In Vino Veritas?
Communication Under the Influence - An Experimental Study*

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Abstract

We report results from controlled laboratory experiments designed to investigate the effects of drinking alcohol on communication and transactions. In a game played in laboratory experiments, sellers who are privately informed about their asset's quality communicate and trade with potential buyers after both parties drink their given alcoholic beverages. We investigated the effects of alcohol consumption by varying the alcohol content of the assigned beverages across treatments. Our main findings are as follows. First, sellers with a drink of a high alcohol content lie significantly more often than those with a drink of a low alcohol content. Second, upon receiving a "High" message, buyers with a drink of a high alcohol content make higher offers for assets than those with a drink of a low alcohol content. Third, the public availability of information on alcohol content does not change players' behavior significantly. These findings are qualitatively consistent with the model of communication with a lying cost and naive receivers, suggesting that alcohol consumption lowers both the lying cost and the receiver's sophistication when interpreting messages, although we cannot completely rule out the possibility that the observed effect is due to something other than alcohol intoxication.

Keywords: Sender-Receiver Games, Communication Under the Influence, Laboratory Experiments, Alcohol Drinking, Lying

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Round, round with the glass, boys, as fast as you can,
Since he who don't drink cannot be a true man.
For if truth is in wine, then 'tis all but a whim
To think a man's true when the wine's not in him.
Drink, drink, then, and hold it a maxim divine
That there's virtue in truth, and there's truth in good wine!

In Vino Veritas, Benjamin Cooke (1770s)

1 Introduction

Are people more truthful when they are under the influence of alcohol? The Latin phrase "In vino veritas" (which translates into "in wine, truth") and the Chinese phrase "After wine blurts truthful speech" illustrate a belief prevalent across ages and cultures in which people under the influence of alcohol are more open to revealing their hidden thoughts. According to the Roman historian Tacitus (Tacitus, 1908), the Germanic peoples kept council at feasts because they believed that drinking prevented the participants from concealing opinions. In modern times, especially in countries such as China, Japan, Korea, and Russia, alcohol consumption is an integral part of business negotiations; major business decisions are, more often than not, made after the involved parties drink together. In her study of international business culture, Meyer (2014) states that across East Asia, drinking a substantial amount with customers and collaborators is routine. In these cultures, it is believed that drinking provides an opportunity to let one's hair down and express one's real thoughts.

In this paper, we use laboratory experiments to investigate whether alcohol consumption makes people more truthful and thereby facilitates negotiations plagued with information asymmetry. We adopt the lemon market environment considered by Forsythe, Lundholm, and Rietz (1999): a seller who is privately informed about her asset type sends a cheap-talk message (Crawford and Sobel, 1982) to a buyer who, in turn, makes a price offer for the asset. Although transferring the asset to the buyer would be Pareto efficient and feasible, information asymmetry prevents efficient trade from materializing (Akerlof, 1970). Assuming players are perfectly rational, the unique equilibrium of the game has no information transmitted in the communication stage and no trade for any but the lowest type of assets.

To investigate the channels through which drinking systematically affects the outcome in the lemon market under study, we develop a simple behavioral model in which the seller has a lying cost and the buyer may be credulous. Specifically, the seller incurs a lying cost whenever she sends a message other than the true type of the asset she is holding, and a fraction of credulous buyers take the sellers' message at face value. The model predicts that when the lying cost is sufficiently low and/or the fraction of credulous buyers is sufficiently high, partial information transmission is possible. Moreover, the lower the lying cost is and the higher the fraction of credulous buyers is, the more likely the seller will be to inflate her asset type. These predictions are in line with the findings of Forsythe et al. (1999) that sellers often exaggerate their asset's quality and that some buyers are deceived, resulting in a gain to sellers at the expense of buyers, unlike the theoretical prediction described above.

Based on the simple model with the seller's lying cost and the receiver's credulity, we hypothesize that drinking may influence players' behavior through two different channels. The first is a *direct* channel, according to which drinking changes the seller's lying cost and the buyer's degree of credulity. The second is an indirect channel, via players' *beliefs*. On the one hand, alcohol consumption could lead a seller to believe that the buyer is more credulous, thus increasing her expected payoff from inflating her asset type. On the other hand, alcohol may lead the buyer to believe that the seller is more truthful (as the folk wisdom goes); thus, the buyer may be more willing to make a high price offer following a favorable message. Whether sellers are more truthful and whether buyers are willing to make higher offers after drinking depend on the direction and the relative strength of these effects and is thus an empirical inquiry.

To investigate the effect of alcohol on communication and trading, we ask our subjects to drink one cup of an alcoholic beverage at the beginning of the experiment. There are two types of beverages: high alcohol content (11% alcohol by volume) and low alcohol content (1% alcohol by volume). By varying the alcohol content of the drinks given to subjects and the information about the content, we are able to study the effects of alcohol on communication and trading behaviors and the possible channels through which these effects take place.

Our main experimental findings are as follows. First, sellers with a drink of a high alcohol content lie significantly more than sellers with a drink of a low alcohol content. Second, buyers with a drink of a high alcohol content tend to make higher offers for the asset. Third, public availability of information on alcohol content does not change players' behavior significantly. Taken together, these findings suggest that alcohol consumption directly lowers people's lying cost and raises their degree of credulity, leading sellers to lie more and buyers to offer more. The indirect channel via beliefs plays a nonsignificant role in how alcohol consumption affects players' behaviors.

Whereas the second finding is in accord with the intuition that alcohol lowers people's ability to extract information from received messages (see, for example, Steele and Josephs (1990)), the finding that people with a drink of a high alcohol content are more likely to lie runs counter to the conventional wisdom that alcohol makes people more truthful. One possible explanation for this finding is that alcohol intoxication weakens the inhibitory restraint over one's immoral and improper behaviors (see, for example, Steele and Southwick (1985), Denton and Krebs (1990), and MacDonald et al. (1995)), so subjects who are under the influence behave less honestly. However, caution must be exercised in extrapolating from our experimental results for real-world business negotiations. First, due to concerns about alcohol's health risks, the volume of alcoholic beverages given to the subjects in our experiments was quite small compared to real-world business settings. Second, communication and negotiation in business meetings can be much more complicated than the simple experimental games we studied.[1] Third, we cannot completely exclude the possibility that our results are driven by something other than the impact of alcohol intoxication (e.g., a placebo effect or an excuse effect). Nonetheless, our result casts doubt on the conventional wisdom about the effect of alcohol, especially when only a small amount is consumed.

There are a few other conceivable channels through which alcohol consumption could affect behaviors. First, it is not difficult to imagine that drinking may affect an individual's degree of bounded rationality. As presented by Crawford (2003), lying and deception can occur when players in communication games are not fully rational. Second, individuals' attitude toward risk may be influenced by drinking. Third, drinking may affect individuals' social preferences.

To test whether the alternative channels discussed above are the primary sources of the experimental results we obtained, we designed three additional stages that followed ten rounds of the communication-trading game in the experiments. First, we had subjects play the 2/3 beauty contest (referred to here as the guessing game)[2] to obtain a simple but reasonable measure of our subjects' average degree of bounded rationality. We find that there is no significant difference in the average number chosen by subjects given high-alcohol-content drinks and that chosen by subjects given low-alcohol-content drinks. Second, we asked our subjects to play the dictator game (Kahneman, Knetsch, and Thaler, 1986) to obtain a reasonable measure of their social preference. We again find that there is no significant difference between the average split proposals offered by subjects under the influence of a high alcohol content and those offered by subjects under no such influence in any treatment. Third, we elicited individuals' risk attitudes and found no systematic evidence that drinking influences their risk tolerance.[3]

The rest of the paper is organized as follows. The related literature is discussed below. Section 2 presents the theoretical environment of the lemon market with strategic information transmission, describes the model of sellers' lying costs and buyers' credulity and shows that partial communication may be possible in equilibrium. The experimental design, hypotheses, and procedure are discussed in Section 3. We report our experimental findings in Section 4. Section 5 concludes the paper. The descriptive analysis, omitted proofs and tables, and sample

[1] For example, information transmission can occur through verifiable disclosure or costly signaling, and negotiation may involve multiple stages of offers and counter offers.

[2] See, e.g., Stahl and Wilson (1994, 1995) and Nagel (1995).

[3] This result is consistent with the findings in Breslin et al. (1999) and Lane et al. (2004).

experimental instructions are presented in the Appendices.

1.1 Related Literature

The effect of alcohol intoxication on individuals' cognitive abilities and decision-making has been studied extensively in the psychology literature. According to the survey by Steele and Josephs (1990), alcohol intoxication impairs ones' information processing ability. It restricts the range of cues that one can perceive in a situation and reduces our ability to process and extract meaning from the cues and information perceived. This effect is in line with our hypothesis that in our experiments, buyers under the influence of alcohol are less likely to correctly update their beliefs about the sellers' asset type based on the messages received and thus are more likely to take the messages at face value. Steele and Southwick (1985) show that alcohol intoxication weakens inhibitory control, making one more likely to engage in behaviors with negative consequences. Abernathy et al. (2010) survey possible neuromechanisms through which alcohol affects decision-making.

There are a few more recent papers that report results from an incentivized experimental environment. Corazzini et al. (2015) found that alcohol intoxication makes people less altruistic and less patient but does not have any significant effect on people's risk tolerance. Similarly, Bregu et al. (2017) and Brañas-Garza et al. (2020) found that alcohol consumption has little systematic effect on economic behavior. However, based on self-reported alcohol use, Fielding et al. (2018) found a significant negative association between individuals' alcohol consumption levels and their generosity.

There is a relatively small body of economic literature on alcohol consumption and its immediate effects. Wang and Houser (2019) experimentally investigate the effects of alcohol intoxication on promise-making and promise-breaking behaviors in a Prisoners' Dilemma Game with preplay communication. They find that alcohol consumption increases male subjects' promise-making but has no impact on their promise-keeping. Our study complements theirs by focusing on another important aspect of business negotiation — overcoming information asymmetry about the gain from trade. Au and Zhang (2016) find that subjects under the influence are more willing to collaborate despite an adverse selection problem. Schweitzer and Gomberg (2001) study the effect of alcohol consumption on the task of structuring a hypothetical offer for a job candidate and find that subjects under the influence use more aggressive tactics and make more mistakes. The long-term effect of alcohol consumption has been studied more extensively, especially in the labor economics literature. Empirical studies have identified a positive relationship between moderate alcohol consumption and earnings. Bray (2005) shows that the effect arises because moderate alcohol consumption improves the return to education and work experience and thus human capital accumulation. Other studies attribute the relationship to the positive impact of moderate alcohol consumption on physical health (MacDonald and Shields, 2001), mental health (Peele and Brodsky, 2000), and social network development (Ziebarth and Grabka, 2009). In a related but different vein, Wang et al. (2017) find that self-control can be improved by systematically resisting alcohol consumption. Furthermore, there are a few theoretical studies related to alcohol consumption building on the assumption that people are more likely to reveal their private type after drinking. Haucap and Herr (2014) propose a signaling model and identify a separating equilibrium in which only high-productivity agents engage in social drinking, and positive assortative matching arises in the subsequent social-interaction stage. Finkle and Shin (2014) suggest that a principal can reduce the agent's information rent by compelling the agent to drink excessively.

The communication game we study belongs to the literature of cheap talk pioneered by Crawford and Sobel (1982). A number of theoretical studies in this literature incorporate senders' lying aversion and receivers' credulity to explain the overcommunication phenomenon frequently documented in the experimental literature (e.g., Dickhaut et al. (1995), Blume et al. (2001), Cai and Wang (2006) and Wang et al. (2010)). Assuming an unbounded message space, Kartik et al. (2007) identifies a fully separating equilibrium in which senders' messages are inflated and credulous receivers are deceived. Kartik (2009) considers a bounded message space and shows that there is always pooling at the highest messages. Chen (2011) assumes that a fraction of senders are truthful and finds that in the limit, as the behavioral types vanish, only top messages are sent, and the equilibrium converges to the most informative equilibrium identified in Crawford and Sobel (1982). In this paper, we adopt their modeling approach in our communication-trading game to study the channel through which alcohol consumption affects the behaviors of sellers (senders) and buyers (receivers).

There is extensive literature on bargaining under asymmetric information. The game we study belongs to the class of lemon markets pioneered by Akerlof (1970). Experimental studies on this class of games have shown that people often suffer from the winner's curse: buyers offer prices that are so high that acquiring the object translates into losses (e.g., Kagel and Levin (1986) and Holt and Sherman (1994)). Explanations for the winner's curse phenomenon have been proposed in Eyster and Rabin (2005) and Charness and Levin (2009). Eyster and Rabin (2005) introduce the notion of a cursed equilibrium in which players do not fully incorporate the information content in other players' actions. Charness and Levin (2009) propose that the winner's curse originates from peoples' inability to perform conditional reasoning. While we also find that in our experiments, subjects who play the role of buyers often make price offers above the equilibrium value (under full rationality), our objective is *not* to uncover the "origin" of such behaviors. Instead, we are primarily interested in whether intoxicated buyers are more likely to be influenced by the seller's message.

2 Theoretical Environment

Our theory and experiment are based on the model of strategic information transmission in a lemon market considered by Forsythe et al. (1999). The game is played between a (female) seller and a (male) buyer. Each seller is endowed with an asset, and each buyer is endowed with some money. The asset held by the seller can be one of the following three possible types: *high*, *medium*, or *low*. The asset's type is drawn from a uniform distribution, that is, $\Pr(\theta) = 1/3$ for all asset types $\theta \in \{h, m, l\} \equiv \Theta$. Asymmetric information is modeled by having the realized type revealed only to the seller and not to the buyer. Every player prefers a higher-type asset to a lower-type asset, and the buyer values the asset more than the seller regardless of the asset's type. Let b_θ and s_θ be the asset's value to the buyer and seller, respectively. In these notations, $b_h > b_m > b_l$, $s_h > s_m > s_l$, and $b_\theta > s_\theta$ for all θ.

Bargaining is modeled as the buyer making a take-it-or-leave-it offer to the seller. The set of possible price offers is restricted to $\Pi \equiv \{p_h, p_m, p_l\}$ with $p_h > p_m > p_l$ and $b_\theta > p_\theta > s_\theta$ for all θ so that a Pareto-improving trade is always feasible. After receiving the offer, the seller can decide either to accept or reject it. If she accepts, a trade takes place, and she sells the asset to the buyer at the offered price. If she rejects the offer, trade does not take place, and the players keep their respective endowments.

After the seller learns the asset's type but before the buyer makes an offer, the seller can send a cheap-talk message to the buyer. The set of feasible messages is M ={"High", "Medium", "Low", "Not reveal"}. Each message is costless to both players, and the seller is not obliged to send a message that coincides with the asset type.

The seller's strategy consists of a reporting component and an acceptance component. Her reporting strategy is a mapping from the set Θ of asset types to the message space M. Her acceptance strategy is a mapping from M and the price offer space Π to acceptance/rejection decisions. The buyer's strategy is a mapping from M to Π.

The Bayesian Nash equilibrium of the game above can be solved by backward induction. In the last stage, the seller holding an asset of type θ would accept the price offer p if and only if $p > s_\theta$. Taking this acceptance rule into account, the buyer evaluates the asset conditional on his offer being accepted and chooses a price $p \in \{p_h, p_m, p_l\}$ that maximizes $E[b_\theta - p | p > s_\theta] \times \Pr(p > s_\theta)$. It is clear that the seller's message plays no role in the computation, so the message should be disregarded by the buyer altogether. Consequently, the seller should be indifferent between any of the messages, and the only equilibrium outcome in the communication stage is babbling.

The lemon property of the transaction can be modeled by the following parametric assumptions:

Assumption 1.

(a) $p_m < s_h$, $p_l < s_m$ and

(b) $(b_l - p_l)/3 > \max\{(b_m + b_l - 2p_m)/3, (b_h + b_m + b_l)/3 - p_h\}$.

With assumption 1(a), it is necessary to offer at least p_θ to induce a type-θ seller to sell her asset. Assumption (ii) implies that at the prior belief, the buyer finds it optimal to offer p_l. The following proposition summarizes the discussion above: a formal proof is omitted, as it is trivial.

