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 transaction. 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 investigate the effects of alcohol consumption by varying the alcohol content of the assigned beverages across treatments. Our main findings are as follows. First, sellers under the influence of high alcohol content lie significantly more than sellers who are not under the influence. Second, buyers under the influence of high alcohol content make higher offers for the assets. Third, the public availability of information on alcohol content does not change players’ behavior significantly. These findings are qualitatively consistent with a model of communication with a cost of lying and naive receivers, and they suggest that alcohol consumption has the direct effects of lowering both the lying cost and the degree of sophistication in interpreting received messages.

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

JEL classification numbers: C72; C92; D82; D83

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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 that 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 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 beverage: 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 under the influence of high alcohol content lie significantly more than sellers who are not under the influence. Second, when buyers are under the influence of higher alcohol content, they tend to make higher offers for the asset. Third, public availability of information on the alcohol content does not change players’ behavior significantly. Taken together, these findings suggest that alcohol consumption directly lowers peoples’ 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 latter finding is in accord with the intuition that alcohol lowers peoples’ ability to extract information from received messages (see, for example, Steele and Josephs (1990)), the finding that people under the influence 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 result to 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. 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 if 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) 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 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.

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.

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


3 This result is consistent with the findings in Breslin et al. (1999), Corazzini et al. (2015), and Lane et al. (2004).
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 one’s 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 is a relatively small body of economic literature on alcohol consumption and its immediate effects. 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). 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. Haucaup 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 to 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: the 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, \( \Pr (\theta) = \frac{1}{3} \) for all asset type \( \theta \in \{h, m, l\} \). 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 \( b_\theta \) and \( s_\theta \) 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 \( \theta \).

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 \( \{p_h, p_m, p_l\} \) with the following properties: (i) \( p_h > p_m > p_l \), (ii) \( b_\theta > p_\theta > s_\theta \) for all \( \theta \), and (iii) \( p_h > \frac{1}{3} (b_h + b_m + b_l) \). The second property ensures that a
Pareto-improving trade is always feasible. The third property ensures that it is suboptimal for the buyer to offer a price \( p_h \) under the prior belief. 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 \( M = \{ \text{"High"}, \text{"Medium"}, \text{"Low"}, \text{"Not reveal"} \} \). Each message is costless to both players, and the seller is not obliged to send a message that coincides with the asset’s type.

The timeline is as follows. The seller privately learns the type of the asset and sends a message to the buyer. After seeing the message (but not the asset type), the buyer makes one of the following offers: \( p_l, p_m, \) or \( p_h \). After receiving the offer, the seller decides whether to accept or reject the offer. If the offer is accepted, the transaction takes place: the asset and money change hands as stated in the offer. Otherwise, no transaction takes place: neither the asset nor money change hands.

The Bayesian Nash equilibrium of the game described above can be solved by backward induction. In the last stage, the seller holding an asset of type \( \theta \) would accept the price offer \( p \) if and only if \( p > s_\theta \). Taking this acceptance rule into account, the buyer would evaluate the asset conditional on his offer being accepted and choose a price \( p \in \{ p_h, p_m, p_l \} \) that maximizes \( E[b_\theta|p > s_\theta] - p \). It is clear that the seller’s message plays no role in these computations, 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 following proposition summarizes the discussion above; a formal proof is omitted, as it is trivial.

**Proposition 1** (Babbling Prediction). In the unique Bayesian Nash equilibrium outcome, 1) the seller’s message does not depend on the type of asset, and 2) the buyer’s price offer does not depend on the message received.

### 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, making it profitable to deceive this group of buyers by overreporting the asset type. However, the existence of a lying cost means that overreporting may not be always optimal. The purpose of such a model is to help develop hypotheses on how alcohol consumption could potentially...
affect communication and trading in the game under study. Therefore, instead of pursuing the most general characterization of equilibria with a lying cost and credulous receivers, we make a number of assumptions to keep the model as simple and tractable as possible.

The game is identical to that in the previous subsection except that some players are assumed to have different payoff functions. Specifically, we assume that each seller has a lying cost $\lambda$; she must bear this cost whenever her report differs from her true asset type. There are two types of buyers: sophisticated and naive. A naive buyer takes the seller’s message at face value, whereas a sophisticated buyer understands the sellers’ incentives and updates his belief accordingly. Moreover, a sophisticated buyer is assumed to adopt the most pessimistic belief about the asset type following off-path messages. The fraction of naive buyers is denoted by $\chi^* \in [0, 1]$. Finally, we impose the following assumptions on the parameters.

**Assumption 1.**

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

(b) $\max \left\{ \frac{1}{2} (b_m + b_l) - p_m, \frac{1}{2} (b_h + b_l) - p_h \right\} < \frac{1}{2} (b_l - p_l)$.

