzini et al. (2015). They find that alcohol consumption has practically no effect on risk aversion[16]; and a marginally negative effect on charity donation.

As alcohol consumption and information released do not change the altruism and risk aversion of participants, we can incorporate the measures for altruism and risk aversion into our regression analysis. We find that altruism increases the likelihood of participation and agreement, whereas risk aversion decreases their participation and agreement. The treatment effect of alcohol consumption remains robust.

Finding 2: Alcohol consumption leads to a higher level of participation in the joint project, and hence more agreement is reached.

[16] Except for a marginal positive effect for female subjects.

Table 4
Determinants of agreement (random effects).

	Pair outcome 1	Pair outcome 2	Pair outcome 3	Individual 1	Individual 2	Individual 3
Alcohol	0.483***	0.483***	0.535**	0.484***	0.651***	0.692**
	(0.0724)	(0.0724)	(0.240)	(0.0724)	(0.121)	(0.282)
Nonalcohol-Announced (NA)	0.0732	0.0732	0.757***	0.0733	0.0489	0.484**
	(0.183)	(0.183)	(0.265)	(0.187)	(0.205)	(0.203)
Endowment					−0.387***	−0.392***
					(0.0249)	(0.0266)
Period		−0.00395			−0.00646	
		(0.0112)			(0.0116)	
Period*NA			−0.0242			−0.0289
			(0.0214)			(0.0250)
Period*Alcohol			0.00663			0.00538
			(0.0183)			(0.0175)
Period*Nonalcohol			0.00466			0.00217
			(0.0136)			(0.0116)
Multiswitcher						0.242**
						(0.120)
Happiness						0.0410*
						(0.0213)
Risk preference						−0.112**
						(0.0549)
Social preference						0.0368
						(0.0385)
Eating time					−0.0322***	−0.0253**
					(0.00992)	(0.0114)
Weight					−0.130*	−0.108
					(0.0682)	(0.0865)
Volunteer time					−0.0138*	−0.0137
					(0.00813)	(0.0149)
Charity times					0.0369***	0.0429***
					(0.00906)	(0.00987)
Year of birth					0.0342***	0.0251*
					(0.0104)	(0.0146)
Malaysia					0.513**	0.819**
					(0.220)	(0.397)
Other nationality					0.518*	0.856***
					(0.269)	(0.278)
Constant	−0.523***	−0.481***	−0.705***	−0.524***	−66.29***	−49.37*
	(0.0573)	(0.144)	(0.144)	(0.0576)	(20.63)	(29.14)
Observations	1140	1140	1140	2280	2280	2280

Notes: (1) Nonalcohol-Announced refers to the treatment with nonalcohol announced; the baseline (omitted) treatment is Nonalcohol treatment where subjects only know they are drinking beer. (2) Standard errors are in parentheses, clustered at session level for the pair estimation and at individual level for the individual estimation. (3) Significance level: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Finally, we would like to point out that Finding 2 holds only at the group or treatment level. Recall in Table 2, the BAC measure has no significant effect on cooperation for the subjects in the Alcohol treatment.[17] One possible explanation is that, in our experiments, the amount of alcohol consumed is quite mild, and insufficient to create significant variation in the BAC measure among individual subjects, even though the aggregate effect exists at the group level.[18]

4.3. A structural model of quantal response equilibrium

As found in the previous section, alcohol consumption affects neither subjects' risk aversion nor altruism. Therefore, a possible explanation for the increase in the likelihood of participation after alcohol consumption, is that subjects under the influence of alcohol are more "cursed" in the sense of Eyster and Rabin (2005). In order to quantitatively evaluate the increase in cursedness induced by alcohol consumption, we estimate a structural model within a framework of quantal response equilibrium (McKelvey and Palfrey, 1995).