Proposition 1 (Babbling Prediction). *Suppose the parametric assumption 1 holds. In the unique Bayesian Nash equilibrium outcome, 1) the seller's message does not depend on the type of asset, 2) the buyer's price offer does not depend on the message received, and 3) only the low-type asset is traded.*

2.1 A Model with Lying Cost and Credulity

In this subsection, we discuss a simple model, à la Chen (2011), Kartik et al. (2007), and Kartik (2009), in which partial information transmission could arise as an equilibrium outcome. In the model, a fraction of buyers are not as skeptical as required in Bayesian Nash equilibrium. The benefit of deceiving this group of buyers by overreporting the asset type is, however, limited by the existence of a lying cost. The purpose of such a model is to help develop *testable hypotheses* on the channels through which alcohol consumption could potentially affect communication and trading in the game under study. Therefore, we make a number of assumptions to keep the model as simple and tractable as possible, instead of pursuing the most general model of costly lying and receivers' credulity.

The game is identical to that in the previous subsection except that some players are assumed to have different payoff functions. On the sellers' side, we assume that she must bear a lying cost whenever her report differs from her true asset type. Specifically, the respective costs of a one-step lie and a two-step lie[4] are λ_1 and λ_2, with $0 \le \lambda_1 \le \lambda_2 \le 2\lambda_1$; that is, the marginal cost of lying is nonnegative and non-increasing.[5] On the buyers' side, there are two types of them: sophisticated and naive. A sophisticated buyer understands the sellers' incentives and updates his belief accordingly. Moreover, he adopts the most pessimistic belief about the asset type following off-path messages. A naive buyer, in contrast, takes the seller's message at face value (simply offers p_θ after receiving message θ). The fraction of naive buyers is denoted by $\chi^* \in [0, 1)$. The following parametric assumptions are adopted.

[4] A one-step lie includes reporting "Medium" when the true asset type is low, or reporting "High" when the true asset type is medium. A two-step lie refers to reporting "High" when the true asset type is low.

[5] Justification for this specification is as follows. Lying consists of a fixed cost component and a variable cost component. A fixed cost is incurred whenever the sender departs from truth-telling. Once the decision to lie is made, the sender also needs to pay a variable cost that depends on the magnitude of the lie. In our setting, the assumption $\lambda_1 \le \lambda_2 \le 2\lambda_1$ arises if the fixed cost of lying is positive and a variable marginal cost that increases at a rate no higher than the fixed cost.

Assumption 2.

(a) $(b_h + b_\theta)/2 - p_h < (b_\theta - p_\theta)/2$ for $\theta \in \{m, l\}$, and $(b_m + b_l)/2 - p_m < (b_l - p_l)/2$.

(b) $p_h - p_m = p_m - p_l$

Assumption 2(a) is related to the lemon property. It implies that a sophisticated buyer is willing to offer only p_l (p_m) if he believes that the asset has an equal chance of being type-h and type-l (type-m) and is willing to offer only p_l if he believes that the asset has an equal chance of being type-m and type-l. Assumption 2(b) is for simplification and can be understood as, for instance, the existence of a price grid over which transaction can be completed. It is straightforward to check that parametric assumptions 1 and 2 hold in our experimental implementation.

Denote the seller's belief about the fraction of naive buyers by χ. Given a belief χ, we say a seller's reporting strategy σ is *consistent* if it is optimal for the seller, given that the sophisticated buyer plays a best response to σ. Note that a consistent reporting strategy is an equilibrium strategy if the seller's belief χ coincides with the actual fraction χ^* of naive buyers. Our notion of a consistent strategy allows the seller's belief to differ from the true value to allow for the possibility that one's belief system can be influenced by external factors (such as own alcohol consumption or information about that of a trading partner).

As the notion of consistency above is belief-driven, there can be multiple consistent strategies at some parameter configuration $(\lambda_1, \lambda_2, \chi)$. Based on the rationale of strategic simplicity and genericity, we adopt the following refinement notion. First, we select a pure strategy over a mixed strategy. Second, consistent strategies that rely on nongeneric parameters are discarded. We call the consistent strategy thus selected a *simple consistent strategy.*

Under parametric assumptions 1, 2 and the positivity of lying cost, an understatement of type is dominated by truthful reporting. Consequently, any consistent strategy must have truthful reporting by type-h sellers, whereas type-m and type-l sellers may lie by exaggerating their type. The proposition below reports how the simple consistent strategy depends on parameters.

Proposition 2. *Suppose $\chi < 1/2$.*[6] *The seller's simple consistent reporting strategy depends on $(\lambda_1, \lambda_2, \chi)$ as follows.*

(i) If $\lambda_1 \geq p_m - p_l$ and $\lambda_2 \geq p_h - p_l$, then all types of sellers report truthfully

(ii) If $\lambda_1 \geq \chi(p_m - p_l)$ and $\lambda_2 \in [\chi(p_h - p_l), p_h - p_l]$, then there is a consistent strategy in which type-l sellers randomize between truthful reporting and lying, whereas type-m sellers report truthfully.

[6] The simplifying assumption $\chi < 1/2$ is made to reduce the number of possible consistent strategies we need to consider. We find it quite natural to believe that naive buyers constitute less than half of the population.

(iii) If $\lambda_1 \in [\chi(p_m - p_l), p_m - p_l]$ and $\lambda_2 \leq \chi(p_h - p_l)$, then there is a consistent strategy in which type-l sellers lie with probability one, whereas type-m sellers report truthfully.

(iv) If $\lambda_1 \leq \chi(p_m - p_l)$ and $\lambda_2 \leq \chi(p_h - p_l)$, then both type-l and type-m sellers lie with probability one.

The proof is provided in Appendix B. Figure 1 below illustrates the proposition graphically.

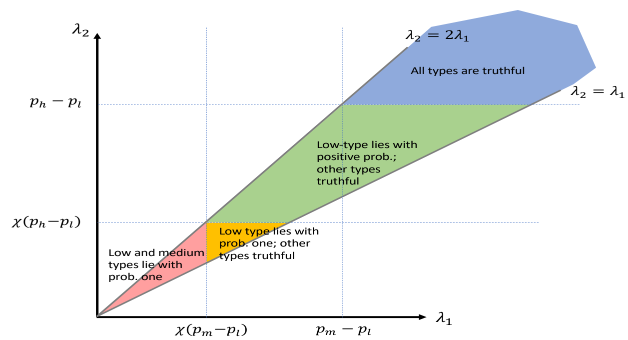

Figure 1: Equilibrium Prediction

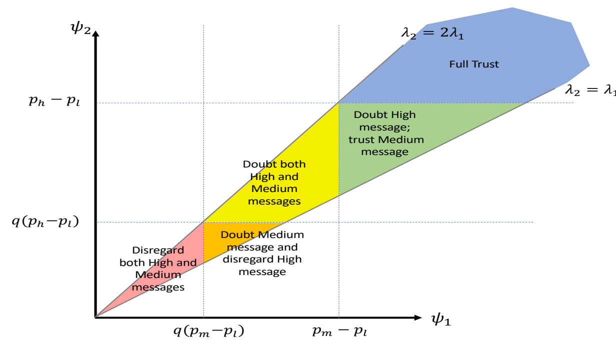

Figure 2: Buyer's Equilibrium Beliefs

The analysis reported in Proposition 2 has several implications. First, any reduction in lying cost, whether λ_1 or λ_2, and/or expected buyer sophistication $1 - \chi$ are associated with weakly more frequent lying. This result is intuitive. When deciding whether to lie, the seller trades off the constant lying cost against the benefit of soliciting a more favorable offer from naive buyers. A low lying cost and a large proportion of naive buyers therefore favor lying. Second, any reduction in lying cost, whether λ_1 or λ_2, and/or expected buyer sophistication weakly increases the prevalence of **both** one-step and two-step lying, an observation that follows from the probability of each type of lying explicitly computed in the proof.[7] Third, sellers with lower asset types tend to lie more. Whereas type-h never lies, there are parameter configurations at which type-l lies, whereas type-m is truthful, but not vice versa.

Consider next the consistency notion for buyers' strategies. A sophisticated buyer forms a belief about the seller's reporting strategy based on his belief about the seller's profile of lying costs, denoted by (ψ_1, ψ_2), as well as his (second-order) belief about the seller's belief about the fraction of naive buyers, denoted by q. Given his belief (ψ_1, ψ_2, q), we say a sophisticated buyer's strategy is consistent if he uses Proposition 2 to deduce the seller's unique consistent reporting strategy and to play the best response to it.[8] The notion of a consistent offer strategy allows the

[7] If the reduction leads to a transition from the (MH, M) region to (H, H) region, the frequency of one-step lies increases from $(b_m - p_m)/[3(p_m - p_l)]$ to 1/3, whereas that of two-step lies increases from (some value above) $(b_h - p_h)/[3(p_h - p_l)]$ to 1/3.

[8] Similar to the discussion above, a consistent offer strategy is an equilibrium strategy if the sophisticated buyer's beliefs are correct, i.e., $(\psi_1, \psi_2) = (\lambda_1, \lambda_2)$ and $q = \chi^*$.

buyer to entertain beliefs different from the truth[9] to incorporate the possibility that the buyer's belief system can be influenced by external factors, which we investigate in the experiments.

Corollary 1. *Suppose $q < 1/2$ and $\psi_2 \leq 2\psi_1$. The sophisticated buyer's consistent offer strategy depends on (ψ_1, ψ_2, q) as follows.*

(i) If $\psi_1 \geq p_m - p_l$ and $\psi_2 \geq p_h - p_l$, then the sophisticated buyer completely trusts the seller's message.

(ii) If $\psi_1 \geq p_m - p_l$ and $\psi_2 < p_h - p_l$, then the sophisticated buyer partially discounts the High message.

(iii) If $\psi_1 \in [q(p_m - p_l), (p_m - p_l))$ and $\psi_2 \in [q(p_h - p_l), p_h - p_l)$, then the sophisticated buyer partially discounts both the High and Medium message.

(iv) If $\psi_1 \in [q(p_m - p_l), (p_m - p_l))$ and $\psi_2 < q(p_h - p_l)$, then the sophisticated buyer partially discounts the Medium message and disregards the High message.

(v) If $\psi_1 \leq q(p_m - p_l)$ and $\psi_2 < q(p_h - p_l)$, then the buyer completely disregards the seller's message.

The corollary predicts that a sophisticated buyer will put less trust in the seller's messages if he believes that she has a low lying cost and the belief that there are many naive buyers. Moreover, the more favorable a message is, the less trust the sophisticated buyer has in it. For instance, there are parameter configurations in which a Medium message is discounted (or disregarded), as is a High message, but not vice versa.

We conclude this subsection with several remarks about the behavioral model. developed here. First, for simplicity, we assume that there are only two types of buyers and that their degrees of sophistication are at the opposing extremes of the possible spectrum. We do not expect any subject in reality to be perfectly naive or perfectly sophisticated; a real person is surely somewhere in between. The finding of Corollary 1 would remain qualitatively valid with alternative specifications of intermediate sophistication.[10] Second, we abstract away from potential cursedness in interpreting offer acceptance (Eyster and Rabin, 2005)[11] and failure in conditional reasoning (Charness and Levin, 2009) because of our intention to focus on the effects of alcohol consumption on communication and its implications for the subsequent bargaining outcomes.

[9] That is, $(\psi_1, \psi_2) \neq (\lambda_1, \lambda_2)$ and $q \neq \chi^*$

[10] A possible way to model intermediate sophistication of the buyers is to impose a belief that some fraction of sellers report truthfully while the rest act strategically. Our current formulation corresponds to assuming that the buyer holds the belief that the seller either reports truthfully with certainty or acts strategically with certainty.

[11] It follows from straightforward calculation that with our parametrization (see the next section), the prediction of the cursed equilibrium coincides concerning communication strategy with that of the Bayesian Nash equilibrium (in the absence of any lying cost and receiver naiveté).

3 Experimental Design, Hypotheses, and Procedure

3.1 Design and Hypotheses

In our experiment implementation, we adopt the following parameters (in units of experiment points). The buyer is initially endowed with 400 experimental points. With these parameters, it

Buyer's value			Seller's value			Price offer		
b_h	b_m	b_l	s_h	s_m	s_l	p_h	p_m	p_l
750	450	250	450	200	0	650	400	150

Table 1: Experimental Parameters

can be shown that there is a unique Bayesian Nash equilibrium outcome in the bargaining stage: the buyer offers p_l, and the seller accepts if and only if the asset is the low type.

In our experiments, subjects are given and asked to consume their alcoholic drinks at the beginning of the experiment. There are two types of drinks: high alcohol content (11% alcohol by volume) and low alcohol content (1% alcohol by volume). We are primarily interested in how alcohol consumption affects people's communication and trading behaviors. Additionally, knowledge of the alcohol content consumed by the trading partner can potentially change players' beliefs about their partners' truthfulness and consequently their decisions. We thus have two experimental variables in our experimental design. The first experimental variable is the alcohol content consumed by each party. All possible combinations yield four primary treatments, as presented in Table 2(a). For instance, Treatment *LL* has both buyers and sellers consuming the low-alcohol-content drinks. Participants in the main treatments were informed that they were supposed to drink some alcoholic beverage but not informed that there were two kinds of beverages with different alcohol content. They were not informed of the alcohol content of their own drinks or that of their trading partners'.[12]

Our second experimental variable is whether a player is *informed* about the alcohol content consumed. In our four main treatments, subjects are not informed of either the alcohol content of their drink or that of their trading partner's drink. In contrast, in the two additional information treatments, *HL-I* and *LH-I*, as presented in Table 2(b), subjects are informed about both the alcohol content of their drink and that of their trading partner's drink. We do not consider the two other possible treatments *LL-I* and *HH-I* where the alcohol content of one's trading

[12] We did not elicit one's belief of his or her own beverage type. However, it is reasonable to believe that on average, the high-alcohol-content group should be more likely to hold a higher belief of their own drunkenness level. Indeed, there was a substantial difference in their measured blood alcohol content (BAC) levels between the high- and low-alcohol-content groups. For more details, please see Section 3.

	Buyer		
Alcohol Content	Low (1%)	High (11%)	
Seller: Low (1%)	*LL*	*LH*	
Seller: High (11%)	*HL*	*HH*	

(a) Four Main Treatments

	Buyer		
Alcohol Content	Low (1%)	High (11%)	
Seller: Low (1%)	N/A	*LH-I*	
Seller: High (11%)	*HL-I*	N/A	

(b) Two Information Treatments

Table 2: Experimental Treatments

partner's drink is the same as that of his or her own drink because we assume that subjects tend to believe that the other party is similarly intoxicated. Thus, the impact of information revelation in these two possible treatments would be insignificant.

We now discuss our hypotheses. As mentioned in the introduction, conventional wisdom suggests that people are more truthful after consuming alcohol. Therefore, our first hypothesis is that alcohol consumption makes the sellers more truthful in their reporting of asset type. There are two possible channels through which alcohol influences sellers' reporting behavior. With the direct channel, alcohol consumption raises the sellers' lying cost λ, whereas with the indirect channel, it lowers their belief χ about the fraction of naive buyers. According to Proposition 2, an increase in λ and/or a decrease in χ would weakly shrink the set of seller types who lie and/or reduce the intensity of lying.

Hypothesis 1 (Null Hypothesis on the Effect of Drinking on Sellers' Messages)**.** *Sellers under the influence of alcohol are more prone to truthful reporting.*

On the other hand, alcohol consumption has been shown to lower people's inhibitory control over inappropriate and immoral behaviors (see, for example, Steele and Southwick (1985), Denton and Krebs (1990), and MacDonald et al. (1995)). Therefore, an alternative hypothesis is that sellers become less morally constrained to truthfully report their asset type, leading to more lying. This can be modeled as a reduction in lying cost λ. Similar to the null hypothesis above, it is also possible that alcohol consumption affects sellers' belief about the likelihood that the buyer is naive. According to Proposition 2, a decrease in λ and/or an increase in χ can lead to less truthful messages by the senders. Thus, we have the following alternative hypothesis regarding the effect of drinking on sellers' messages.