Assumption 1(a) states that for $\theta \in \{ h, m \}$, it is necessary to offer $p_\theta$ in order for a $\theta$-type seller to sell her asset. Assumption 1(b) ensures that a sophisticated buyer is willing to offer only $p_l$ if he believes that the asset has an equal chance either of being type-$l$ and type-$m$ or of being type-$l$ and type-$h$. It is straightforward to check that these assumptions on parameters hold in our experimental implementation.

Recall that a seller’s reporting strategy is a mapping from the set of asset types $\{ h, m, l \}$ to the message space $M$. Denote the seller’s belief about the fraction of naive buyers by $\chi$. Given a belief $\chi$, we say a seller’s reporting strategy $\sigma$ is *consistent* if it is optimal for the seller, given that the buyer plays a best response to $\sigma$. Note that a consistent reporting strategy is an equilibrium strategy if the seller’s belief $\chi$ coincides with the actual fraction $\chi^*$ of naive buyers. To allow for the possibility that one’s belief system is influenced by external factors (such as one’s own alcohol consumption and information about that of one’s trading partner), the notion of a consistent strategy allows the seller’s belief $\chi$ to differ from the true fraction $\chi^*$.

The following two observations are immediate. First, as $p_m < s_h$, an $h$-type seller would always report “High” because any other message necessarily gives her a negative payoff (due to the lying cost). Second, an $m$-type or an $l$-type seller, if she decides to lie, only lies by reporting “High”. The reason is that a “High” message allows her to obtain a strictly more favorable offer from a naive buyer and a weakly more favorable offer from a sophisticated buyer (as an $h$-type seller always reports ”High”).

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4That is, the lying cost is constant regardless of how much she lies.
Using the observations above, the proposition below characterizes the seller’s consistent reporting strategy for all combinations of $\lambda$ and $\chi$.

**Proposition 2.** The seller’s consistent reporting strategy depends on $(\lambda, \chi)$ as follows.

(i) If $\lambda \geq p_h - p_l$, then all seller types report truthfully.

(ii) If $\lambda \in [\chi (p_h - p_l), p_h - p_l]$, then only $l$-type sellers lie with a positive probability.\(^5\)

(iii) If $\lambda \in (\chi (p_h - s_m) - (p_m - s_m), \chi (p_h - p_l))$, then only $l$-type sellers lie (with certainty).

(iv) If $\lambda \in (\chi (p_h - s_m) - (p_m - s_m), \chi (p_h - p_m))$, there are two consistent strategies:

(a) only $l$-type sellers lie (with certainty);

(b) both $l$-type and $m$-type sellers lie (with certainty).

(v) If $\lambda < \chi (p_h - s_m) - (p_m - s_m)$, then both $l$-type and $m$-type sellers lie (with certainty).

The proof of the proposition is presented in Appendix A. The proposition states that a lower value of $\lambda$ and a higher value of $\chi$ are associated with more lying. This result is intuitive. When a seller decides whether to lie, she trades off the constant lying cost against the benefit of soliciting a more favorable offer from the naive buyers. A low lying cost and a large proportion of naive buyers therefore favor lying.

Recall that a buyer’s strategy is a mapping from the received messages to price offers. A naive buyer simply offers $p_\theta$ after receiving message $\theta$. A sophisticated buyer forms a belief about the seller’s reporting strategy based on his belief about the seller’s cost of lying, denoted by $\delta$, and his (second-order) belief about the seller’s belief about the fraction of naive buyers, denoted by $q$. We require a sophisticated buyer to play an offer strategy consistent with his belief $(\delta, q)$. Specifically, given his belief $(\delta, q)$, a sophisticated buyer uses Proposition 2 to deduce the seller’s unique consistent reporting strategy and to play the best response. Note that a consistent offer strategy is an equilibrium strategy if the sophisticated buyer’s beliefs are correct, i.e., $\delta = \lambda$ and $q = \chi^*$. Similar to the discussion of the seller’s reporting strategy, the notion of a consistent offer strategy allows the buyer to entertain beliefs different from the truth (i.e., $\delta \neq \lambda$ and $q \neq \chi^*$) in order to incorporate the possibility that the buyer’s belief system is influenced by external factors, which we consider in the experiments.

**Corollary 1.** The sophisticated buyer’s consistent offer strategy depends on $(\delta, q)$ as follows.

(i) If $\delta \geq p_h - p_l$, then the buyer completely believes the seller’s message.

\(^5\)The probability is constant at $\frac{1}{5}$ under our parameter configurations (described in the next section).
(ii) If $\delta \in (q(p_h - s_m) - (p_m - s_m), p_h - p_l)$, then the buyer partially discounts the seller’s message.

(iii) If $\delta \leq q(p_h - s_m) - (p_m - s_m)$, then the buyer completely disregards the seller’s message.

The corollary predicts that a sophisticated buyer will put more trust in the seller’s messages if he believes that she has a high lying cost and that she believes the fraction of naive buyers is small.