[17] We cannot include BAC in the regressions that estimate the treatment effects because of the collinearity between the BAC measure and treatment dummies, noting that we only measure BAC in the Alcohol treatment. In other words, the alcohol treatment effect absorbs the average impact of the BAC measure.

[18] Alternatively, as suggested by one referee, we might display the results of a regression in which we include BAC (but not the treatment dummies, due to collinearity) for all 114 subjects, where we impute BAC = 0 to all the subjects not in the Alcohol treatment. We would probably find a positive and significant effect of BAC, but such result would be partly based on imputed BAC and therefore would be questionable.

Table 5
Treatment effects on preferences.

	Risk aversion	Altruism	Happiness	Risk aversion	Altruism	Happiness
Alcohol	−0.186	−0.103	−0.0944	−0.700	0.334	−0.524
	(0.477)	(0.187)	(0.633)	(0.427)	(0.257)	(0.723)
Nonalcohol-Announced	0.205	−0.358	−0.247	0.0425	−0.293	−0.932
	(0.195)	(0.297)	(0.564)	(0.396)	(0.317)	(0.773)
Profit stage 1				0.292***	0.0190	−0.302*
				(0.0851)	(0.117)	(0.141)
Endowment				−0.287**	0.136	0.0726
				(0.110)	(0.106)	(0.100)
Multiswitcher				−0.315	0.127	−0.777
				(0.447)	(0.366)	(0.683)
Eating time				0.112**	−0.114***	0.0269
				(0.0452)	(0.0338)	(0.0940)
Weight				0.364**	0.0606	0.671***
				(0.121)	(0.199)	(0.135)
Drinking addiction				−0.0421	1.081	−1.881**
				(0.540)	(0.761)	(0.570)
Volunteer time				0.00319	0.0329	−0.0307
				(0.0372)	(0.0306)	(0.0486)
Charity amount				−0.00131	0.00100	0.00256
				(0.00137)	(0.00129)	(0.00176)
Gender				−1.201**	−0.0204	−0.394
				(0.419)	(0.427)	(0.574)
Malaysia				−3.705	3.934***	1.221
				(2.833)	(0.551)	(0.867)
China				0.798	0.803	2.466*
				(1.169)	(0.527)	(1.245)
India				2.161*	−1.649*	−5.566**
				(1.160)	(0.795)	(2.087)
Other nationality				2.853**	−0.415	−1.136
				(1.112)	(0.580)	(1.754)
Constant	5.611***	2.103***	7.694***	191.5	−73.16	190.0
	(0.135)	(0.126)	(0.555)	(126.1)	(112.5)	(171.6)
Observations	114	114	114	114	114	114

Notes: (1) Nonalcohol-Announced refers to the treatment with nonalcohol announced; the baseline (omitted) treatment is Nonalcohol treatment where subjects only know they are drinking beer. (2) Standard errors are in parentheses, clustered at session level. (3) Significance level: * $p<0.1$, ** $p<0.05$, *** $p<0.01$. (4) The reference group for Nationality dummies is Singapore. 5 Results are robust, if only treatment dummies are included.

We specify the model to be estimated below. Define by $P(\theta)$ the probability of participation, given endowment θ. With cursedness χ, the perceived expected utility of participation, given endowment θ, is given by

$$U(\theta) \equiv (1-\chi)\left\{\frac{1}{91}\sum_{s\in\{1,1.1,1.2,\ldots,10\}}\left[P(s)\left(\frac{1}{2}V(\theta,s)\right)+(1-P(s))\theta\right]\right\} + \chi\left[\left(\frac{1}{91}\sum_{s\in\{1,1.1,\ldots,10\}}P(s)\right)\left(\frac{1}{2}V(\theta,5.5)\right)+\left(1-\frac{1}{91}\sum_{s\in\{1,1.1,\ldots,10\}}P(s)\right)\theta\right]. \tag{3}$$

On the other hand, the perceived expected utility of non-participation, given endowment θ, is just θ. We adopt a logit quantal response equilibrium (QRE) by assuming that the probability of participation is positively related to the relative perceived utility, according to the following formula:

$$P(\theta)=\frac{\exp(\mu U(\theta))}{\exp(\mu U(\theta))+\exp(\mu\theta)}, \tag{4}$$

where $\mu>0$ is the error parameter.