Hypothesis 2 (Alternative Hypothesis on the Effect of Drinking on Sellers' Messages)**.** *Sellers under the influence of alcohol are less truthful when reporting.*

Hypotheses 1 and 2 can be tested by comparing the reporting strategies of the sellers in Treatments *HH* and *HL* against those in Treatments *LH* and *LL*, respectively.

Regarding the effect of alcohol consumption on buyers' behavior, we hypothesize that alcohol consumption leads buyers to view the sellers' messages as more trustworthy. There are again two channels through which this effect can occur. First, alcohol consumption can directly increase the naiveté of the buyers; i.e., χ^* increases. Second, it can increase buyers' estimate of the sellers' lying cost q, thus indirectly inducing more trust in the sellers' messages. These two effects together lead to the following hypothesis.

Hypothesis 3 (Null Hypothesis on the Effect of Drinking on Buyers' Offers)**.** *Buyers under the influence of alcohol make higher price offers upon receiving a favorable message from the seller.*

Hypothesis 3 can be tested by comparing the offer strategies of buyers in Treatments *HH* and *LH* against those in Treatments *HL* and *LL*, respectively.

In the hypotheses above, both a direct and an indirect channel could be at work in delivering the hypothesized effects. We are interested in determining which channel plays a more important role in shaping traders' behaviors. Consider first alcohol's effect on sellers' reporting behavior. If the indirect channel of beliefs plays a more prominent role, we would expect that factors directly affecting sellers' beliefs would have a significant impact on their reporting strategies. In particular, it is plausible that sellers hold the belief that buyers are more likely to be naive when they are under the influence of alcohol (as in Hypothesis 3). Therefore, if sellers are *informed* that buyers are under the influence, they will assume a higher value for χ and find it more profitable to inflate their message (recall Proposition 2).

Hypothesis 4 (Null Hypothesis on the Effect of Information on Sellers' Messages)**.** *If a seller is informed that the buyer is under the influence of alcohol, she is more likely to lie.*

Hypothesis 4 can be tested as follows. It is natural to expect that in the main (no information) treatments, subjects assume that the other side is given the same beverage, and thus they infer the level of intoxication of their trading partner by introspection. Therefore, comparing Treatment *HL* and Treatment *HL-I*, Hypothesis 4 predicts that sellers lie more in Treatment *HL*. Similarly, comparing Treatment *LH* and Treatment *LH-I* leads to the prediction that sellers lie more in Treatment *LH-I*.

Next, consider alcohol's effect on buyers' offer behavior. Again, if the indirect channel of beliefs plays a prominent role in shaping buyers' offer behavior, we would expect that factors directly affecting their beliefs would have a significant impact on the offers they make. In particular, it is plausible that buyers believe that people are more truthful under the influence of alcohol (as conventional wisdom states). This implies an increase in δ, and according to Corollary 1, they will be more willing to trust the seller's message. Consequently, we hypothesize that if a buyer is informed that the seller is intoxicated, he will be willing to make more generous offers following each message.

Hypothesis 5 (Null Hypothesis on the Effect of Information on Buyers' Offers)**.** *If a buyer is informed that the seller is under the influence of alcohol, he is more likely to make a higher price offer.*

Similar to Hypothesis 4 above, Hypothesis 5 can be tested by comparing treatments that differ in the information offered to subjects on alcohol content. It predicts that buyers make higher price offers in Treatment *HL-I* than in Treatment *HL* and, similarly, that they make higher price offers in Treatment *LH* than in Treatment *LH-I*.

3.2 Experimental Procedure

Our experiment was conducted at Nanyang Technological University (Singapore) in English and at Southwestern University of Finance and Economics (China) in Mandarin Chinese.[13,14] A total of 312 subjects who were above 21 years old (at the time of the experiment) with no prior experience in these experiments were recruited from the undergraduate/graduate population of these two universities to participate in 18 experimental sessions, three per treatment.[15,16] A between-subjects design was used, and each session involved 14-20 subjects making decisions in 7-10 pairs.[17] The experiment was programmed and conducted using z-Tree (Fischbacher, 2007).

We illustrate the instructions for Treatment *HL-I*. The experiment consisted of four stages. Upon arrival at the lab, subjects were instructed to sit at separate computer terminals. Each was given a copy of the experimental instructions for Stage 1 at the beginning of the session and was told that the instructions for Stages 2-4 would be provided on the screen before each of those stages (see Appendix D). Instructions for Stage 1 were read aloud. Next, subjects were asked to complete three quiz questions and consume a mint (˜1g). The purpose of the quiz questions was to ensure that the subjects had sufficient comprehension of the structure of the game, and the mint made it difficult for subjects to detect the actual alcohol content in the assigned beverage (which was consumed later). We then delivered the answers to the quiz questions and asked subjects to drink one cup of alcoholic beverage (~200 ml) in 6 minutes.[18] There were two types

[13] Online Appendix D presents the English version of the experimental instructions that were for the experiments at Nanyang Technological University. The authors translated the Chinese text of the instructions used at Southwestern University of Finance and Economics.

[14] The experiments were conducted after approval from the IRB at Nanyang Technological University was obtained.

[15] All information treatments and one session for each of the main treatments were conducted at Nanyang Technological University. Two sessions for each of the main treatments were conducted at Southwestern University of Finance and Economics. The total number of participants was 160 in Singapore and 152 in China.

[16] We recruited only subjects aged 21 or above, and in our recruitment messages, we explicitly stated that the experiment involved a mild to moderate amount of alcohol consumption.

[17] We had 58, 54, 56, and 50 participants for Treatments *HH*, *HL*, *LH*, and *LL*, respectively. The two information treatments, *HL-I* and *LH-I*, respectively, had 44 and 50 participants.

[18] The subjects read the instructions and finished the quiz for the main task when they were sober, and this

of beverages: high alcohol content (approximately 11%) and low alcohol content (approximately 1%). The beverages were a mixture of vodka and tonic water in specific proportions. This type of alcoholic beverage has been shown to have a particularly fast rate of absorption so that it takes a relatively short time for the effects of alcohol to appear.[19] We randomly selected half of the subjects to drink each type of beverage.[20] Before the 10 official rounds of Stage 1 began, subjects were given one practice round to become familiar with the experiment protocol.

Stage 1 - Communication Game: At the beginning of this stage, those participants who had drunk the high-alcohol-content beverage were assigned to the role of Member A, and those participants who had drunk the low-alcohol-content beverage were assigned to the role of Member B. The roles were fixed throughout this stage of the experiment. Subjects were randomly paired in each round and played 10 rounds of decision-making.

In each round, Member A was endowed with an asset K, whereas Member B was endowed with 400 experimental points. The asset K could be the low, medium, or high type. At the beginning of each round, the computer randomly selected, with equal chances, the type of asset, which was revealed only to Member A. Member A then chose what message about the type of asset to send to Member B among four available messages: "High", "Medium", "Low", and "Not Reveal." After observing the message from Member A, Member B made one of three available offers to buy the asset K: 150 Points, 400 Points, and 650 Points. Member A then decided whether to accept or reject the offer. If Member A rejected the offer from Member B, then Member A retained the asset K and no transaction took place. Otherwise, Member A transferred the asset K to Member B, and Member B paid the offered number of points to Member A. If at the end of a stage, Member A held the asset, then the asset would be translated into 0 points, 200 points, and 450 points, for a low, medium and high type, respectively. If Member B instead held the asset, then the asset would be translated into 250 points, 450 points, and 750 points for the low, medium and high types, respectively. For the payment from Stage 1, One round was randomly selected at the end of the experiment.

Stage 2 - Dictator Game: At the beginning of this stage, One-half of the participants were

was to ensure that they understood fully the game. One potential issue might be that the subjects may have formed their decisions prior to the consuming of alcohol beverage in which case we should not see any treatment effect. Given that we found a significant treatment effect, it is unlikely that our subjects formed their decisions prior to their alcohol consumption.

[19] Mitchell Jr et al. (2014) show that after the initiation of consumption of a mixture of vodka and tonic water, subjects' blood alcohol content rises almost linearly, peaks at 30 minutes, and stays relatively high until 90 minutes has passed. As subjects in our experiments were given a shorter time to finish the alcoholic beverage than those in Mitchell Jr et al. (2014) (6 minutes versus 20 minutes), the alcohol's effects took place even more quickly in our experiments.

[20] While we are aware that the individual effects of alcohol consumption are likely to differ depending on gender, weight and previous drinking background, the random assignment of subjects into different treatments and roles eliminates any individual-level heterogeneity and systematic bias in our estimation of treatment effects. See Table A1 in Appendix C for the balance check.

randomly assigned the role of Member C, and the other half to the role of Member D. The role assignment was independent of that of Stage 1. This stage only had 1 round of decision-making. Member C and Member D were randomly paired, and Member C made a split (only with integers) of 100 points as "[_______] points for me and [_______] points for Member D". The split made by Member C was revealed to Member D, and the 100 points were divided accordingly. Member D thus had no decision to make.

Stage 3 - Guessing Game: In this stage, each subject simultaneously and independently chose an integer between 0 and 100 inclusively. The computer then calculated the average of the numbers chosen by all subjects. The participant whose number choice was closest to 2/3 of the average was declared the winner and awarded 100 points. In the event of a tie, the prize of 100 points was shared equally among the joint winners.

Stage 4 - Risk-attitude Elicitation: In this stage, we presented a table with 12 rows for each subject, where each row contained a decision between two options. The first option was to receive 100 points with certainty. The second option was a lottery between 140 points and 60 points. The chance of receiving 140 points in the second option was strictly increasing in the row number. We randomly selected one of the 12 rows and paid according to the choice made by a subject.[21] After all stages were concluded but before we paid the subjects, we tested their blood alcohol content (BAC) using *BACTRACK S80* breathalyzers.

The final cash payment to each subject was the sum of his or her earnings from all four stages plus a show-up fee. For the sessions conducted in Singapore, we offered a show-up payment of SGD5 and used an exchange rate of 35 points = 1 SGD. For the sessions conducted in China, we offered a show-up payment of CNY10 and used an exchange rate of 10 points = 1 CNY. The average payments were SGD21.7 (≈ USD16.3) in Singapore, with a payment range of [SGD10, SGD40], and CNY65.03 (≈ USD10.27) in China, with a payment range of [CNY20.08, CNY128.16].[22] The sessions lasted for 80 minutes on average, including 15 minutes for experimental instructions, 6 minutes for waiting time after alcohol consumption, 40 minutes for one practice round followed by ten official rounds of communication-trading games, Stages 2-4 and the breathalyzer test.

[21] The payoff from each stage was revealed to the subjects at the end of each stage. Thus, there is a potential order effect. However, the order effect, if it exists, should not contribute to the treatment effect because our main communication-trading game was placed at the beginning of the experiment in all sessions and treatments.

[22] A typical meal (including a cup of tea or soft drink) in the university cafeterias at Nanyang Technological University and Southwestern University of Finance and Economics costs SGD6 (≈ USD4.5) and CNY10 (≈ USD1.58), respectively. Thus, the difference in the average payments between the two locations reflects the difference in purchasing power between the two countries.

4 Experimental Results

4.1 BAC Levels

Before presenting our main results, we first report the average and distribution of BAC levels of the participants in the low- and high-alcohol-content groups that we measured at the end of the experiments conducted at Southwestern University of Finance and Economics, China.[23] The average BAC level for the participants in the high-alcohol content group was 0.0168 after approximately 90 minutes. Based on an (gender-adjusted) estimated hourly elimination of BAC level 0.018 among ethnic Chinese (Tam et al., 2006), and the fact that the BAC level reaches its peak 20-30 minutes after alcohol consumption, the peak BAC level has an average value of approximately 0.0348 ($= 0.0168 + 1 \times 0.018$). This estimated level of intoxication is reasonably close to the average BAC level (0.0406) measured at the beginning of the experiment in Au and Zhang (2016). In contrast, the average BAC level in the low-alcohol content group was 0. Figure 3 below presents the cumulative distributions of BAC for the participants in the high- and low-alcohol-content groups.[24]

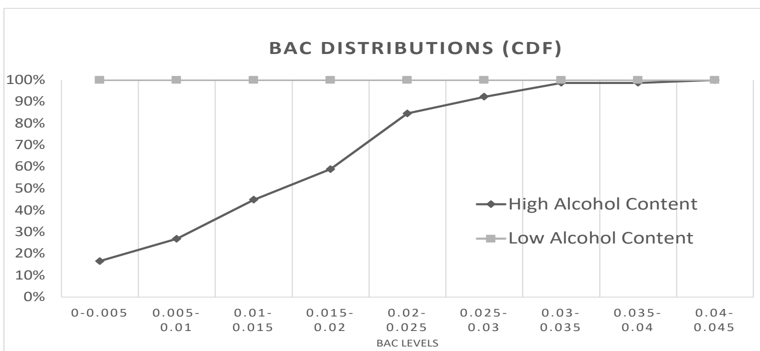

Figure 3: BAC Distributions (CDF)

We now report results from regression analyses that estimate the treatment effects in the communication-trading game, controlling for a multitude of factors such as measures of subjects' social preference, degree of bounded rationality and elicited risk attitudes, as well as the period and country effects. In Appendix A, we report treatment-level data aggregated across all three sessions and all ten rounds of the communication-trading game. We provide suggestive evidence that sellers' messages are informative and buyers' offers are dependent on the message received.

[23]We are unable to report the measured BAC levels for the sessions conducted at Nanyang Technological University, Singapore because the measuring machine did not work. It showed a single, same number for every participant. We realized the issue only after conducting a few sessions in Singapore. However, we followed the exact procedure presented in Dry et al. (2012) to make the beverage with a target alcohol content both in China and in Singapore such that the reported BAC levels should be representative of the entire set of participants.

[24]In our main treatments, subjects were not informed about the alcohol contents of their own beverage, and we did not elicit their beliefs about it. However, it is not difficult to imagine that, on average, the high-alcohol-content group should be more likely to hold a higher belief of their own alcohol content.

We further present glimpses of some treatment effects regarding the role of higher alcohol content and the role of publicly available information about that alcohol content. We then report the treatment-level data from the Guessing Game, the Dictator Game, and the Risk-attitude Elicitation to show that the overall behaviors observed do not vary across treatments. This result suggests that the treatment effects observed in the communication game cannot be attributed to the potential influence of alcohol on an individual's bounded rationality, degree of other-regarding preferences, and risk attitudes. In Section 4.2, we analyze how alcohol consumption affects sellers' reporting behavior. In Section 4.3, we analyze alcohol's effects on buyers' offers, which reveal how they interpret the messages they receive from sellers. Section 4.4 studies how alcohol consumption affects transactions and hence market efficiency. Finally, Section 4.5 looks at whether the public availability of information about the alcohol content of assigned beverages affects communication behaviors and transaction outcomes.

4.2 Impact of Alcohol Consumption on Sellers' Reporting Behaviors

Table 3 shows the estimated treatment effects with Treatment *LL* as the baseline (i.e., the omitted group). In all specifications, sellers in both Treatments *HH* and *HL* who are under the influence lie significantly and substantially more (approximately 10% or 15%) than those in Treatment *LL*. In contrast, there is no difference between Treatments *LL* and *LH*, in which the buyers are under the influence. In all specifications, none of the control variables, including period trend, period dummies, country fixed effects, measures of risk preferences and higher-order rationality, have any significant impact on the estimated treatment effects. It appears that participants in China lie significantly less than participants in Singapore, and the social preference measure is positively related to the lies of sellers. There is no evidence showing dynamic dependence, as both the time trend and period dummies have no significant impact on lying.