We conclude this subsection with several remarks about the behavioral model developed here. First, for simplicity, we assume that the lying cost is independent of the message sent, provided that it differs from the true asset type. Allowing the lying cost to be fully message dependent would expand the set of consistent strategies, but the result in Proposition 2 that more sellers lie when the lying cost goes down remains qualitatively valid. Second, for simplicity again, 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. A possible way to model intermediate sophistication for the buyers is to impose the belief that the seller reports truthfully with some probability and acts strategically with the complementary probability. The finding of Corollary 1 would remain qualitatively valid with this alternative formulation. Finally, we abstract away from potential cursedness in interpreting offer acceptance (Eyster and Rabin (2005)) and failure in conditional reasoning (Charness and Levin (2009)) in our model formulation, not because we think it is irrelevant but because we would like to focus on the effects of alcohol consumption on communication and its implications for the subsequent bargaining outcomes.

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 experiment points. With these parameters, it

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6For instance, $l$-type sellers send message $m$, whereas $m$-type and $h$-type sellers pool at message $h$, which in turn justifies an offer of $p_m$ by a sophisticated buyer following message $h$.

7Our current formulation corresponds to assuming that the buyer holds the belief that the seller either reports truthfully with certainty or acts strategically with certainty.

8It follows from straightforward calculation that with our parametrization (see the next section), the prediction of the cursed equilibrium coincides with that of the Bayesian Nash equilibrium (in the absence of any lying cost and receiver naivety).
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 result in our four primary treatments as presented in Table 2(a). For instance, Treatment $LL$ has both buyers and sellers consuming the low-alcohol-content drinks.

<table>
<thead>
<tr>
<th>Buyer’s value</th>
<th>Seller’s value</th>
<th>Price offer</th>
</tr>
</thead>
<tbody>
<tr>
<td>$b_h$</td>
<td>$b_m$</td>
<td>$b_l$</td>
</tr>
<tr>
<td>750</td>
<td>450</td>
<td>250</td>
</tr>
</tbody>
</table>

Table 1: Experimental Parameters

Our second experimental variable is whether or not 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 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 $\lambda$, whereas with the indirect channel, it lowers their belief $\chi$ about the fraction of naive buyers. According to Proposition 2,
an increase in $\lambda$ and/or a decrease in $\chi$ 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 peoples’ 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 $\lambda$. 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 $\lambda$ and/or an increase in $\chi$ 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 $LL$.

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 naivety of the buyers, i.e., $\chi^*$ goes up. 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 generate 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 $\chi$ 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 $LH-I$, it predicts 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 the conventional wisdom states). This implies an increase in $\delta$, 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 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.\(^9\)\(^10\) A total

\(^9\)Online Appendix C 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.

\(^{10}\)The experiments were conducted after the approval from the IRB at the Nanyang Technological University was obtained.
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.\textsuperscript{11,12} A between-subjects design was used, and each session involved 14-20 subjects making decisions in 7-10 pairs. The experiment was programmed and conducted using z-Tree (Fischbacher, 2007).

We illustrate the instructions for Treatment \textit{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 Online Appendix C). Instructions for stage 1 were read aloud. Next, subjects were asked to complete three quiz questions and consume a mint (\textasciitilde{}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 of 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 (\textasciitilde{}200ml) in 6 minutes. There were two types of beverage: 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 the alcohol to appear.\textsuperscript{13} We randomly selected half of the subjects to drink each type of beverage.\textsuperscript{14} Before the 10 official rounds of Stage 1 began, subjects were given one practice round to become familiar with the experiment protocol.

\textbf{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.

\textsuperscript{11}All information treatments and one session for each of the main treatments were conducted at Nanyang Technological University. Two sessions for each of the information treatments were conducted at Southwestern University of Finance and Economics. The total number of participants was 160 in Singapore and 152 in China.

\textsuperscript{12}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.

\textsuperscript{13}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.

\textsuperscript{14}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 eliminate any individual-level heterogeneity and systematic bias in our estimation of treatment effects.
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 the asset, which was revealed only to Member A. Member A then chose what message about the type of the 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 amount 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 type, 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 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 the $2/3$ 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 to 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 to receive 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.

After all stages were concluded but before we paid the subjects, we tested their blood alcohol content using BACTRACK S80 breathalyzers. We suggested subjects leave the lab only if their blood alcohol content fell below the legal limit for driving: 0.02% in China and 0.08% in
Singapore.

The final cash payment to each subject was the sum of his/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]. 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.

4 Experimental Results

In this section, we report our experimental results. In Section 4.1.1, we report treatment-level data aggregated across all three sessions and all ten rounds of the communication-trading game. We provide evidence that sellers’ messages are informative and buyers’ offers are dependent on the message received. 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 in Section 4.1.2 and 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. All statistical analyses and regression results will be presented in Section 4.2.

4.1 Descriptive Analysis

4.1.1 Communication-Trading Game

Figure 1(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

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15A 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.