In our estimation, we first numerically compute the function $P(\theta)$ for each pair of parameter (χ, μ). This involves numerically solving for the fixed point characterized by the system of Eqs. (3) and (4). We then compute the maximum likelihood estimates of this cursed QRE model. Results are reported in Table 6. The standard errors are corrected for individual clusters.[19]

[19] The data and Matlab codes for the estimation are available upon request.

Table 6
Estimation results of quantal response equilibrium (QRE).

Treatment	QRE by treatment			QRE all treatments		
	χ	μ	QLLH	χ	μ	LLH
Alcohol	0.4593 (0.1083)	3.2609 (0.4681)	282.58	0.4611 (0.1018)		
Nonalcohol	0.3055 (0.0642)	3.7682 (0.4847)	269.06	0.3022 (0.0701)	3.2308 (0.3506)	870.17
Nonalcohol-Announced	0.2020 (0.0807)	2.7808 (0.6934)	314.12	0.2094 (0.0727)		

Notes: (1) LLH represents the maximum loglikelihood; (2) Standard errors are in parentheses; (3) χ is the cursedness parameter and μ is the error parameter in the QRE.

According to Table 6, the estimated cursedness χ of the Alcohol treatment significantly exceeds that of the Nonalcohol treatment, indicating a clear alcohol effect. Moreover, the estimated cursedness of the Nonalcohol treatment exceeds that of the Nonalcohol-Announced treatment, providing supporting evidence for the placebo effect.

As a robustness check, we impose a uniform value of error parameter μ across treatments and conduct an additional maximum likelihood estimation. The results, reported in the 4th and 5th columns of Table 6, are similar in magnitude and direction to those using different μ.

To summarize, both the regression and the QRE estimation provide support for the existence of alcohol effect (Hypothesis 2). Alcohol consumption affects neither subjects' mood, altruism, nor risk aversion. A plausible channel through which the alcohol effect takes place is limiting subjects' ability to infer information content of other subjects' action, as confirmed by the estimation results of a cursed QRE model.

The evidence for the placebo effect (Hypothesis 3), which may arise as the subjects expect others to be intoxicated and have a higher willingness to participate, is less supportive. Whereas the cursed QRE estimation gives positive placebo effect, the regression analysis finds no significant effect. We conjecture the reason for the weak placebo effect is that subjects infer others' intoxication level from their own feeling: if she does not feel drunk (recall she drank a nonalcoholic beer), she may correctly infer that her fellow partner is likely to be sober and have a low willingness to participate. Consequently, she is less likely to participate herself.

Finding 3: The estimation of quantal response equilibrium shows that subjects are more cursed in the treatment with alcohol consumption than in the nonalcohol treatments.

5. Concluding remarks

Given the harmful effects of excessive alcohol consumption on health are well-known, it is not clear and therefore interesting to investigate why aggressive business drinking has become a routine, and even an accepted culture in many countries. In this study, we make the first attempt to study the effect of a mild amount of alcohol consumption on bargaining under incomplete information. We find a positive effect of alcohol consumption on the efficiency of bargaining in a specific experimental setting. Our finding suggests that consuming a mild to moderate amount of alcoholic drink in business meetings can potentially help smooth the negotiation process.