For robustness, we conduct two pairwise comparisons, one between treatments *LL* and *HL* and the other between Treatments *LH* and *HH*. These comparisons allow us to fully identify the effect of alcohol consumption on sellers' reporting behaviors given the alcohol content of buyer's beverages. Table A2 in Appendix C presents the estimated results, where each column has a distinct baseline treatment as specified in the first row of the table. Columns (1) and (2) of Table A2 reveal that sellers lie more under the influence of higher alcohol content, fixing the alcohol content of buyers' drinks at low and high, respectively. However, Columns (3) and (4) of the same table show that changing only the alcohol content of buyers' drinks has no effect on sellers' lying behavior. We thus establish the following result:

Result 1. *Sellers under the influence of a higher alcohol content are less truthful than those under no such influence.*

Table 3: **Treatment Effect of Alcohol on Seller's Lying**

	(1) Baseline	(2) More Controls	(3) Period Dummies	(4) Last 5 Periods	(5) Preference Controls
Treatment *LH*	-0.0320	-0.0344	-0.0343	-0.0729	-0.0320
	(0.0459)	(0.0455)	(0.0456)	(0.0643)	(0.0460)
Treatment *HL*	0.107**	0.105**	0.105**	0.0777	0.0928*
	(0.0462)	(0.0464)	(0.0465)	(0.0655)	(0.0480)
Treatment *HH*	0.155***	0.154***	0.157***	0.154**	0.147***
	(0.0446)	(0.0445)	(0.0443)	(0.0617)	(0.0444)
Participants in China		-0.0987***	-0.0986***	-0.0999**	-0.107***
		(0.0343)	(0.0343)	(0.0487)	(0.0353)
Period		0.00249			
		(0.00545)			
Constant	0.449***	0.506***	0.544***	0.421***	0.490***
	(0.0331)	(0.0510)	(0.0626)	(0.0723)	(0.0792)
Period Dummies	N	N	Y	Y	Y
Observations	976	976	976	486	976
R-squared	0.024	0.032	0.043	0.058	0.059

Notes: Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1. The baseline treatment is *LL*, in which both sellers and buyers drink the beverage with lower (L) alcohol content; similar notation for other treatments: the first letter refers to the sellers' alcohol content and the second letter for the buyers. The sample size in Column (4) is not $\frac{976}{2} = 488$ because in one treatment, we lost the date from the last period due to an unexpected early shut-down of the program. The estimates are from linear regression models.

We also analyze sellers' reporting behavior according to different asset types randomly drawn at the beginning of the game. Table A3 in Appendix C presents the estimation results. Sellers under the influence of high alcohol content lie more for all asset types; interestingly, the proportion of lying is the highest when the asset type is medium. One explanation is that the seller might feel guiltier about lying when the asset type is the lowest.[25] The second part of Table A3 shows that subjects are less likely to send the message "Not reveal" when they are under the influence of alcohol.

To identify whether the higher misreporting rate under alcohol influence is due to the increase of one-step lying (from L to M or M to H), two-step lying (from L to H) or both, we present results from the regression that distinguishes the two types of lying in Table A4 in Appendix C. The findings show that although the overall picture of the one-step lie is consistent with that presented in Table 3, the estimates are no longer significant, which suggests that the result presented in Table 3 is mainly driven by two-step lying.

In summary, our experimental results support Hypothesis 2. This finding casts doubts on the conventional wisdom that alcohol consumption makes one more truthful, at least for the mild level of intoxication we induced in our subjects.

Table 4: **Treatment Effect of Alcohol on Buyers' Offers**

	(1) Baseline *LL*	(2) Baseline *LL*	(3) Baseline *LH*	(4) Baseline *LL*	(5) Baseline *HL*
Treatment *LH*	-0.00264			-0.00310	
	(0.0503)			(0.0507)	
Treatment *HL*	-0.0636	-0.0657			
	(0.0504)	(0.0503)			
Treatment *HH*	0.0195		0.0209		0.0832*
	(0.0522)		(0.0486)		(0.0491)
Participants in China	0.105***	-0.0227	0.216***	0.0941*	0.116**
	(0.0377)	(0.0567)	(0.0496)	(0.0544)	(0.0526)
Constant	1.406***	1.493***	1.333***	1.427***	1.323***
	(0.0737)	(0.0992)	(0.0905)	(0.101)	(0.0901)
Period Dummies	Y	Y	Y	Y	Y
Observations	1,090	520	570	530	560
R-squared	0.014	0.007	0.040	0.011	0.020

Notes: The dependent variable is the ordered offer choice (1, 2, 3) with higher number representing higher price from a buyer. The baseline treatment is *LL*, in which both sellers and buyers drink the beverage with lower (L) alcohol content; similar notation for other treatments: the first letter refers to the sellers' alcohol content and the second letter for the buyers. The estimates are from linear regression models. Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

4.3 Impact of Alcohol Consumption on Buyers' Offers

In this subsection, we analyze how buyers' offers are affected by alcohol consumption. Table 4 reports the results from the regression, with the dependent variable being the offers values buyers made. Column (5) of Table 4 shows that, given that sellers are under the influence, buyers make higher offers when they are under the influence of a high alcohol content than when they are not.[26] In contrast, Column (4) of Table 4 shows that, given that sellers are not under the influence, buyers' offers do not significantly vary depending on whether they are under the influence of high or low alcohol content. Columns (2) and (3) show, as expected, that the alcohol content of the sellers' drink has no statistically significant effect on the buyers' offers.

In the regressions reported in Table 5, we restrict our attention to the buyers' offer behavior following a "High" message from the sellers. This analysis is relevant because, as mentioned in the descriptive analysis presented in Appendix A, approximately 62% of messages in the whole sample are "High". Note also that the dependent variables are dummy variables indicating the buyers' offer choices. Columns (4) and (6) indicate that conditional on sellers being under the influence of alcohol, buyers are significantly more likely to make high offers (relative to medium and low offers, respectively) when they are under the influence of alcohol than when they are not. However, such a difference does not exist when the sellers are not under the influence, as Columns (3) and (5) present. This finding is partially consistent with that of Table 4. These

[25]This result is consistent with the partial lying result documented in the experimental literature on lying and deception, e.g., Gneezy, Kajackaite, and Sobel (2018) and Abeler, Nosenzo, and Raymond (2019).

[26]The finding that buyers made higher offers under the influence of alcohol is consistent with Au and Zhang (2016). They find that, after drinking, people become less sensitive to the information content of others' messages or actions.

Table 5: **Treatment Effect of Alcohol on Buyers' Offers Conditional on "High"**

	(1)	(2)	(3)	(4)	(5)	(6)
Offer Choice	2 (vs 1)	2 (vs 1)	3 (vs 1)	3 (vs 1)	3 (vs 2)	3 (vs 2)
Baseline Treatment	LL	HL	LL	HL	LL	HL
Treatment *LH*	-0.0119		-0.0378		-0.0565	
	(0.0602)		(0.0581)		(0.0587)	
Treatment *HH*		0.0488		0.0972**		0.121**
		(0.0551)		(0.0459)		(0.0571)
Participants in China	0.0192	0.138**	0.0104	0.0462	-0.0171	-0.0591
	(0.0627)	(0.0579)	(0.0553)	(0.0469)	(0.0611)	(0.0773)
Constant	1.062***	0.0572	0.164	-0.0342	-0.0199	0.153
	(0.178)	(0.135)	(0.184)	(0.0831)	(0.184)	(0.168)
Period Dummies	Y	Y	Y	Y	Y	Y
Preference and Cognitive Measures	Y	Y	Y	Y	Y	Y
Observations	295	340	181	217	152	165
R-squared	0.111	0.086	0.049	0.075	0.084	0.094

Notes: Dependent variable is dummies of offer choice, e.g., 2(1) refers to the choice of offer 2 over offer 1; higher number for higher price. Robust standard errors in parentheses; *** $p<0.01$, ** $p<0.05$, * $p<0.1$. The baseline treatment is *LL*, in which both sellers and buyers drink the beverage with lower (L) alcohol content; similar notation for other treatments: the first letter refers to the sellers' alcohol content and the second letter for the buyers. The estimates are from linear regression models.

findings support Hypothesis 3 that buyers make higher price offers following a favorable message when they are under the influence of alcohol. In summary, we obtain the following result:

Result 2. *Given that sellers are under the influence of alcohol, buyers upon receiving the message "High" make higher offers more frequently when they are under the influence of a high alcohol content than when they are not.*

We conduct an additional analysis on transactions by controlling for buyers' offers and/or asset type. The results are summarized in Table A6, Appendix C. The results show that there is no significant difference in transactions between treatments *LL* and *LH* when we only control for the offer. However, when we control for both the offer and asset type, the difference between *HL* and *HH* disappears. However, there are significant decreases in transactions among all three treatments (*HL*, *LH*, and *HH*) compared with *LL* when we consider only the low and middle offer cases, except that the HL treatment effect is not significant in the middle offer sample. These results suggest that the results are likely attributed to sellers' messaging since offers are given in the analysis of the last three columns.

4.4 Consequence of Alcohol Consumption on Market Outcomes

Given the finding that sellers under the influence of a high alcohol content tend to be less truthful, one may naturally expect that deals are made less frequently when sellers are under the influence. This expectation turns out to be true, as seen in the comparison between treatments *HL* and *LL* presented in Column (2) of Table 6. This result is consistent with Morewedge et al. (2014),

Table 6: **Treatment Effect on Transaction Rates**

	(1) Baseline *LL*	(2) Baseline *LL*	(3) Baseline *LH*	(4) Baseline *LL*	(5) Baseline *HL*
Treatment *LH*	-0.0430			-0.0438	
	(0.0434)			(0.0435)	
Treatment *HL*	-0.0928**	-0.0942**			
	(0.0435)	(0.0435)			
Treatment *HH*	-0.0348		0.00729		0.0582
	(0.0431)		(0.0418)		(0.0420)
Participants in China	0.00801	-0.0828*	0.0867*	-0.0113	0.0262
	(0.0327)	(0.0476)	(0.0448)	(0.0473)	(0.0452)
Constant	0.579***	0.666***	0.463***	0.578***	0.487***
	(0.0601)	(0.0791)	(0.0761)	(0.0802)	(0.0779)
Period Dummies	Y	Y	Y	Y	Y
Observations	1,090	520	570	530	560
R-squared	0.018	0.035	0.022	0.023	0.020

Notes: Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1. The baseline treatment is *LL*, in which both sellers and buyers drink the beverage with lower (L) alcohol content; similar notation for other treatments: the first letter refers to the sellers' alcohol content and the second letter for the buyers. The estimates are from linear regression models.

who found that intoxicated responders in their Ultimatum Game experiment are more likely to reject unequal offers.

Result 3. *Given that buyers are not under the influence of alcohol, the transaction rate is lower when sellers are under the influence than when they are not.*

Column (3) of Table 6 presents a comparison between Treatments *HH* and *LH* and shows that such difference disappears when buyers are also under the influence of a high alcohol content. One reason is that, as reported in Result 2 above, intoxicated buyers tend to make higher offers, thus partially offsetting the negative effect of sellers' untruthful behaviors on transaction rates. Note, however, that this effect on its own is not strong enough to generate a systematic difference in transaction rates, as shown by the comparisons presented in Columns (4) and (5) of Table 6. Finally, we check the robustness of these findings by controlling for the asset types in Table A5 (Appendix C) and obtain similar results.

4.5 Impact of Information on Communication Outcomes

In this subsection, we investigate the effect of publicizing the information about the alcohol content of the assigned beverages on the communication and transaction outcomes. The upper panel of Table 7 considers the effect when sellers are given low-alcohol-content drinks and buyers are given high-alcohol-content drinks. The lower panel of Table 7 considers the effect when sellers are given high-alcohol-content drinks and buyers are given low-alcohol-content drinks. We do not find any significant treatment effect from information revelation on sellers' lying, buyers' offers, or transaction rates.

Table 7: **Comparison between Treatments with and without Information**

	(1) lie	(2) lie	(3) offer	(4) offer	(5) deal	(6) deal
Treatment LH-I	0.0408	-0.0708	-0.0556	-0.00688	-0.00113	-0.0172
	(0.0403)	(0.0551)	(0.0533)	(0.0314)	(0.0271)	(0.0364)
Constant	0.433***	0.543***	0.868***	1.760***	0.481***	0.597***
	(0.0229)	(0.0999)	(0.0307)	(0.0671)	(0.0154)	(0.0668)
Period Dummies	N	Y	N	Y	N	Y
Preferences and Cognitive Measures	N	Y	N	Y	N	Y
Observations	697	697	2,028	2,028	1,560	1,560
R-squared	0.001	0.028	0.001	0.809	0.000	0.022
Treatment HL-I	-0.00825	-0.0748	0.00362	0.0603*	-0.0138	-0.00122
	(0.0415)	(0.0556)	(0.0558)	(0.0308)	(0.0279)	(0.0358)
Constant	0.582***	0.534***	0.853***	1.604***	0.441***	0.463***
	(0.0219)	(0.0865)	(0.0298)	(0.0627)	(0.0148)	(0.0626)
Period Dummies	N	Y	N	Y	N	Y
Preferences and Cognitive Measures	N	Y	N	Y	N	Y
Observations	704	704	2,028	2,028	1,560	1,560
R-squared	0.000	0.028	0.000	0.807	0.000	0.011

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1. The baseline treatments are *LH-LL* for the upper panel and *HL-HH* for the lower panel. The estimates are from linear regression models.

Result 4. *Public availability of information about the alcohol content of assigned beverages has no significant effect on communication and transaction outcomes.*

In light of the findings discussed above, Hypotheses 4 and 5 are not supported. As the availability of information has a direct impact on subjects' beliefs about the sellers' tendency to lie and their beliefs about the buyers' degree of naiveté in interpreting received messages, the finding implies that variation in subjects' beliefs does not play a significant role in determining their reporting and offer strategies. Recall that Hypotheses 2 and 3, which are supported by evidence reported in Results 1 and 2, respectively, can be driven by a direct channel (via changes in lying cost and degree of naiveté, respectively) and an indirect channel (via changes in beliefs about the trading partner's lying cost and degree of naiveté, respectively). Result 4 therefore suggests that the direct channel is likely to be the main driving force for the results, as the variation in subjects' beliefs is shown to have nonsignificant effects in shaping their behaviors.[27]

5 Concluding Remarks

In this paper, we experimentally investigate the effect of alcohol consumption in an otherwise standard communication-trading game. In contrast to folk wisdom and to our surprise, alcohol consumption led to less truthful communication in our experiments. Moreover, subjects under

[27]Results from similar analysis using only Treatment *LH* (or *HL*) to compare with Treatment *LH-I* (or *HL-I*) are qualitatively consistent with the findings in Table 7.

alcohol's influence were willing to make higher offers, indicating that they were less adept at extracting information content from received messages. These results suggest that alcohol consumption lowers lying costs and that the degree of sophistication in message interpretation could be a main driving force.

There is one important caveat in interpreting our experimental results. The theoretical model we presented allows us to disentangle the direct and indirect channels through which drinking affects decision-making in the communication game. However, the model is built upon several assumptions, and one could easily imagine that a different model could be written based on a different set of assumptions, highlighting different possible channels through which drinking affects individuals' decision-making. If one used an angle provided by an alternative model to examine and interpret the same experimental data, a different conclusion might be made. In this regard, we would like to emphasize that the experimental evidence we provided about the direct effect of alcohol on the lying cost of the senders and degree of credulity of the receivers must be suggestive but not entirely conclusive. However, it does not undermine the importance of presenting a concrete theoretical model and making predictions. Our model enables us to generate a set of testable hypotheses and provides a reasonable angle to interpret the data. Our experimental design can be justified only after one understands the direct and indirect channels that our theoretical model highlights.

There are a number of additional caveats in interpreting our findings. First, our experimental data provide only suggestive but not conclusive evidence that alcohol consumption lowers both the lying cost and the degree of sophistication when interpreting received messages. The reason is that our experimental design does not allow us to exclude the possibility that the observed treatment effects are driven by something other than the impact of alcohol intoxication such as a placebo effect or an excuse effect. Second, our subjects' level of alcohol intoxication is quite mild (even in the high-alcohol-content treatment) compared to that in actual business settings. It is conceivable that people's behavior can be quite different at a (much) higher level of intoxication. Third, the communication game we studied is one of cheap talk, whereas in real-world settings, communication often involves disclosing verifiable information. As discussed in Section 4.2, we find evidence that subjects are less likely to choose "Not reveal" when they are under alcohol's influence. This suggests that alcohol consumption could facilitate communication by increasing people's disclosure of (verifiable) information. Testing the validity of this conjecture is an interesting avenue for future study. Forth, the number of unique subjects per treatment in our study is relatively small (26). Although our analysis relies on the repeated decisions (10 times) in the main game with random re-matching, a larger scale investigation would allow one to draw a more concrete conclusion. Finally, we adopt a very simple design in modeling trading by having the buyer make take-it-or-leave-it offers. Real-world business negotiations could involve more complicated bargaining protocols in which players could, for example, make promises, bluffs, and threats. Our study is silent on alcohol's effects on the implementability and profitability of sophisticated bargaining tactics, which constitute another interesting avenue for future research.