16In reporting the aggregate-level data, we pooled the data from two different countries. Even if we are aware that the average alcohol consumption and social norms associated with drinking in China and Singapore are not the same, the country does not affect the treatment effects if any exist. In our regression analysis reported in the later sections, we controlled for the country effects.
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 1(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 1(a) and contribute more to increasing the earnings of sellers than to increasing the earnings of buyers.\(^\text{17}\)

These results are summarized as follows:

Observation 1. 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 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

\(^{17}\)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 mistake of the second type.
transaction rates reported in Figure 1(b). Second, making information public about the asymmetry of the 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 those earnings of the sellers in Treatment $HL$, but 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 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 high alcohol content.

We now report the sellers’ and the buyers’ behaviors separately. Figure 2 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 high alcohol content, while the last three treatments are those with the sellers under the influence of low alcohol content. 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 high alcohol content.

**Figure 2: Frequencies of Messages Conditional on Asset Type**

(a) Asset Type Low  
(b) Asset Type Medium  
(c) Asset Type High
of 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 2(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 2(b)) and to 40%-57% when the asset type is Low (Figure 2(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.

The messages become more informative when the sellers are not under the influence of 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 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 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 is 77%-81% when they are under the influence of high alcohol content, while the proportion is substantially higher (85%-89%) when the sellers are not. 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 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. But 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.

![Figure 3: Frequency of Offers Conditional on Messages](image)

(a) Message “Low” (7%)  
(b) Message “Medium” (21%)  
(c) Message “High” (62%)  
(d) Message “Not Reveal” (10%)

Figure 3 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 the buyers under the influence of higher alcohol content, and the last three treatments are those with the buyers under the influence of 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 they are 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”.

20
The effect of alcohol on the 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 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 the 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.*

### 4.1.2 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 elicitation, which show that these factors do not play a significant role in shaping individuals’ behaviors.

**Dictator Game:** Figure 4(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 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 high alcohol content are the same as those made by participants under no such influence (with the lowest $p$-value = 0.4880). 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 4(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 high alcohol content seems to be slightly higher than that from those 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 $LL$. 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 $LL$ is the same as those observed in Treatment $HH$ (Mann-Whitney test, $p$-value = 0.9483).

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18 All Mann-Whitney tests reported in this section are two-sided.
Risk-attitude: Figure 5 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 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 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 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 high alcohol content is the same as that among individuals not under the influence ($p$-value = 0.9168).

4.2 Estimating Treatment Effects

In this subsection, we 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 effect. In Section 4.2.1, we analyze how alcohol consumption affects sellers’ reporting behavior. In Section 4.2.2, we analyze alcohol’s effects on buyers’ offers, which reveal how they
interpret the messages they receive from sellers. Section 4.2.3 studies how alcohol consumption affects transaction and hence market efficiency. Finally, Section 4.2.4 looks at whether the public availability of information about the alcohol content of assigned beverages affects communication behaviors and transaction outcomes. Broadly speaking, we find that our regression results corroborate the observations discussed in the previous two subsections.

### 4.2.1 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 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.

<table>
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<th>Treatment</th>
<th>(1) Baseline</th>
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</table>

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 alcohol content.

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. The estimated results are presented in Table 8 (Appendix B), where each column has a distinct baseline treatment as specified in the first row of the table. Columns (1) and (2)
of Table 8 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 higher alcohol content are less truthful than those under no such influence.*

We also analyze sellers’ reporting behavior according to different asset types randomly drawn at the beginning of the game. The estimation results are presented in Table 9 (Appendix B). 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.\(^{19}\) The second part of Table 9 shows that subjects are less likely to send the message ”Not reveal” when they are under the influence of alcohol.

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

### 4.2.2 Impact of alcohol consumption on buyers’ offers

In this subsection, we analyze how buyers’ offers are affected by alcohol consumption. Table 4 reports 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 high alcohol content than when they are not.\(^{20}\) 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. Column (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 Section 4.1, 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 buyers are significantly more likely to make high offers (relative to medium

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\(^{19}\)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 (forthcoming).

\(^{20}\)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 4: Treatment Effect of Alcohol on Buyers’ Offers (Value)

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<td>-0.0227</td>
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<tr>
<td>Constant</td>
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<td>1.493***</td>
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<td>Observations</td>
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<tr>
<td>R-squared</td>
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<td>0.007</td>
<td>0.040</td>
<td>0.011</td>
<td>0.020</td>
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</tbody>
</table>

Notes: Robust standard errors in parentheses; *** p < 0.01, ** p < 0.05, * p < 0.1; SH and BH refer to sellers and buyers drinking the high-alcohol beverage, respectively; in all specifications, the same set of control variables are used as in previous tables, including period dummies, preferences and cognitive measures; all those variables have no significant effects on the findings.