Out of the concern of health risk, the alcohol consumption of subjects in our experiment is mild relative to business drinking in real world. Our results still can shed useful light on understanding the effect of business drinking. First, the alcohol intoxication effects, especially on information processing and working memory, have shown to be present even at a mild dose of alcohol similar to that used in our experiment (Dry et al., 2012). Moreover, the intoxication effect is increasing in BAC up to a moderate level. We thus conjecture that a slight increase in dosage would strengthen our results. Second, the medical literature has well documented that chronic alcohol consumption makes the drinker develop tolerance to some of alcohol's effects.[20] Consequently, the amount of alcohol needed to achieve a certain level of intoxication for a graduate student (who do not drink much typically) can be much smaller than the amount for a businessman (who drinks more heavily and frequently).

Despite the aforementioned positive effect for a mild dose of alcohol, caution must be exercised in extrapolating the results too far. It is well known that an excessive dose of alcohol can lead to a range of harmful effects, including aggressive and violent behaviors (Dougherty et al., 1999), as well as impairment in problem solving ability (Streufert et al., 1993). Therefore, it is almost certain that excessive drinking would hamper efficiency in bargaining.

What are the channels through which alcohol use affects bargaining strategies and outcomes in our setting? It is commonly accepted that alcohol use lowers one's ability to make appropriate reasoning and inference from available information.

[20] See National Institute on Alcohol Abuse and Alcoholism (1995) and the references therein. Alcohol tolerance can be developed through two main channels described below. With functional tolerance, brain functions adapt to compensate for the disruption caused by alcohol in both their behavior and their bodily functions. With metabolic tolerance, a group of liver enzymes becomes more effective in alcohol degradation, thereby reducing the duration of alcohol's intoxication effects.

Therefore, in settings in which skepticism can lead to a breakdown in negotiation, alcohol consumption can make people drop their guard for each others' actions, thus facilitating reaching an agreement. Our QRE estimation of a cursed equilibrium provides some support for this channel.

Other conceivable channels can be ruled out as follows. First, in line with the existing literature on the effect of alcohol use, we find that a mild does of alcohol has little (if not zero) effect on our subjects' risk aversion and altruism. Therefore, the increase in willingness to collaborate does not arise from a decrease in risk aversion, and/or an increase in altruism. Second, the positive effect of alcohol in social setting has often been attributed to creating a more comforting and relaxing atmosphere. Our experiment is conducted in a laboratory, and each subject consumed the given beer individually. As such, the socializing effect of alcohol is clearly absent in our setting. Third, alcohol consumption has been suggested to have a signaling value that one is trustworthy and is ready to commit to a relationship. (See for example, Haucap and Herr (2014) and Schweitzer and Kerr (2000).) In our study, treatments are randomized and enforced by the experimenters: subjects do not get to choose whether and what type of drink to consume, so they cannot signal their private information. Whereas our experiment design abstracts away from the second and the third channels discussed above, future research can consider alcohol's effects on relieving tension and building trust in a social setting.

Appendix. Instruction.

General instruction

This experiment is a study of decision-making. If you follow the instructions carefully and make good decisions, you may earn a considerable amount of money. If you have any questions, please raise your hand and someone will speak with you privately about your question. We ask that you do not use your phone or other device, do not drink or eat unless we ask you to do so, and do not talk with one another for the duration of the experiment.

As part of this study, we will first ask you to drink one cup of beer in 6 min. After everyone has finished the drink, we will proceed to the experiment that consists of 3 stages.

Stage 1

Stage 1 consists of 20 periods. In each period you will be randomly matched with another participant, and you are required to make some decisions. What you earn from each decision will depend on what you and the other participant decide.

Once all your decisions in the 20 periods have been made, we will randomly select one of from the first 10 and one from the second 10 periods as the periods-that-count. We will use the periods-that-count to determine your actual earnings. Since all periods are equally likely to be chosen, you should make your decision in each period as if it will be the periods-that-count.

We will give you the opportunity to practice 2 periods before the 20-periods formal experiment.

At the beginning of each period, each of you will be given an endowment that is randomly generated between $1 and $10. Any number between 1 and 10 can be drawn with equal probability. The endowments are private information: You do not know the endowment of your partner, and your partner does not know your endowment either.