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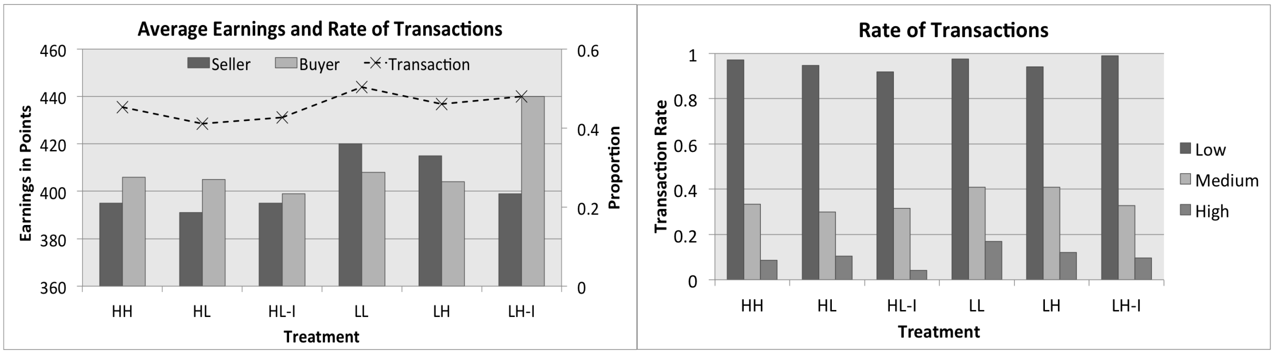
Appendices

A Descriptive Analysis

Communication-Trading Game



(a) Average Earnings and Rate of Transactions (b) Rate of Transactions | Asset Type

Figure A1: Experimental Outcomes

Figure A1(a) reports the average earnings and average rate of transactions for each treatment aggregated across all three sessions and all ten rounds of decision-making. Two observations are immediately apparent. First, in all treatments, the average earnings of the sellers (390-420 points) are substantially higher than the theoretical prediction of 267 points. The same observation is valid for the buyers even if the difference is of smaller magnitude (reported average value of 433.3 points vs. theoretical prediction of 410 points). Second, the average transaction rates observed in the lab (> 41%) are consistently and substantially higher than the theoretical prediction of 33%.

According to Proposition 1, the lemon market nature of our communication-trading game generates a prediction of adverse selection and market failure; i.e., transactions only occur when the asset type is low. Figure A1(b) presents a sharp contrast. First, in line with the theoretical prediction, the transaction rate is close to 100% when the asset type is low. When the asset type is medium, however, the average transaction rate is between 30% and 41%, which is substantially higher than the theoretical prediction of 0%. Even when the asset type is high, the rate is strictly positive (> 4%) in all treatments and sometimes reaches 17% (in Treatment LL). The higher transaction rates observed in all treatments are the main source of the higher earnings reported in Figure A1(a) and contribute more to increasing the earnings of sellers than to increasing the earnings of buyers.[28] These results are summarized as follows:

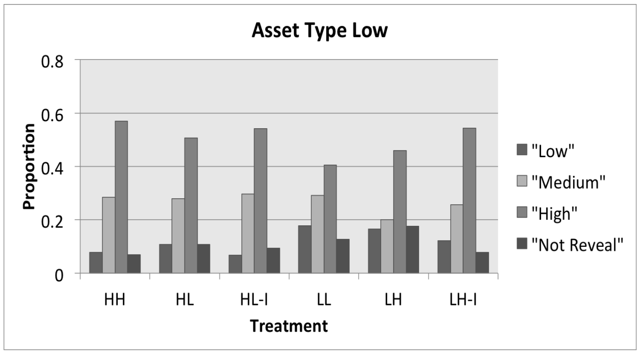
[28]The sellers could make two different types of mistakes. The first type is to accept an offer that they should reject, and the second type is to reject an offer that they should accept. In our data, the sellers made very few mistakes (< 3%) of the first type and no mistakes of the second type.

Observation 1. *The observed transaction rates and average earnings in the laboratory are substantially higher than the predicted levels of the unique babbling equilibrium outcome.*

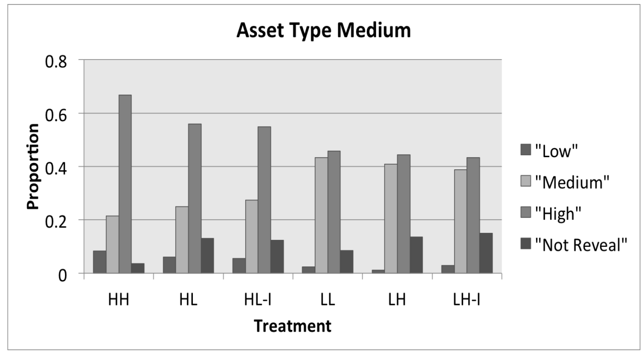
Two additional results are worth reporting. First, both sellers' and buyers' payoffs are consistently lower in the treatments in which the sellers are under the influence of a higher alcohol content (Treatments *HH*, *HL*, and *HL-I*) than in the treatments in which they are under no such influence (Treatments *LL*, *LH*, and *LH-I*). The same finding can be identified from the transaction rates reported in Figure A1(b). Second, making information public about the asymmetry of alcohol content between sellers and buyers helps those players under the influence of high alcohol content increase their earnings. The average earnings of the buyers are 14 points higher than the earnings of the sellers in Treatment *HL*, However, the difference drops to only 4 points in Treatment *HL-I*. The average earnings of the buyers are 11 points lower than those of the sellers in Treatment *LH*, but the ranking is reversed by a substantial margin of 41 points in Treatment *LH-I*.

Observation 2. *The average earnings of sellers and buyers, as well as the average transaction rates, are consistently lower when the sellers are under the influence of a high alcohol content than when they are under no such influence. The public availability of information about the asymmetry between the alcohol content of sellers' and buyers' drinks increases the average earnings of the players who are under the influence of a high alcohol content.*

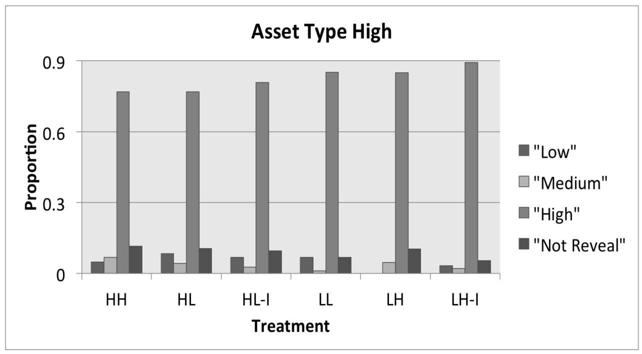
We now report the sellers' and the buyers' behaviors separately. Figure A2 presents sellers' messages conditional on asset type aggregated across all ten rounds of all three sessions. The first three treatments in each bar chart are those with the sellers under the influence of a high alcohol content, while the last three treatments are those with the sellers under the influence of a low alcohol content. A few observations emerge. First, the proportion of "High" messages is the highest in all treatments, and the proportion of "Low" messages is almost always the lowest. Second, the message "Not Reveal" is not frequently used (on average 10%) and never reaches 18%. Third, it is evident that, inconsistent with the babbling prediction, the messages are informative. Figure A2(c) reports that when the asset type is High, the proportion of "High" messages is consistently over 77% and sometimes reaches 89% (in Treatment *LH-I*). The proportion decreases to 43%-67% when the asset type is Medium (Figure A2(b)) and to 40%-57% when the asset type is Low (Figure A2(a)). The message "Medium" is rarely sent when the asset type is High (<6%) but is used significantly more frequently when the asset type is Medium (21%-43%). When the asset type is Medium, in particular, there is almost no difference between the proportion of "High" messages and that of "Medium" messages in Treatments *LL*, *LH* and *LH-I* (on average 44% vs. 41%). When the asset type is Low, a non-negligible proportion of sellers (7%-18%) send a "Low" message.



(a) Asset Type Low



(b) Asset Type Medium



(c) Asset Type High

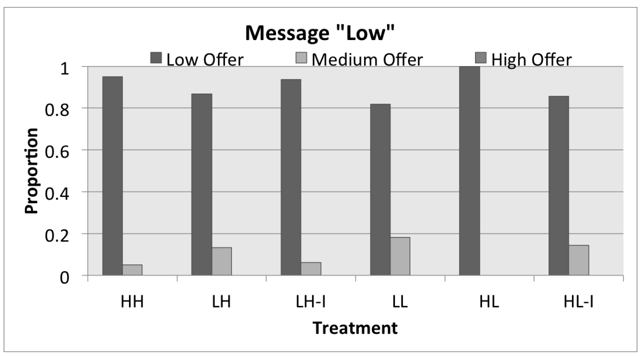
Figure A2: Frequencies of Messages Conditional on Asset Type

The messages become more informative when the sellers are *not* under the influence of a high alcohol content. When the asset type is Medium, the proportions of "Medium" messages in the three treatments with the sellers under the influence of a high alcohol content are substantially lower than those in the three other treatments (on average 25% vs. 41%), and the proportions of "High" messages in the three treatments with the sellers under the influence are substantially higher than those in the three other treatments (on average 58% vs. 44%). Similarly, when the asset type is Low, the proportion of sellers sending a "Low" message is consistently lower when the sellers are under the influence of a high alcohol content than when they are not (7%-11% vs. 12%-18%). When the asset type is High, the proportion of sellers sending a "High" message (77%-81%) is still higher when they are under the influence of a high alcohol content than when the sellers are not (85%-89%), but the difference in magnitude is not as large as the differences we have in the other two cases with "Low" and "Medium" messages. These observations are in line with our Hypothesis 2 that sellers under the influence of alcohol report less truthfully. Summarizing these results, we establish the following observation.

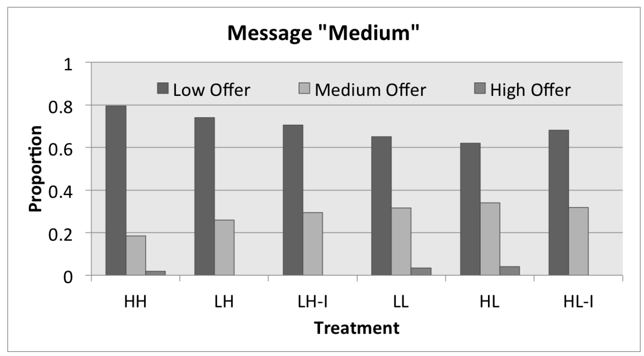
Observation 3. *Observed messages in the laboratory are informative. However, the messages are less informative when the sellers are under the influence of a high alcohol content than when they are not under such influence.*

We now consider the effect of the public availability of information about the alcohol content. The proportions of "High" messages conditional on the asset type being Low and on the asset type being High are slightly higher in Treatment *HL-I* than in Treatment *HL*. However, the public availability of information does not change the overall shape of the sellers' message choices when they are under the influence of high alcohol content. On the other hand, when buyers are under the influence, the proportions of "High" messages conditional on the asset type being Low and on the asset type being High are substantially higher. Nevertheless, again, the overall shape of the sellers' message choices does not vary with the availability of information. This observation is inconsistent with our Hypothesis 4 that sellers lie more when they are informed that the buyer is under the influence of alcohol.

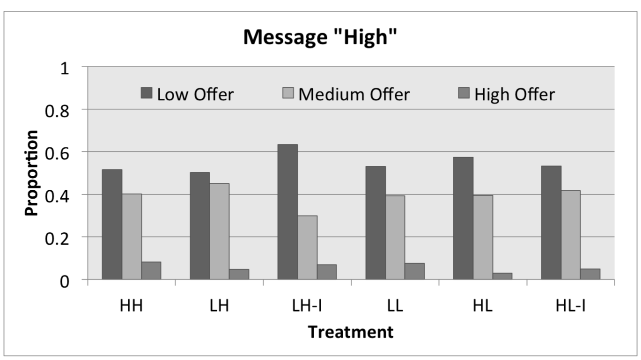
Observation 4. *The sellers' choice of message does not vary regardless of whether information about the alcohol content is publicly available.*



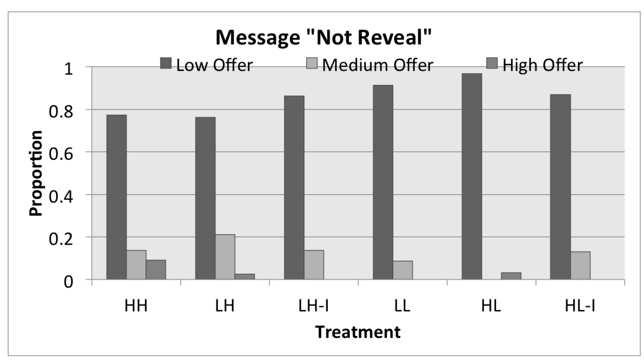
(a) Message "Low" (7%)



(b) Message "Medium" (21%)



(c) Message "High" (62%)



(d) Message "Not Reveal" (10%)

Figure A3: Frequency of Offers Conditional on Messages

Figure A3 presents buyers' offers conditional on the messages received aggregated across all ten rounds of all three sessions. The first three treatments in each bar chart are those with buyers under the influence of higher alcohol content, and the last three treatments are those with buyers under the influence of a low alcohol content. It is immediately clear that buyers' offers, to a large extent, depend on the messages they receive. The proportions of Low offers are highest conditional on the message "Low" (86%-100%) and lowest when the messages are "High" (50%-65%). The proportions of Medium offers are consistently higher when the messages are either "Medium" (19%-34%) or "High" (30%-45%) than when the messages are "Low" (0%-18%). The proportion of High offers is 0% when the received message is "Low" and almost always 0% when the message is "Medium," while the proportions become strictly positive (3%-8%) in all treatments when the received message is "High".

The effect of alcohol on buyers' offers depends on the message they receive. For example, the proportion of Medium offers conditional on the message "Medium" is consistently lower when the buyers are under the influence (19%-29%) than when they are not (32%-34%). The proportion of Low offers conditional on the message "Not Reveal" is consistently lower when the buyers are under the influence (76%-86%) than when they are not (87%-97%). However, it is appropriate to pay more attention to the contingency that the message "High" is received, which covers 62% of the data. In this case, in line with our Hypothesis 3, the proportion of Low (High) offers in Treatment *HL* is 57.5% (3.0%), which is substantially higher (lower) than the 51.5% (8.3%) in Treatment *HH*. Similarly, upon receiving the message "High", the proportion of Low (Medium) offers is 53.1% (39.3%) in Treatment *LL*, which is substantially higher (lower) than the 50.3% (45%) in Treatment *LH*. These observations show that buyers under the influence of a high alcohol content make higher offers on average.

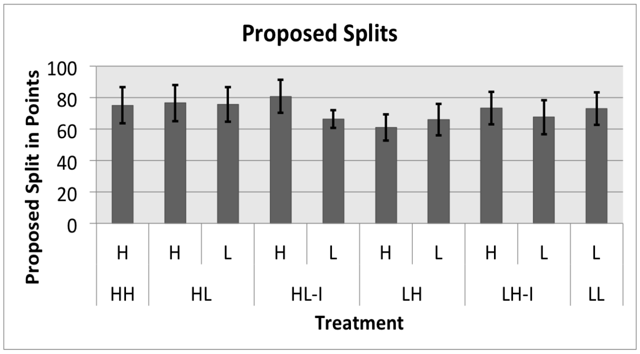
Observation 5. *Observed offers by buyers in the laboratory depend on the messages they receive. Conditional on receiving a "High" message, buyers who are under the influence make the Low offer less frequently than those who are not under such influence.*

The effect of information about the alcohol content on the buyers' offer choices seems to be nonsignificant. Upon receiving a High" message, the proportion of High offers does not vary significantly between Treatment *HL-I* and Treatment *HL*. Similarly, the proportion of High offers does not vary significantly between Treatment *LH-I* and Treatment *LH*. These observations do not support our Hypothesis 5.