Table 5: Treatment Effect of Alcohol on Buyers’ Offers (Choice)

<table>
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<td>2 (vs 1)</td>
<td>3 (vs 1)</td>
<td>3 (vs 1)</td>
<td>3 (vs 2)</td>
<td>3 (vs 2)</td>
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<td>HL</td>
<td>LL</td>
<td>HL</td>
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<td>Treatment $HH$</td>
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<td>0.0972**</td>
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<td>0.121**</td>
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<td>0.138**</td>
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<td>(0.0469)</td>
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<td>(0.0773)</td>
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<td>Constant</td>
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<td>-0.0199</td>
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<td>(0.184)</td>
<td>(0.0831)</td>
<td>(0.184)</td>
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<td>Y</td>
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<tr>
<td>Preference and Cognitive Measures</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
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<tr>
<td>Observations</td>
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<td>165</td>
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<tr>
<td>R-squared</td>
<td>0.111</td>
<td>0.086</td>
<td>0.049</td>
<td>0.075</td>
<td>0.084</td>
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</tbody>
</table>

Notes: Dependent variable is dummies of offer choice, e.g., 2(1) refers to the choice of offer 2 over offer 1. Robust standard errors in parentheses; *** p < 0.01, ** p < 0.05, * p < 0.1; SH and BH refer to sellers and buyers drinking the high-alcohol beverage, respectively.
Table 6: Treatment Effect on Transaction Rates

<table>
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<td>(0.0434)</td>
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</tr>
<tr>
<td>Treatment HL</td>
<td>-0.0928**</td>
<td>-0.0942**</td>
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</tr>
<tr>
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<td>(0.0435)</td>
<td>(0.0435)</td>
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</tr>
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<td>Treatment HH</td>
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</tr>
<tr>
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<td>(0.0431)</td>
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<td>(0.0418)</td>
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<tr>
<td>Participants in China</td>
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<td>(0.0448)</td>
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<td>0.463***</td>
<td>0.578***</td>
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<td>(0.0802)</td>
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<td>Preference and Cognitive Measures</td>
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</tr>
<tr>
<td>Observations</td>
<td>1,090</td>
<td>520</td>
<td>570</td>
<td>530</td>
<td>560</td>
</tr>
<tr>
<td>R-squared</td>
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<td>0.035</td>
<td>0.022</td>
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</tbody>
</table>

Notes: Robust standard errors in parentheses; *** p < 0.01, ** p < 0.05, * p < 0.1; In columns (4)-(5), period dummies are omitted because most estimates are nonsignificant.

and low offers, respectively) when they are under the influence of alcohol than when they are not. This finding is consistent with that of Table 4. These findings support Hypothesis 3 that buyers make higher price offers following a favorable message when they are under the influence of alcohol. In sum, we obtain the following result:

Result 2. Given that sellers are under the influence of alcohol, buyers make higher offers upon receiving the message “High” when they are under the influence of high alcohol content than when they are not.

4.2.3 Consequence of alcohol consumption on market outcomes

Given the finding that sellers under the influence of 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.

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 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.
Table 7: Comparison between Treatments with and without Information

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<th>(4)</th>
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<th>(6)</th>
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<td></td>
<td>lie</td>
<td>lie</td>
<td>offer</td>
<td>offer</td>
<td>deal</td>
<td>deal</td>
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<tr>
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<td>0.047</td>
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<tr>
<td></td>
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<td>offer</td>
<td>offer</td>
<td>deal</td>
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<tr>
<td>Treatment HL-I</td>
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<td>(0.0845)</td>
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<td>(0.141)</td>
<td>(0.104)</td>
<td>(0.124)</td>
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<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Preference and Cognitive Measures</td>
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<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
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<tr>
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<td>300</td>
<td>300</td>
<td>300</td>
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</tr>
<tr>
<td>R-squared</td>
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<td>0.070</td>
<td>0.000</td>
<td>0.125</td>
<td>0.022</td>
<td>0.037</td>
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Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1
The baseline treatment is LL or L, i.e., both sellers and buyers or only sellers, respectively, drink a lower-alcohol beverage.

Finally, we check the robustness of these findings by controlling for the asset types in Table 10 (Appendix B) and obtain similar results.

4.2.4 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.

**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, Hypothesis 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 Hypothesis 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 variation in subjects’ beliefs are shown to have nonsignificant effects in shaping their behaviors.

5 Concluding Remarks

In this paper, we experimentally investigate the effect of alcohol consumption in an otherwise-standard communication-trading game. Contrary to the folk wisdom, alcohol consumption lead to less truthful communication in our experiments. Moreover, subjects under alcohol’s influence are willing to make higher offers, indicating that they are less adept at extracting information content from received messages. We find that these results are mainly driven by the direct channel that alcohol consumption lowers ones’ lying cost and degree of sophistication in message interpretation.