Then, you will be choosing whether to participate in a joint project or not.

If EITHER you OR your partner declines to participate in the joint project, both of you will keep your respective endowments.

If both of you agree to start the joint project, the total output of the project will be equally divided between you and your partner. The project's total output is determined by the endowments of you and your partner according to the following formula:

$$(1.2) * (\text{your endowment} + \text{partner's endowment})$$

Because total output is shared equally, both you and your partner will collect

$$(0.6) * (\text{your endowment} + \text{partner's endowment})$$

Here are a few examples on how to compute the payoff from one period.

Example: Suppose your endowment is $2.8 and you decide to participate in the joint project; the endowment of your partner is $8 and also decides to join the project. Then, each of you will get 0.6 * ($2.8 + $8) = $6.96.

Example: Suppose your endowment is $8 and you decide to participate in the joint project; the endowment of your partner is $2.8 and also decides to join the project. Then, each of you will get 0.6 * ($8 + $2.8) = $6.96.

Example: Suppose your endowment is $8 and you decide NOT to participate in the joint project; the endowment of your partner is $2.8 and decides to join the project. Then, each of you will keep your respective endowment $8 and $2.8, because the joint project is not started.

Example: Suppose your endowment is $8 and you decide to participate in the joint project; the endowment of your partner is $2.8 and decides NOT to join the project. Then, each of you will keep your respective endowment $2.8 and $8, because the joint project is not started.

Example: Suppose your endowment is $8 and you decide to participate in the joint project; the endowment of your partner is $7.2 and also decides to join the project. Then, each of you will get 0.6 * ($8 + $7.2) = $9.12.

Example: Suppose your endowment is $3 and you decide to participate in the joint project; the endowment of your partner is $1 and also decides to join the project. Then, each of you will get 0.6 * ($3 + $1) = $2.4.

Example: Suppose your endowment is $4 and you decide to participate in the joint project; the endowment of your partner is $3 and also decides to join the project. Then, each of you will get 0.6 * ($4 + $3) = $4.2.

At the end of each period, you will receive an earning statement for that period. You will be given anonymous details of your partner's decision as well. In the next period, you will be again randomly matched with another participant and make the same decision.

After the stage 1, we will then explain the instructions for stage 2 and stage 3.

Please note: You must make your decisions without knowing what the others are deciding. Do not discuss your decision with any other participant.

Stage 2 (will not be given written instruction for this stage, but simply show this on the screen)

Now you will be randomly matched with another participant to make a decision. If you give up 1 dollar of your earning, it will increase the earning of the participant paired with you by 2 dollars. The other participant paired with you can do the same thing. You need to decide how much you want to give up. You can give up AT MOST $5 of your earnings from stage 1 of the experiment.

For example, if you give up $2, the person matched with you will get $4, and you will LOSE your $10. If your partner gives up $1, you will get $2, and your partner will lose $1.

Instructions for stage 3 (give written instructions but separately)

In this part of the experiment you will be asked to make a series of choices. How much you receive in this stage will depend partly on chance and partly on the choices you make. The decision problems are not designed to test you. What we want to know is what choices you would make in them.

For each line in the table that will be shown to you on the screen, please state whether you prefer option A or option B. Notice that there are a total of 10 lines in the table but just one line will be randomly selected for payment. You do not know which line will be paid when you make your choices. Hence you should pay attention to the choice you make in every line. After you have completed all your choices, the computer will randomly generate a number, which determines which line is going to be paid.

Your earnings for the selected line depend on which option you chose: If you chose option A in that line, you will receive $3. If you chose option B in that line, you will receive either $9 or $0. To determine your earnings in the case you chose option B there would be second random draw. The computer will randomly determine if your payoff is $9 or $0, with the chances stated in option B.

You earnings from part will be revealed at the end of the study after you have completed a short questionnaire that will be shown to you on your computer screen.

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