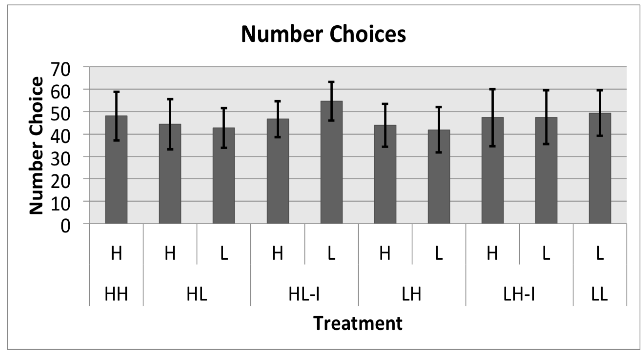
Observation 6. *The public availability of information about alcohol content does not alter buyers' offer behaviors.*

Dictator Game, Guessing Game, and Risk Attitude

Is it possible that the treatment effects reported in the previous subsection are direct consequences of the influence of alcohol on individual's other-regarding preference, degree of bounded rationality, or attitudes toward risk? In this subsection, we report the aggregate-level data from the Dictator Game, Guessing Game, and belief elicitations, which show that these factors do not play a significant role in shaping individuals' behaviors.



(a) Proposed Splits in Dictator Game



(b) Number Choices in Guessing Game

Note: The error bars indicate 1 standard deviation.

Figure A4: Experimental Outcomes - Dictator Game and Guessing Game

Dictator Game: Figure A4(a) reports the average split proposal observed in the Dictator Game for each drinking category (H: High alcohol content; L: Low alcohol content) in each treatment. There is no systematic evidence that drinking affects the split proposals in this game. For example, the average proposal from individuals under the influence of a high alcohol content is nonsignificantly higher than that from individuals not under the influence in Treatments *HL-I* and *LH-I*. Moreover, the ranking is reversed in Treatment *LH*. The average split proposals are essentially the same between Treatment *HH* and Treatment *LL*. For almost all treatments, the nonparametric Mann-Whitney tests reveal that we cannot reject the null hypothesis that within a treatment, the split proposals made by participants under the influence of a high alcohol content are the same as those made by participants under no such influence (with the lowest p-value = 0.4880).[29] One marginal case is Treatment *HL-I*, in which the null hypothesis is rejected with a p-value 0.09. Similarly, regarding the between-treatment comparison, we cannot reject the null hypothesis that the split proposals observed in Treatment *LL* are the same as those observed in Treatment HH (Mann-Whitney test, p-value = 0.8721).

Guessing Game: Figure A4(b) reports the average number choices observed in the Guessing Game for each drinking category in each treatment. Again, there is no systematic evidence that drinking influences the number choices. The average number choice from individuals under the influence of a high alcohol content seems to be slightly higher than that from individuals not under the influence in Treatments *HL*, *LH* and *LH-I*. However, the differences are neither substantial in magnitude nor statistically significant. Moreover, the ranking becomes reversed in Treatment *HL-I*. The average number choices are essentially the same in Treatment *HH* and Treatment

[29] All Mann-Whitney tests reported in this section are two-sided.

LL. Confirming this observation, the nonparametric Mann-Whitney tests show that we cannot reject the null hypothesis that within a treatment, the number choices made by participants under the influence of high alcohol content are the same as those made by participants under no such influence in all treatments with no exception (the lowest p-value = 0.1019). Regarding the between-treatment comparison, we again cannot reject the null hypothesis that the number choices observed in Treatment LL are the same as those observed in Treatment HH (Mann-Whitney test, p-value = 0.9483).

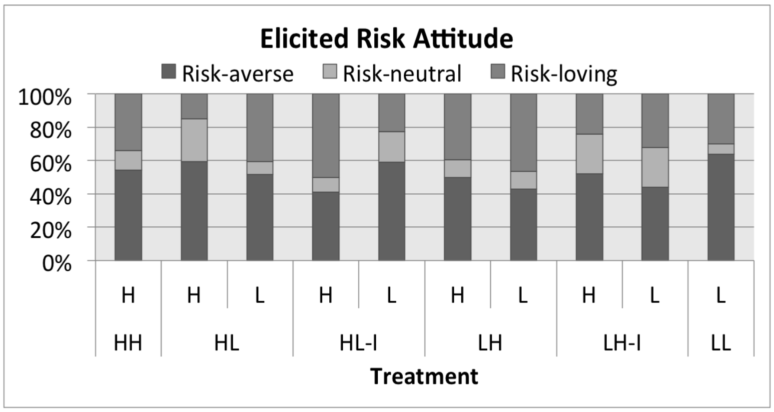


Figure A5: Experimental Outcomes - Risk Attitudes

Risk attitude: Figure A5 reports the result from the elicitation of participants' risk attitudes. Substantial variations exist in the empirical distributions of risk attitudes across treatments. However, no evidence is found that drinking systematically influences individuals' attitudes toward risk. On the one hand, the between-treatment comparison reveals that the proportion of risk-averse individuals is smaller in Treatment *HH* than in Treatment *LL* (54% vs. 64%). Similarly, the within-treatment comparison shows that the proportion of risk-averse individuals among those under the influence of high alcohol content is smaller than the proportion of risk-averse individuals among those under no such influence in Treatment *HL-I* (41% vs. 59%). On the other hand, all other within-treatment comparisons show that the proportion of risk-averse individuals among those under the influence of a high alcohol content is larger than that among those under no such influence in Treatment *HL-I*. The Mann-Whitney test, conducted with the average proportions of risk-averse individuals for each drinking category in each treatment as an independent observation reveals that we cannot reject the null hypothesis that the proportion of risk-averse individuals among those under the influence of a high alcohol content is the same as that among individuals not under the influence (p-value = 0.9168). Similarly, we cannot reject the null hypothesis that the proportion of risk-loving individuals among those under the influence of a high alcohol content is the same as that among individuals not under the influence (p-value = 0.9168).

B Proof of Proposition 2 and Corollary 1

Proof of Proposition 2 Recall that a consistent strategy always has truthful reporting by type-h sellers. Type-l and type-m may, however, exaggerate their reports.

Pure strategy

A pure strategy can be denoted by $(r_l, r_m) \in \{L, M, H\} \times \{M, H\}$. Note first that pure strategies (L, H) and (M, M) are necessarily inconsistent: if a type-m (type-h) seller finds one-step lying worthwhile (knowing that sophisticated buyers are not fooled), so would a type-l (type-m) seller (believing that they can fool sophisticated buyers).

Strategy (L, M) This strategy corresponds to truth-telling. The buyers are expected to always follow their received message in their price offers. Thus, a type-m seller's payoff is

$$\begin{cases} p_m - s_m & \text{if report Medium} \\ p_h - s_m - \lambda_1 & \text{if report High} \end{cases}.$$

A type-l seller's payoff is

$$\begin{cases} p_l - s_l & \text{if report Low} \\ p_m - s_l - \lambda_1 & \text{if report Medium} \\ p_h - s_l - \lambda_2 & \text{if report High} \end{cases}.$$

The truth-telling strategy (L, M) is consistent if and only if a type-m seller finds it optimal to report Medium and a type-l seller finds it optimal to report Low; that is, $\lambda_1 \geq p_m - p_l$ and $\lambda_2 \geq p_h - p_l$.

Strategy (H, H) The sophisticated buyers are expected to offer price p_l following every message. Thus, a type-m seller's payoff is

$$\begin{cases} \chi (p_m - s_m) & \text{if report Medium} \\ \chi (p_h - s_m) - \lambda_1 & \text{if report High} \end{cases}.$$

A type-l seller's payoff is

$$\begin{cases} p_l - s_l & \text{if report Low} \\ \chi p_m + (1 - \chi) p_l - s_l - \lambda_1 & \text{if report Medium} \\ \chi p_h + (1 - \chi) p_l - s_l - \lambda_2 & \text{if report High} \end{cases}.$$

The strategy under consideration is consistent if and only if $\lambda_1 \leq \chi(p_m - p_l)$ and $\lambda_2 - \lambda_1 \leq \chi(p_m - p_l)$. Under the restriction that $\lambda_1 \leq \lambda_2 \leq 2\lambda_1$, the condition above is simply $\lambda_1 \leq \chi(p_m - p_l)$.

Strategy (M, H) The sophisticated buyers are expected to offer price p_l following message Medium and price p_m following message High. A type-l seller's payoff is thus

$$\begin{cases} p_l - s_l & \text{if report Low} \\ \chi p_m + (1-\chi) p_l - s_l - \lambda_1 & \text{if report Medium} \\ \chi p_h + (1-\chi) p_m - s_l - \lambda_2 & \text{if report High} \end{cases}.$$

The strategy under consideration is consistent only if the type-l seller finds it optimal to report High, which requires $\lambda_1 \leq \chi(p_m - p_l)$ and $\lambda_2 - \lambda_1 \geq p_m - p_l$. These conditions are, however, incompatible with the assumption that $\lambda_2 \leq 2\lambda_1$.

Strategy (H, M) The sophisticated buyers are expected to offer price p_m following message Medium, and price p_l following message High. Thus, a type-l seller's payoff is

$$\begin{cases} p_l - s_l & \text{if report Low} \\ p_m - s_l - \lambda_1 & \text{if report Medium} \\ \chi p_h + (1-\chi) p_l - s_l - \lambda_2 & \text{if report High} \end{cases}.$$

The strategy under consideration is consistent only if the type-l seller finds it optimal to report High, which requires $\lambda_2 - \lambda_1 \leq \chi p_h + (1-\chi) p_l - p_m = (2\chi - 1)(p_m - p_l)$. This is, however, incompatible with the condition that $\chi < 1/2$.

Mixed Strategies with only Type-l Randomizing

A mixed strategy with only type-l randomizing can be represented by $(r_l, r_m) \in \{LM, LH, MH, LMH\} \times \{M, H\}$, where r_l stands for the set of messages over which type-l sender randomizes.

Some strategies in this class can be immediately excluded from consideration. First, strategies (LM, H) and (LMH, H) can only be consistent with knife-edge parameter configurations. The reason is as follows. The reporting strategy induces sophisticated buyers to offer p_l following messages "Low" and "Medium." A type-l seller can only find these messages equally appealing in the knife-edge parameter case (specifically, $\chi(p_m - p_l) = \lambda_1$). Moreover, strategy (LM, M) cannot be consistent: if a type-l seller finds one-step lying worthwhile (knowing that sophisticated buyers are not fooled), so would a type-m seller (believing that they can fool the sophisticated buyers).

Strategy (LH, M) The sophisticated buyers are expected to randomize between p_h (with probability α) and p_l following a High message. Thus, a type-m seller's payoff is

$$\begin{cases} p_m - s_m & \text{if report Medium} \\ (\chi + (1-\chi)\alpha)(p_h - s_m) - \lambda_1 & \text{if report High} \end{cases}.$$

Moreover, a type-l seller's payoff is

$$\begin{cases} p_l - s_l & \text{if report Low} \\ p_m - s_l - \lambda_1 & \text{if report Medium} \\ (\chi + (1-\chi)\alpha) p_h + (1-\chi)(1-\alpha) p_l - s_l - \lambda_2 & \text{if report High} \end{cases}$$

To ensure that the type-l seller finds it optimal to mix between Low and High messages, it is necessary that $\alpha = [\lambda_2 - \chi(p_h - p_l)] / [(1-\chi)(p_h - p_l)]$ and $\lambda_1 \geq p_m - p_l$. We have $\alpha \in [0,1]$ if and only if $\chi(p_h - p_l) \leq \lambda_2 \leq p_h - p_l$. Moreover, it can be verified that with this α, a type-m seller indeed finds it optimal to report truthfully. In summary, strategy (LH, M) is consistent if and only if $\lambda_1 \geq p_m - p_l$ and $\chi(p_h - p_l) \leq \lambda_2 \leq p_h - p_l$.

Strategy (LMH, M) The sophisticated buyers are expected to randomize between p_h (with probability α_h) and p_l following a High message and randomize between p_m (with probability α_m) and p_l following a Medium message. Thus, a type-m seller's payoff is

$$\begin{cases} (\chi + (1-\chi)\alpha_m)(p_m - s_m) & \text{if report Medium} \\ (\chi + (1-\chi)\alpha_h)(p_h - s_m) - \lambda_1 & \text{if report High} \end{cases}.$$

A type-l seller's payoff is

$$\begin{cases} p_l - s_l & \text{if report Low} \\ (\chi + (1-\chi)\alpha_m) p_m + (1-\chi)(1-\alpha_m) p_l - s_l - \lambda_1 & \text{if report Medium} \\ (\chi + (1-\chi)\alpha_h) p_h + (1-\chi)(1-\alpha_h) p_l - s_l - \lambda_2 & \text{if report High} \end{cases}.$$

The type-l seller finds all messages equally desirable if and only if

$$\alpha_h = \frac{\lambda_2 - \chi(p_h - p_l)}{(p_h - p_l)(1-\chi)} \text{ and } \alpha_m = \frac{\lambda_1 - \chi(p_m - p_l)}{(p_m - p_l)(1-\chi)}.$$

It follows from direct computation that at these values, the type-m seller finds it optimal to report Medium. The sophisticated buyers' strategy is well defined if and only if $\alpha_m, \alpha_h \in [0,1]^2$, or equivalently,

$$\chi(p_m - p_l) \leq \lambda_1 \leq p_m - p_l \text{ and } \chi(p_h - p_l) \leq \lambda_2 \leq p_h - p_l.$$

Strategy (MH, M) The sophisticated buyers are expected to randomize between p_m (with probability α_m) and p_l (with probability $1-\alpha_m$) following the Medium message and randomize between p_h (with probability α_h) and p_l (with probability $1-\alpha_h$) following the High message. Generically, it is impossible to have the sophisticated buyers' indifference following both the High and Medium messages. Moreover, Assumption 1 implies that $\alpha_m = \alpha_h = 1$ is impossible, and that $\alpha_m = \alpha_h = 0$ requires knife-edge parameters. Therefore, either $\alpha_m = 0$ or $\alpha_h = 0$.

A type-m seller's payoff is

$$\begin{cases} (\chi + (1-\chi)\alpha_m)(p_m - s_m) & \text{if report Medium} \\ (\chi + (1-\chi)\alpha_h)(p_h - s_m) - \lambda_1 & \text{if report High} \end{cases}.$$

A type-l seller's payoff is

$$\begin{cases} p_l - s_l & \text{if report Low} \\ (\chi + (1-\chi)\alpha_m) p_m + (1-\chi)(1-\alpha_m) p_l - s_l - \lambda_1 & \text{if report Medium} \\ (\chi + (1-\chi)\alpha_h) p_h + (1-\chi)(1-\alpha_h) p_l - s_l - \lambda_2 & \text{if report High} \end{cases}.$$

To ensure that a type-l seller is willing to mix between Medium and High messages, it is necessary that

$$2\alpha_h - \alpha_m = \frac{(\lambda_2 - \lambda_1) - \chi(p_h - p_m)}{(1-\chi)(p_m - p_l)} \text{ and} \tag{1}$$

$$\alpha_m \geq \frac{1}{1-\chi}\left(\frac{\lambda_1}{p_m - p_l} - \chi\right),$$

$$\text{(or equivalently, } \alpha_h \geq \frac{1}{1-\chi}\left(\frac{\lambda_2}{p_h - p_l} - \chi\right)). \tag{2}$$

To ensure that a type-m seller is willing to report truthfully, it is necessary that

$$(p_h - s_m)\alpha_h - (p_m - s_m)\alpha_m \leq \frac{\lambda_1 - \chi(p_h - p_m)}{1-\chi}. \tag{3}$$

We first explain that we cannot have $\alpha_m = 0$. Suppose (1) requires that $\alpha_h = [(\lambda_2 - \lambda_1) - \chi(p_h - p_m)] / [2(1$ This value of α_h satisfies (2) if and only if $\lambda_1 \leq \chi(p_m - p_l)$, which makes (3) impossible with a positive value of α_h and $\alpha_m = 0$. Next, with $\alpha_h = 0$, (1) requires that $\alpha_m = [\chi(p_h - p_m) - (\lambda_2 - \lambda_1)] / [(1-\chi)(p_m - p$ (2) is satisfied provided that $\lambda_2 \leq \chi(p_h - p_l)$ and (3) is satisfied provided that $\lambda_1 \geq \chi(p_h - p_m)$.[30] Moreover, it can be readily checked that $\alpha_m \in [0, 1]$ is guaranteed by $\chi \leq 1/2$ and $\chi(p_h - p_m) \leq \lambda_1 \leq \lambda_2 \leq \chi(p_h - p_l)$.