There are a number of caveats in interpreting our findings. First, 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 peoples’ behavior can be quite different at a (much) higher level of intoxication. Second, 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 4.2.1, 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 peoples’ disclosure of (verifiable) information. Testing the validity of this conjecture is an interesting avenue for future study. Finally, we adopt a very simple design in modelling trading by having the buyer making a 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.
References


Appendix A – Proof of Proposition 2

Proof of Proposition 2: Following the remark prior to the proposition statement, a seller either tells the truth or lies by reporting "High". Thus, there are only four possible consistent reporting strategies:

1. all types report truthfully
2. only $l$-type seller lies
3. only $m$-type lies
4. both $l$- and $m$-types lie

In our subsequent analysis, we normalize the sellers’ payoff with no trade to zero. Note also that under the assumption that buyers assign the most pessimistic belief to off-path messages, a $l$-type seller’s payoff of reporting "Low" is always $p_l - s_l$.

Case 1: All types report truthfully  If all types of sellers report truthfully, then both the naive and sophisticated buyers fully believe in the message sent. The respective expected payoff of a $m$- type and a $l$-type seller depends on message as follows:

$$
\Pi_l(r) = \begin{cases} 
  p_l - s_l & \text{if } r = \text{Low} \\
  p_h - s_l - \lambda & \text{if } r = \text{High}
\end{cases}
$$

and

$$
\Pi_m(r) = \begin{cases} 
  p_m - s_m & \text{if } r = \text{Medium} \\
  p_h - s_m - \lambda & \text{if } r = \text{High}
\end{cases}.
$$

(1)

Both types of seller find it optimal to report truthfully if and only if $\lambda \geq p_h - p_l$. Therefore, truthful reporting is a consistent strategy if and only if $\lambda \geq p_h - p_l$.

Case 2: Only $l$-type seller lies  Suppose $m$-type seller reports truthfully, but $l$-type seller lies with probability $\beta \in (0,1]$. Then the sophisticated buyer offers $p_m$ upon receiving message "Medium". A "High" message may come from a $l$-type or a $h$-type seller, and the sophisticated buyer's payoff of offering $p_h$ and $p_l$ are respectively $\frac{1}{1+\beta} b_h + \frac{\beta}{1+\beta} b_l - p_h$ and $\frac{\beta}{1+\beta} (b_l - p_l)$. If $\beta < \frac{b_h - p_h}{p_h - p_l}$, then offering $p_h$ is strictly optimal; if $\beta > \frac{b_h - p_h}{p_h - p_l}$, then offering $p_l$ is strictly optimal. If $\beta = \frac{b_h - p_h}{p_h - p_l}$, then he is indifferent between $p_h$ and $p_l$. Note that by Assumption (ii), the cutoff $\frac{b_h - p_h}{p_h - p_l}$ is strictly within $(0,1)$.

If $\beta < \frac{b_h - p_h}{p_h - p_l}$, the respective expected payoff of a $m$- type and a $l$-type seller coincide with that in (1). Therefore, the reporting strategy under consideration is consistent if and only if $p_h - p_m \leq \lambda = p_h - p_l$. 

33
Suppose next that $\beta > \frac{b_n - p_n}{p_n - p_l}$. Then a $l$-type seller’s payoff of lying is $\chi (p_h - s_l) + (1 - \chi) (p_l - s_l) - \lambda$, whereas the payoff of $m$-type seller is

$$
\Pi_m (r) = \begin{cases} 
p_m - s_m & \text{if } r = \text{Medium} \\
\chi (p_h - s_m) - \lambda & \text{if } r = \text{High} \end{cases}.
$$

Only $l$-type finds it profitable to lie if and only if $\lambda \in [\chi (p_h - s_m) - (p_m - s_m), \chi (p_h - p_l)]$. Moreover, if $\beta < 1$, then it is necessary that $\lambda = \chi (p_h - p_l)$.

Finally, if $\beta = \frac{b_n - p_n}{p_n - p_l}$, then the buyer is indifferent between offering $p_h$ and $p_l$. Denote his probability of offering $p_h$ by $\alpha$. The $l$-type seller’s payoff of lying is thus $\chi (p_h - s_l) + (1 - \chi) [(1 - \alpha) (p_l - s_l) + \alpha (p_h - s_l)] - \lambda$. The payoff of $m$-type seller is

$$
\Pi_m (r) = \begin{cases} 
p_m - s_m & \text{if } r = \text{Medium} \\
\chi (p_h - s_m) + (1 - \chi) \alpha (p_h - s_m) - \lambda & \text{if } r = \text{High} \end{cases}.
$$

A $l$-type seller is willing to randomize between lying and truth-telling if and only if $\alpha = \frac{1}{1 - \chi} \left( \frac{\lambda}{p_n - p_l} - \chi \right)$. At this $\alpha$, it is straightforward that $m$-type seller finds truth-telling optimal. Moreover, $\alpha \in (0, 1)$ if and only if $\lambda \in [\chi (p_h - p_l), p_h - p_l]$.

In sum, if $\lambda \in [\chi (p_h - p_l), p_h - p_l]$, then it is a consistent strategy for $l$-type seller to randomize between ”High” and ”Low”, and $m$-type seller to report truthfully. If $\lambda \in [\chi (p_h - s_m) - (p_m - s_m), \chi (p_h - p_l)]$, then it is a consistent strategy for $l$-type seller to lie with certainty, and for $m$-type seller to report truthfully.