In sum, strategy (MH, M) is a consistent strategy if $\chi(p_h - p_m) \leq \lambda_1 \leq \lambda_2 \leq \chi(p_h - p_l)$.

[30] As shown above, the case of $\lambda_1 \leq \chi(p_h - p_m)$ admits a pure consistent strategy of (H, H).

Strategy (LH, H) The sophisticated buyers are expected to offer p_l following a (off-path) Medium message, and randomize between p_m (with probability α) and p_l following a High message. Thus, a type-m seller's payoff is

$$\begin{cases} \chi(p_m - s_m) & \text{if report Medium} \\ \chi(p_h - s_m) + (1-\chi)\alpha(p_m - s_m) - \lambda_1 & \text{if report High} \end{cases}.$$

A type-l seller's payoff is

$$\begin{cases} p_l - s_l & \text{if report Low} \\ \chi p_m + (1-\chi)p_l - s_l - \lambda_1 & \text{if report Medium} \\ \chi p_h + (1-\chi)\alpha p_m + (1-\chi)(1-\alpha)p_l - s_l - \lambda_2 & \text{if report High} \end{cases}.$$

To ensure that a type-l seller finds it optimal to mix between Low and High messages, it is necessary that $\alpha = (\lambda_2 - \chi(p_h - p_l)) / ((p_m - p_l)(1-\chi))$ and $\lambda_1 \geq \chi(p_m - p_l)$. We have $\alpha \in [0,1]$ if and only if $\chi(p_h - p_l) \leq \lambda_2 \leq (1+\chi)(p_m - p_l)$. With this α, a type-m seller's payoff is willing to report High if and only if

$$\lambda_2 \geq \lambda_1 \frac{p_m - p_l}{p_m - s_m} + (2\chi(p_m - s_m) - \chi(p_m - p_l)) \frac{p_m - p_l}{p_m - s_m}.$$

The last inequality is, however, incompatible with $\lambda_1 \geq \chi(p_m - p_l)$ and $\lambda_2 \leq (1+\chi)(p_m - p_l)$, as it implies

$$\lambda_2 \geq \lambda_1 \frac{p_m - p_l}{p_m - s_m} + (2\chi(p_m - s_m) - \chi(p_m - p_l)) \frac{p_m - p_l}{p_m - s_m} \geq 2\chi(p_m - p_l) > (1+\chi)(p_m - p_l).$$

Strategy (MH, H) The sophisticated buyers are expected to offer p_l following a Medium message. As a type-l seller finds a Low message weakly inferior, it is necessary that $p_l - s_l \leq \chi p_m + (1-\chi)p_l - s_l - \lambda_1 \Leftrightarrow \lambda_1 \leq \chi(p_m - p_l)$. In this case, strategy (MH, H) is not as simple as (H, H).

Mixed Strategies with Only Type-m Randomizing A mixed strategy with only type-m randomizing can be represented by $(r_l, r_m) \in \{L, M, H\} \times \{MH\}$. First, strategy (L, MH) is never consistent: if a type-m seller finds one-step lying worthwhile (knowing that sophisticated buyers are not fooled), so would a type-l seller (believing that they can fool the sophisticated buyers). Second, strategy (M, MH) is not as simple as (H, H). Under strategy (M, MH), sophisticated buyers are expected to offer p_l following a Medium message, so a type-l seller finds a Low message weakly inferior only if $p_l - s_l \leq \chi p_m + (1-\chi)p_l - s_l - \lambda_1 \Leftrightarrow \lambda_1 \leq \chi(p_m - p_l)$. Finally, strategy (H, MH) can only be consistent with knife-edge parameter configurations, as sophisticated buyers offer p_l following a High message and a type-m seller is indifferent between

Medium and High messages.

Mixed Strategies with Both Type-m and Type-l Randomizing A mixed strategy with both type-m and type-l randomizing can be represented by $(r_l, r_m) \in \{LM, LH, MH, LMH\} \times \{MH\}$, where r_l stands for the set of messages over which a type-l sender randomizes.

Strategy (MH, MH) The sophisticated buyers are expected to randomize between p_m (with probability β) and p_l following a Medium message. They are expected to randomize between p_h (with probability α_h), p_m (with probability α_m), and p_l (with probability $\alpha_l = 1 - \alpha_h - \alpha_m$) following a High message. Generically, it is impossible to have sophisticated buyers' indifference for all price offers stated above, following both the High and Medium messages.

A type-m seller's payoff is thus

$$\begin{cases} (\chi + (1-\chi)\beta)(p_m - s_m) & \text{if report Medium} \\ (\chi + (1-\chi)\alpha_h)(p_h - s_m) + (1-\chi)\alpha_m(p_m - s_m) - \lambda_1 & \text{if report High} \end{cases}.$$

A type-l seller's payoff is

$$\begin{cases} p_l - s_l & \text{if report Low} \\ (\chi + (1-\chi)\beta)p_m + (1-\chi)(1-\beta)p_l - s_l - \lambda_1 & \text{if report Medium} \\ (\chi + (1-\chi)\alpha_h)p_h + (1-\chi)\alpha_m p_m + (1-\chi)(1-\alpha_h-\alpha_m)p_l - s_l - \lambda_2 & \text{if report High} \end{cases}.$$

To ensure that the type-m seller finds it optimal to mix between Medium and High messages, it is necessary that

$$(p_h - s_m)\alpha_h + (p_m - s_m)\alpha_m = \frac{1}{1-\chi}\left((\chi + (1-\chi)\beta)(p_m - s_m) - \chi(p_h - s_m) + \lambda_1\right).$$

To ensure that the type-l seller is indifferent between Medium and High messages, it is necessary that

$$\alpha_h(p_h - p_l) + \alpha_m(p_m - p_l) = \frac{1}{1-\chi}\left((\chi + (1-\chi)\beta)p_m + (1-\chi)(1-\beta)p_l - \chi p_h - (1-\chi)p_l + \lambda_2 - \lambda_1\right).$$

Fixing a $\beta \in [0,1]$, the two equations in (α_h, α_m) above gives a solution of

$$\alpha_h = \frac{1}{1-\chi}\left(\frac{-\lambda_2(p_m - s_m) + \lambda_1(p_h - s_m)}{(s_m - p_l)(p_h - p_m)} - \chi\right); \text{ and} \tag{4}$$

$$\alpha_m = \frac{1}{1-\chi}\left(\frac{\lambda_2(p_h - s_m) - \lambda_1(2p_h - p_l - s_m)}{(s_m - p_l)(p_h - p_m)} + (\chi + \beta(1-\chi))\right). \tag{5}$$

Observe that α_h does not depend on β and lies in $[0,1]$ if and only if

$$-1 \leq \frac{\lambda_2 (p_m - s_m) - \lambda_1 (p_h - s_m)}{(s_m - p_l)(p_h - p_m)} \leq -\chi. \tag{6}$$

Generically, if the sophisticated buyers fully mix following a High message, then they do not randomize following a Medium message ($\beta = 0$ or 1). Suppose this is indeed the case and $\beta = 0$. Then, $\alpha_m \in [0,1]$ if and only if

$$-\chi \leq \frac{\lambda_2 (p_h - s_m) - \lambda_1 (2p_h - s_m - p_l)}{(s_m - p_l)(p_h - p_m)} \leq 1 - 2\chi.$$

This is, however, inconsistent with (6) and $\lambda_2 \leq 2\lambda_1$.

Suppose next that $\beta > 0$. As $\alpha_m, \alpha_h > 0$ generically (by (4) and (5)), p_h (p_m) is one of the optimal prices for sophisticated buyers following a High (Medium) message. This implies that sophisticated buyers are willing to pay at least p_m under the prior belief of the seller's type, which contradicts Assumption 1.

Strategy (LH, MH) The sophisticated buyers are expected to randomize between p_h (with probability α_h), p_m (with probability α_m), and p_l (with probability $\alpha_l = 1 - \alpha_h - \alpha_m$) following a High message. A type-m seller's payoff is thus

$$\begin{cases} p_m - s_m & \text{if report Medium} \\ (\chi + (1-\chi)\alpha_h)(p_h - s_m) + (1-\chi)\alpha_m (p_m - s_m) - \lambda_1 & \text{if report High} \end{cases}.$$

A type-l seller's payoff is

$$\begin{cases} p_l - s_l & \text{if report Low} \\ p_m - s_l - \lambda_1 & \text{if report Medium} \\ (\chi + (1-\chi)\alpha_h) p_h + (1-\chi)\alpha_m p_m + (1-\chi)(1-\alpha_h-\alpha_m) p_l - s_l - \lambda_2 & \text{if report High} \end{cases}.$$

To ensure that the type-m seller finds it optimal to mix between Medium and High messages, it is necessary that

$$p_m - s_m = (\chi + (1-\chi)\alpha_h)(p_h - s_m) + (1-\chi)\alpha_m (p_m - s_m) - \lambda_1.$$

To ensure that the type-l seller is indifferent between Low and High messages, it is necessary that

$$p_l = (\chi + (1-\chi)\alpha_h) p_h + (1-\chi)\alpha_m p_m + (1-\chi)(1-\alpha_h-\alpha_m) p_l - \lambda_2.$$

The solution to the system of equations above has

$$\alpha_m = \frac{\lambda_2 (p_h - s_m) - (\lambda_1 + (p_m - s_m))(p_h - p_l)}{(1-\chi)(s_m - p_l)(p_h - p_m)};$$

To ensure that the buyer's strategy is well defined, we need $\alpha_m \geq 0$, or equivalently,

$$\frac{2(p_m - s_m)}{s_m - p_l} \leq \frac{\lambda_2 (p_h - s_m) - \lambda_1 (p_h - p_l)}{(s_m - p_l)(p_h - p_m)}. \tag{7}$$

As the type-l sellers should find the Medium report weakly dominated, it is necessary that $\lambda_1 \geq p_m - p_l$. It can be directly verified that (7) holds with equality at $(\lambda_1, \lambda_2) = (p_h - p_m, p_h - p_l,)$. Consequently, any combination of (λ_1, λ_2) that satisfies (7) in the region $\lambda_1 \geq p_m - p_l$ must have $\lambda_2 \geq p_h - p_l$. However, a pure strategy (L, M) is consistent for $\lambda_1 \geq p_m - p_l$ and $\lambda_2 \geq p_h - p_l$, so this strategy is never simple.

Strategy (LM, MH) We show below that this strategy cannot be consistent. The sophisticated buyers are expected to randomize between p_m (with probability α_m) and p_l following a Medium message, and randomize between p_h (with probability α_h) and p_m following a High message. A type-m seller's payoff is thus

$$\begin{cases} (\chi + (1-\chi)\alpha_m)(p_m - s_m) & \text{if report Medium} \\ (\chi + (1-\chi)\alpha_h) p_h + (1-\chi)(1-\alpha_h) p_m - s_m - \lambda_1 & \text{if report High} \end{cases}.$$

A type-l's seller's payoff is

$$\begin{cases} p_l - s_l & \text{if report Low} \\ (\chi + (1-\chi)\alpha_m) p_m + (1-\chi)(1-\alpha_m) p_l - s_l - \lambda_1 & \text{if report Medium} \\ (\chi + (1-\chi)\alpha_h) p_h + (1-\chi)(1-\alpha_h) p_m - s_l - \lambda_2 & \text{if report High} \end{cases}.$$

To ensure that the type-l seller finds it optimal to mix between Low and Medium messages, it is necessary that $\alpha_m = (\lambda_1/(p_m - p_l) - \chi)/(1-\chi)$. The mixed strategy of the sophisticated buyer is well defined only if $\alpha_m \in [0,1] \Leftrightarrow \chi(p_m - p_l) \leq \lambda_1 \leq p_m - p_l$.

With the α_m pinned down above, the type-m seller finds it optimal to mix between Medium and High messages only if

$$\alpha_h = \left(\left(\left(\frac{\lambda_1}{p_m - p_l} - 1\right)(p_m - s_m) + \lambda_1\right)\frac{1}{p_h - p_m} - \chi\right)\frac{1}{1-\chi}.$$

Moreover, the type-l sender should find it suboptimal to report a High message. With the values of α_m and α_h pinned down above, this requirement is equivalent to $\lambda_2 \geq (2p_m - s_m - p_l)\lambda_1/(p_m - p_l) +$

$s_m - p_l$. This is, however, incompatible with the assumption that $\lambda_2 \leq 2\lambda_1$, as

$$2\lambda_1 \geq \left(\frac{2p_m - s_m - p_l}{p_m - p_l}\right)\lambda_1 + s_m - p_l \Leftrightarrow \lambda_1 \geq p_m - p_l,$$

which contradicts the above requirement that $\alpha_m \leq 1 \Leftrightarrow \lambda_1 \leq p_m - p_l$.

Strategy (LMH, MH) The sophisticated buyers are expected to randomize between p_m (with probability β) and p_l following a Medium message. They are expected to randomize between p_h (with probability α_h), p_m (with probability α_m), and p_l (with probability $\alpha_l = 1 - \alpha_h - \alpha_m$) following a High message. The payoff functions of type-l and type-m thus coincide with those in the strategy (MH, MH) considered above. In this case, in contrast, it is possible to have a fully mixed strategy for sophisticated buyers.

Upon solving the system of equations (in β, α_h, α_m and α_l) to attain the indifference of type-l and type-m sellers between the relevant messages, we obtain that

$$\alpha_m = \frac{1}{1-\chi}\frac{(\lambda_2 - 2\lambda_1)(p_h - s_m)}{(s_m - p_l)(p_h - p_m)},$$

which, however, cannot be positive as $\lambda_2 \leq 2\lambda_1$. Therefore, this class of mixed strategies cannot be consistent in the parameter region under study.

Summary

After scanning all possible simple consistent strategies above, we are left with the following six relevant cases:

- (L, M): $\lambda_1 \geq p_m - p_l$ and $\lambda_2 \geq p_h - p_l$
  - Sophisticated buyers offer p_m following the Medium message, and offer p_h following the High message.
- (LH, M): $\lambda_1 \geq p_m - p_l$ and $\chi(p_h - p_l) \leq \lambda_2 \leq p_h - p_l$
  - Sophisticated buyers offer p_m following the Medium message, and mix between p_h (with probability $[\lambda_2 - \chi(p_h - p_l)] / [(1-\chi)(p_h - p_l)]$) and p_l following the High message.
  - The type-l sellers send the High message with probability $(b_h - p_h) / (p_h - p_l)$.
- (LMH, M): $\chi(p_m - p_l) \leq \lambda_1 \leq p_m - p_l$ and $\chi(p_h - p_l) \leq \lambda_2 \leq p_h - p_l$

- Sophisticated buyers mix between p_m (with probability $[\lambda_1 - \chi(p_m - p_l)] / [(1-\chi)(p_m - p_l)]$) and p_l following the Medium message, and mix between p_h (with probability $[\lambda_2 - \chi(p_h - p_l)] / [(1 -$ and p_l following the High message.
- The type-l sellers send the Medium message with probability $(b_m - p_m) / (p_m - p_l)$, and send the High message with probability $(b_h - p_h) / (p_h - p_l)$.

- (MH, M): $\chi(p_h - p_m) \leq \lambda_1$ and $\lambda_2 \leq \chi(p_h - p_l)$

  - Sophisticated buyers mix between p_m (with probability $[\chi(p_h - p_m) - (\lambda_2 - \lambda_1)] / [(1-\chi)(p_m - p_l)$ and p_l following the Medium message, and offer p_l following the High message.
  - The type-l sellers send the Medium message with probability $(b_m - p_m) / (p_m - p_l)$, and send the High message with probability at least $(b_h - p_h) / (p_h - p_l)$.

- (H, H): $\lambda_1 \leq \chi(p_m - p_l)$

  - Sophisticated buyers offer p_l always.

The figure below depicts the consistent strategies for each lying cost combination.

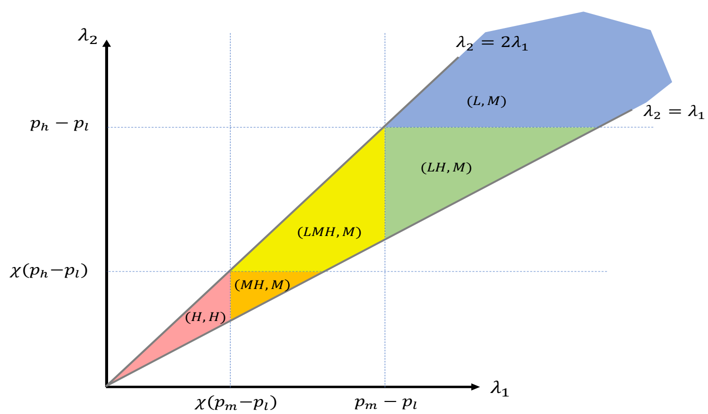


Figure A6: Consistent Strategies

Proof of Corollary 1

It follows from the summary of the analysis in the proof of Proposition 2.

C Tables

Table A1: **Balance Check**

	Mean/[SD]				p-values					
	(1)	(2)	(3)	(4)						
	HH	*HL*	*LH*	*LL*	(1)-(2)	(1)-(3)	(1)-(4)	(2)-(3)	(2)-(4)	(3)-(4)
Drinking Ability	4.472	4.865	4.763	4.861	0.466	0.520	0.461	0.830	0.994	0.831
	[0.366]	[0.390]	[0.268]	[0.376]						
Body Weight	51.944	54.459	54.474	53.333	0.200	0.249	0.489	0.994	0.507	0.562
	[1.572]	[1.159]	[1.506]	[1.228]						
Gender (Female)	0.167	0.270	0.184	0.250	0.291	0.845	0.391	0.380	0.846	0.499
	[0.063]	[0.074]	[0.064]	[0.073]						
Risk Preference	4.500	4.432	4.895	4.778	0.897	0.381	0.533	0.371	0.503	0.792
	[0.317]	[0.407]	[0.315]	[0.309]						

Note: The displayed p-values are from t-tests.

Table A2: **Pairwise Comparisons**

	(1)	(2)	(3)	(4)
	Baseline *LL*	Baseline *LH*	Baseline *LL*	Baseline *HL*
Treatment *HL*	0.108**			
	(0.0464)			
Treatment *HH*		0.193***		0.0521
		(0.0429)		(0.0439)
Treatment *LH*			-0.0357	
			(0.0458)	
Participants in China	-0.00206	-0.185***	-0.153***	-0.0498
	(0.0505)	(0.0461)	(0.0504)	(0.0470)
Constant	0.452***	0.589***	0.582***	0.616***
	(0.0853)	(0.0771)	(0.0868)	(0.0773)
Period Dummies	Y	Y	Y	Y
Observations	466	510	469	507
R-squared	0.026	0.088	0.027	0.026

Notes: Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1. The estimates are from linear regression models.

Table A3: **Sellers' Lying Behavior by Asset Types**

	Baseline: Treatment *LL*			Baseline: Treatment *LH*		
Lie given asset type	Low	Medium	High	Low	Medium	High
Treatment *HL*	0.0835	0.186**	0.0558			
	(0.0630)	(0.0755)	(0.0491)			
Treatment *HH*				0.116**	0.251***	0.0784*
				(0.0560)	(0.0741)	(0.0420)
Constant	0.797***	0.526***	0.0854***	0.800***	0.526***	0.0521**
	(0.0488)	(0.0576)	(0.0310)	(0.0481)	(0.0576)	(0.0228)
Observations	136	163	167	165	157	188
R-squared	0.013	0.037	0.008	0.028	0.070	0.019
	Baseline: Treatment *LL*			Baseline: Treatment *LH*		
Message "Not Reveal" given asset type	Low	Medium	High	Low	Medium	High
Treatment *HL*	-0.0199	0.0457	0.0371			
	(0.0520)	(0.0457)	(0.0416)			
Treatment *HL*				-0.108**	-0.101**	0.0126
				(0.0486)	(0.0421)	(0.0431)
Constant	0.127***	0.0843***	0.0682**	0.176***	0.136***	0.103***
	(0.0377)	(0.0307)	(0.0270)	(0.0416)	(0.0368)	(0.0295)
Observations	154	183	183	187	172	211
R-squared	0.001	0.005	0.004	0.028	0.032	0.000

Notes: Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1. The estimates are from linear regression models.

Table A4: **Treatment Effect of Alcohol on Seller's Lying - Two-Step Lying**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	One-Step Lying			Two-Step Lying			Ordered Probit
Treatment LH	-0.0373	-0.0379	-0.0341	0.0202	0.0211	-0.0322	-0.038
	(0.0401)	(0.0401)	(0.0401)	(0.0331)	(0.0332)	(0.0459)	(0.114)
Treatment HL	0.0535	0.0531	0.0476	0.0180	0.0192	0.0927*	0.178*
	(0.0423)	(0.0425)	(0.0444)	(0.0331)	(0.0332)	(0.0479)	(0.108)
Treatment HH	0.0484	0.0491	0.0449	0.0754**	0.0772**	0.143***	0.329***
	(0.0410)	(0.0412)	(0.0412)	(0.0342)	(0.0341)	(0.0446)	(0.104)
Participants in China			-0.0554*			-0.107***	-0.127
			(0.0332)			(0.0353)	(0.080)
Period			-0.00203			0.0026	0.016
			(0.005)			(0.005)	(0.013)
Constant	0.269***	0.251***	0.271***	0.141***	0.145***	0.450***	
	(0.0295)	(0.0512)	(0.0656)	(0.0231)	(0.0438)	(0.0715)	
Period Dummies	N	Y	N	N	Y	N	Y
Preference etc.	N	N	Y	N	N	Y	Y
Observations	976	976	976	976	976	976	976
R-squared	0.007	0.013	0.016	0.006	0.016	0.048	0.017

Notes: Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1. The estimates are from linear regressions, except for the column (7) that reports estimates from the ordered Probit model.

Table A5: **Treatment Effect on Transaction Rates Controlling for Asset Types**

	(1)	(2)	(3)	(4)	(5)	(6)
	Baseline LL	Baseline LL	Baseline LL	Baseline LH	Baseline LL	Baseline HL
Treatment *LH*	-0.0430	-0.0282			-0.0289	
	(0.0434)	(0.0323)			(0.0325)	
Treatment *HL*	-0.0928**	-0.0701**	-0.0712**			
	(0.0435)	(0.0321)	(0.0321)			
Treatment *HH*	-0.0348	-0.0543*		-0.0271		0.0124
	(0.0431)	(0.0302)		(0.0289)		(0.0291)
Asset Type 2		-0.594***	-0.602***	-0.574***	-0.547***	-0.641***
		(0.0280)	(0.0396)	(0.0403)	(0.0415)	(0.0381)
Asset Type 3		-0.838***	-0.820***	-0.858***	-0.810***	-0.863***
		(0.0199)	(0.0305)	(0.0263)	(0.0303)	(0.0262)
Participants in China	0.00801	0.00933	-0.0800**	0.0905***	-0.00899	0.0293
	(0.0327)	(0.0249)	(0.0377)	(0.0332)	(0.0379)	(0.0323)
Constant	0.579***	1.048***	1.104***	0.976***	1.050***	0.970***
	(0.0601)	(0.0470)	(0.0671)	(0.0525)	(0.0665)	(0.0552)
Period Dummies	Y	Y	Y	Y	Y	Y
Observations	1,090	1,090	520	570	530	560
R-squared	0.018	0.504	0.482	0.537	0.464	0.546

Notes: Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1. The estimates are from linear regression models.

Table A6: **Treatment Effect on Transaction Rates Controlling for Buyers' Offers and Asset Types**

	(1)	(2)	(3)	(4)	(5)
Control	Offer	Offer and Asset	Offer Low	Offer Middle	Offer High
Treatment LH	-0.0409	-0.0238	-0.0711***	-0.00600	0.119
	(0.0409)	(0.0268)	(0.0272)	(0.0353)	(0.115)
Treatment HL	-0.0732*	-0.0457*	-0.0586**	-0.0626*	0.137
	(0.0405)	(0.0268)	(0.0259)	(0.0366)	(0.131)
Treatment HH	-0.0412	-0.0627**	-0.0659***	-0.0639**	0.0935
	(0.0401)	(0.0253)	(0.0253)	(0.0307)	(0.0905)
Asset Type Middle		-0.609***	-0.908***	-0.00902	-0.0847
		(0.0228)	(0.0201)	(0.0149)	(0.0864)
Asset Type High		-0.889***	-0.914***	-0.888***	-0.0765
		(0.0196)	(0.0193)	(0.0265)	(0.0800)
Participants in China	-0.0220	-0.0256	-0.0253	-0.0303	-0.0412
	(0.0307)	(0.0208)	(0.0214)	(0.0311)	(0.0459)
Offer Middle	0.284***	0.334***			
	(0.0316)	(0.0205)			
Offer High	0.634***	0.779***			
	(0.0294)	(0.0511)			
Constant	0.460***	0.928***	1.043***	1.068***	1.032***
	(0.0569)	(0.0410)	(0.0485)	(0.0397)	(0.0632)
Period Dummies	Y	Y	Y	Y	Y
Observations	1,090	1,090	683	358	49
R-squared	0.136	0.672	0.819	0.819	0.241

Notes: Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1. Treatment LL is the baseline. The estimates are from linear regression models.

D Experimental Instructions

Instructions

Welcome to the experiment. In the following two hours or less, you will participate in 4 stages of economics decision-making experiment. Please read the instructions below carefully; the cash payment you will receive at the end of the experiment depends on how you make your decisions according to these instructions. Communication of any kinds with any other participants will not be allowed.

Today's experiments consist of FOUR stages. The final cash payment will be the sum of your earnings from the four stages, translated into SGD as the exchange rate of 35 points = 1 SGD, plus a show-up payment of 5 SGD for arriving to the experiment on time and participating.

As part of this study, we will first ask you to drink one cup of alcoholic beverage (~200ml) in 6 minutes. There are two types of beverage: high alcohol content (about 11%), and low alcohol content (about 1%). We will randomly select half of you to drink each type of beverage. Then, we will proceed to the experiment. The following is the instruction for the first stage. After you participate in the first stage, further instructions will be given to you via your computer screen.

STAGE 1

At the beginning of this stage, those participants who have drunk the high-alcohol-content beverage will be assigned the role of Member A, and those participants who have drunk the low-alcohol-content beverage will be assigned the role of Member B. Your role will remain fixed throughout this stage of the experiment.

This stage consists of 10 rounds of decision-making. In each round, one Member A and one Member B will be randomly and anonymously paired to form a group, with a total of 10 groups. You will not be told the identity of the participant you are matched with, nor will that participant be told your identity – even after the end of the experiment.

For the payment from this stage, one round will be randomly selected at the end of the experiment. Every participant will be paid based on their actions and the actions of their randomly counterpart in the selected game. Any of the games could be the game selected. Therefore, you should treat each game like it will be the one determining your payment.

Your Decision in Each Round

In each round, Member A is endowed with **an asset K**, whereas Member B is endowed with **400 points**. The asset K can be low, medium, or high type. At the beginning of each round, the computer randomly selects, with equal chances, the type of the asset K, which will be revealed only to Member A.

After observing the type of the asset, Member A chooses what message about the type of asset to send to Member B. Four messages are available:

"High" / "Medium" / "Low" / "Not Reveal."

It is not part of instruction that you need to tell the truth.

After receiving the message sent by Member A, Member B makes an offer (in points) to buy the asset K from Member

A. Three offers are available:

150 Points / 400 Points / 650 Points.

Member A then decides whether to accept or reject the offer.

Your Earnings in Each Round

Your earning in each round depends on i) the actual type of asset K, ii) the offer made by Member B, and iii) whether Member A accepts or rejects the offer.

1. If Member A rejects the offer from Member B, then Member A will retain the asset K and no transaction will take place.
2. If Member A accepts the offer from Member B, the transaction will take place: Member A will transfer the asset K to Member B, and Member B will pay the offered amount of points to Member A.

At the end of each round, the asset K will be transferred into points according to the following table:

[**Table 1: Value of Asset K (in points)**]

Asset K's Actual Type	If Member A Holds Asset K	If Member B Holds Asset K
Low	0	250
Medium	200	450
High	450	750

For example,

1. Suppose that Member A accepts the offer of 650 points from Member B. It turns out that the actual type of asset K is Medium. Then,
   Member A's Earning = Payment Transfer from Member B = 650 points
   Member B's Earning = Initial Endowment – Payment + Value of Asset K
   = 400 – 650 + 450 = 200 points.
2. Suppose that Member A rejects the offer of 400 points from Member B. It turns out that the actual type of asset K is medium. Then,
   Member A's Earning = Value of Asset K = 200 points
   Member B's Earning = Initial Endowment = 400 points.

Information Feedback

At the end of each round, you will be informed about (i) the message sent by Member A, (ii) the offer made by Member B, (iii) the accept/reject decision by Member A, (iv) the actual type of asset K, and (v) your earning in points.

Practice Rounds

We will provide you with one practice round. At the beginning of the practice round, you will be randomly assigned the role of either Member A or Member B. Your role in the official rounds will be the same as that in the practice round. Once the practice round is over, the computer will tell you "The official rounds begin now!"

Administration

Your decisions and your monetary payment will be kept confidential. Upon finishing the experiment, you will receive your cash payment. You will be asked to sign your name to acknowledge your receipt of the payment. You are then free to leave.

If you have any question, please raise your hand now. We will answer your question individually. If there is no question, we will proceed to the practice round now.

QUIZ

1. Suppose that Member A accepts the offer of 150 points from Member B. It turns out that the actual type of asset K is High. Calculate each member's earning. (Please use the information in **Table 1**.)

   Member A's Earning = ______________________________

   Member B's Earning = ______________________________

2. Suppose that Member A rejects the offer of 150 points from Member B. It turns out that the actual type of asset K is High. Calculate each member's earning. (Please use the information in **Table 1**.)

   Member A's Earning = ______________________________

   Member B's Earning = ______________________________

3. Suppose that Member A accepts the offer of 650 points from Member B. It turns out that the actual type of asset K is Low. Calculate each member's earning. (Please use the information in **Table 1**.)

   Member A's Earning = ______________________________

   Member B's Earning = ______________________________

STAGE 2

At the beginning of this stage, one half of the participants will be randomly assigned the role of Member C, and the other half the role of Member D. Your role will remain fixed throughout this stage of the experiment.

This stage only has 1 round of decision-making. At the beginning, one Member C and one Member D will be randomly and anonymously paired to form a group. You will not be told the identity of the participant you are matched with, nor will that participant be told your identity – even after the end of the experiment.

In each group, Member C makes a split (only with integers) of 100 points as

"____________Points for me and _____________Points for Member D."

The split made by Member C is revealed to Member D, and 100 points are divided accordingly. Member D thus has no decision to make. At the end of the stage, the following message will be displayed:

"Member C receives _____ Points and Member D receives ______Points."

STAGE 3

In this stage, each participant simultaneously and independently chooses an integer number between 0 and 100 inclusively. The computer will then calculate the average of the numbers chosen by all participants. The participant whose number choice is closest to the 2/3 of the average will be declared the winner, and awarded 100 points. In the case of tie, the prize of 100 points will be shared equally among the joint winners.

At the beginning of this stage, the computer displays the following message:

Please input an integer number between 0 and 100 (inclusively).

You can input any number between 0 and 100. After all participants have entered their numbers, the computer will do the calculation and decide the winner(s). At the end of this stage, you will receive a message of the following form:

The winning number: W / Your number choice: N / Award given to you: P

STAGE 4

In this stage, 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 **12 rows** in the table but just one row 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 100 points. If you chose option B in that line, you will receive either 140 points or 60 points. To determine your earnings in the case you chose option B, there would be a second random draw. The computer will randomly determine if your payoff is 140 points or 60 points, with the chances stated in Option B.

You earnings from this stage 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.