**Case 3: Only $m$-type seller lies** Suppose $l$-type seller reports truthfully, but $m$-type seller lies with probability $\beta \in (0, 1]$. Then the sophisticated buyer offers $p_l$ upon message ”Low”. A ”High” message may come from a $m$-type or a $h$-type seller, and the sophisticated buyer’s payoff of offering $p_h$ and $p_m$ are respectively $\frac{1}{1+\beta_1} b_h + \frac{\beta_1}{1+\beta_1} b_m - p_h$ and $\frac{\beta_1}{1+\beta_1} (b_m - p_m)$. If $\beta < \frac{b_n - p_n}{p_n - p_m}$, then offering $p_h$ is strictly optimal; if $\beta > \frac{b_n - p_n}{p_n - p_m}$, then offering $p_l$ is strictly optimal. If $\beta = \frac{b_n - p_n}{p_n - p_m}$, then he is indifferent between $p_h$ and $p_m$. Note that by Assumption (ii), the cutoff $\frac{b_n - p_n}{p_n - p_m}$ is strictly within $(0, 1)$.

If $\beta < \frac{b_n - p_n}{p_n - p_m}$, the respective expected payoff (increases) of a $m$-type and a $l$-type seller coincide with that in (1). Therefore, the reporting strategy under consideration is consistent if and only if $p_h - p_l \leq \lambda \leq p_h - p_m$, which is impossible as $p_m > p_l$.

Next suppose $\beta > \frac{b_n - p_n}{p_n - p_m}$. Then a $l$-type seller’s payoff of lying is $\chi (p_h - s_l) + (1 - \chi) (p_m - s_l) - \lambda$. The payoff of a $m$-type seller is

$$
\Pi_m (r) = \begin{cases} 
p_m - s_m & \text{if } r = \text{Medium} \\
\chi (p_h - s_m) + (1 - \chi) (p_m - s_m) - \lambda & \text{if } r = \text{High} \end{cases}.
$$
Only $m$-type finds it profitable to lie if and only if $\chi p_h + (1 - \chi) p_m - p_l \leq \lambda \leq \chi (p_h - p_m)$. But this is again impossible as $p_m > p_l$.

Finally, suppose $\beta = \frac{b_l - p_h}{p_h - p_m}$. The sophisticated buyer is indifferent between $p_h$ and $p_m$. Denote his probability of offering $p_h$ by $\alpha$. Then a $l$-type seller’s payoff of lying is $\chi (p_h - s_l) + (1 - \chi) [\alpha (p_h - s_l) + (1 - \alpha) (p_m - s_l)] - \lambda$. The payoff of $m$-type seller is

$$\Pi_m (r) = \begin{cases} p_m - s_m & \text{if } r = \text{Medium} \\ \chi (p_h - s_m) + (1 - \chi) [\alpha (p_h - s_m) + (1 - \alpha) (p_m - s_m)] - \lambda & \text{if } r = \text{High} \end{cases}.$$

A $m$-type seller is willing to randomize between lying and truth-telling if and only if $\alpha = \frac{1}{1 - \chi} \left( \frac{\lambda}{p_h - p_m} - \chi \right)$. However, at this $\alpha$, the $l$-type seller finds it strictly optimal to lie too, a contradiction.

In sum, there is no consistent reporting strategy in which only $m$-type seller lies.

**Case 4: Both $l$- and $m$-types lie** Following an argument similar to the case above, if a $m$-type seller finds it optimal to lie, then a $l$-type seller would find it strictly optimal to lie. Although a ”High” message may come from any type of seller, because of Assumption (ii), the sophisticated buyer offers $p_l$, regardless of the proportion of lying $m$-type seller. Suppose first that a $m$-type seller randomizes between ”High” and ”Medium”, then the respective expected payoff of a $m$- type and a $l$-type seller depends on message as follows:

$$\Pi_l (r) = \begin{cases} p_l - s_l & \text{if } r = \text{Low} \\ \chi (p_h - s_l) + (1 - \chi) (p_l - s_l) - \lambda & \text{if } r = \text{High} \end{cases} \quad \text{and} \quad \Pi_m (r) = \begin{cases} p_m - s_m & \text{if } r = \text{Medium} \\ \chi (p_h - s_m) - \lambda & \text{if } r = \text{High} \end{cases}.$$

The strategy under consideration is consistent if and only if $\lambda = \chi (p_h - s_m) - (p_m - s_m)$.

Next suppose a $m$-type seller lies with certainty. Then the message ”Medium” is off-path and the expected payoff (increases) of a $m$- type seller depends on message as follows:

$$\Pi_m (r) = \begin{cases} \chi (p_m - s_m) & \text{if } r = \text{Medium} \\ \chi (p_h - s_m) - \lambda & \text{if } r = \text{High} \end{cases}.$$

A $m$-type seller finds it optimal to lie if and only if $\lambda \leq \chi (p_h - p_m)$.

In sum, if $\lambda \leq \chi (p_h - p_m)$, then it is a consistent strategy for both $l$-type seller and $m$-type seller to lie with certainty. Q.E.D.
## Appendix B – Tables

### Table 8: Pairwise Comparisons

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treatment <em>HL</em></td>
<td>0.108**</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.0464)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Treatment <em>HH</em></td>
<td></td>
<td>0.193***</td>
<td>0.0521</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.0429)</td>
<td>(0.0439)</td>
<td></td>
</tr>
<tr>
<td>Treatment <em>LH</em></td>
<td></td>
<td></td>
<td>-0.0357</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(0.0458)</td>
<td></td>
</tr>
<tr>
<td>Participants in China</td>
<td>-0.00206</td>
<td>-0.185***</td>
<td>-0.153***</td>
<td>-0.0498</td>
</tr>
<tr>
<td></td>
<td>(0.0505)</td>
<td>(0.0461)</td>
<td>(0.0504)</td>
<td>(0.0470)</td>
</tr>
<tr>
<td>Constant</td>
<td>0.452***</td>
<td>0.589***</td>
<td>0.582***</td>
<td>0.616***</td>
</tr>
<tr>
<td></td>
<td>(0.0853)</td>
<td>(0.0771)</td>
<td>(0.0868)</td>
<td>(0.0773)</td>
</tr>
<tr>
<td>Period dummies</td>
<td>included</td>
<td>included</td>
<td>included</td>
<td>included</td>
</tr>
<tr>
<td>Preference and cognitive measures</td>
<td>included</td>
<td>included</td>
<td>included</td>
<td>included</td>
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<tr>
<td>Observations</td>
<td>466</td>
<td>510</td>
<td>469</td>
<td>507</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.026</td>
<td>0.088</td>
<td>0.027</td>
<td>0.026</td>
</tr>
</tbody>
</table>

Notes: Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

### Table 9: Sellers’ Lying Behavior by Asset Types

<table>
<thead>
<tr>
<th>Lie given asset type</th>
<th>Baseline: Treatment <em>LL</em></th>
<th>Baseline: Treatment <em>LH</em></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Low</td>
<td>Medium</td>
</tr>
<tr>
<td>Treatment <em>HL</em></td>
<td>0.0835</td>
<td>0.186**</td>
</tr>
<tr>
<td></td>
<td>(0.0630)</td>
<td>(0.0755)</td>
</tr>
<tr>
<td>Treatment <em>HH</em></td>
<td></td>
<td>0.526***</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.0576)</td>
</tr>
<tr>
<td>Constant</td>
<td>0.797***</td>
<td>0.526***</td>
</tr>
<tr>
<td></td>
<td>(0.0488)</td>
<td>(0.0576)</td>
</tr>
<tr>
<td>Period Dummies</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Preference and Cognitive Measures</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Observations</td>
<td>136</td>
<td>163</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.013</td>
<td>0.037</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Message &quot;Not Reveal&quot; given asset type</th>
<th>Baseline: Treatment <em>LL</em></th>
<th>Baseline: Treatment <em>LH</em></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Low</td>
<td>Medium</td>
</tr>
<tr>
<td>Treatment <em>HL</em></td>
<td>-0.0199</td>
<td>0.0457</td>
</tr>
<tr>
<td></td>
<td>(0.0520)</td>
<td>(0.0457)</td>
</tr>
<tr>
<td>Treatment <em>HL</em></td>
<td></td>
<td>0.0843***</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.0377)</td>
</tr>
<tr>
<td>Constant</td>
<td>0.127***</td>
<td>0.0843***</td>
</tr>
<tr>
<td></td>
<td>(0.0377)</td>
<td>(0.0307)</td>
</tr>
<tr>
<td>Period Dummies</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>Preference and Cognitive Measures</td>
<td>Y</td>
<td>Y</td>
</tr>
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<td>Observations</td>
<td>154</td>
<td>183</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.001</td>
<td>0.005</td>
</tr>
</tbody>
</table>

Notes: Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1; SH and BH refer to sellers and buyers drink high-alcohol beverage respectively; In all specifications, the same set of control variables are used as in previous tables, including period dummies; all those variables have no significant effects on the findings.
Table 10: **Treatment Effect on Transaction Rates Controlling for Asset Types**

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

Notes: Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1. In all specifications, the same set of control variables are used as in previous tables, including period dummies; all those variables have no significant effects on the findings.
Appendix C – Experimental Instructions (Online Only, Not Intended for Publication)

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>
<thead>
<tr>
<th>Table 1: Value of Asset K (in points)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asset K’s Actual Type</td>
</tr>
<tr>
<td>Low</td>
</tr>
<tr>
<td>Medium</td>
</tr>
<tr>
<td>High</td>
</tr>
</tbody>
</table>

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.