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Keywords: asymmetric information, insurance, trust, cooperation, experimental economics

JEL Classification: C91, D9, D47, D82, L86

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1. Introduction

Asymmetric information is ubiquitous in economic transactions. Consumers are often unable to verify sellers' credibility before purchasing a product. In this case, if the consumer does not trust the seller, they may refrain from the transaction entirely. Many mechanisms have been designed to solve this asymmetric information problem and facilitate efficient transactions. Among them, insurance (or warranties) is a common practice. In particular, the buyer can purchase insurance or warranties from a third-party provider to protect his purchase. For example, online markets such as eBay offer the option of purchasing warranties from the third-party provider Squaretrade. Buyers can purchase the warranty either at the time of buying the product on eBay or directly from Squaretrade's website after purchasing the product (Steiner, 2012). The insurance provided by a third party offers additional or extended coverage to the existing manufacturer's warranty or protection when consumers purchase products, especially second-hand ones, for which the manufacturer's warranty is not honored. However, such insurance is often costly and comes with exclusions and limitations. If buyers are unwilling to pay the cost of insurance or are discouraged by complicated exclusion clauses, the inclusion of insurance may not generate more transactions. Moreover, insurance provided by a third party may not change the incentives for sellers or manufacturers to cooperate and thus have a limited impact on improving consumers' willingness to trade. In this paper, we propose and test a novel insurance advice mechanism aimed at promoting trust and cooperation in markets with asymmetric information.

The key to our proposed mechanism is to allow the seller (the party who has more information) to advise the buyer whether he should purchase third-party insurance[1]. In general, insurance often addresses two different types of risks: 1) risks about the seller's cooperative type, such as her intention to deliver the product on time or her intention to produce a high-quality product as advertised; and 2) natural risks that are out of her control, such as bad weather that causes the delay of the shipment. As our focus is on the asymmetric information problem, the proposed advice mechanism is related to insurance against the first type of risk. As a first step, we test the mechanism built on insurance provided by a third party instead of the seller. This feature avoids potential confounds due to the additional profit incentives that sellers may have to sell insurance.

We hypothesize that advising not to purchase insurance introduces a psychological cost for defection. First, giving advice may lead the seller to feel more accountable for the

[1] For simplicity, we will use "she" to refer to the seller and "he" to refer to the buyer.

buyer's payoffs, as she now plays a more active role in the buyer's decision (Tetlock, 1985; Lerner and Tetlock, 1994; 1999). Second, if the seller is subject to omission bias (Ritov and Baron, 1992), she may judge defection—after advising the buyer not to protect himself from the risk—as morally worse than when she does not exert any influence on the buyer's decision. Third, if the advice of not purchasing insurance is taken as a statement that the seller will cooperate, subsequent defection may render the advice a lie and inflict psychological costs due to lying aversion (Cressey, 1986; Gneezy et al., 2013; Abeler et al., 2014; Abeler et al., 2019). Lastly, if advising not to purchase insurance increases the buyer's expectation that the seller will cooperate, the seller may be averse to disappointing the buyer (Charness and Dufwenberg, 2006; Battigalli and Dufwenberg, 2007; Balafoutas and Sutter, 2017; Cartwright, 2019). When such psychological costs are sufficiently high, the advice of not purchasing insurance leads sellers to cooperate with buyers. We show theoretically that, at equilibrium, sellers advise not to purchase insurance, buyers follow sellers' advice, and sellers ship the product, provided psychological costs are not too low. Thus, the insurance advice mechanism can facilitate more transactions and increase market efficiency.

We conduct a controlled laboratory experiment to examine the effectiveness of the mechanism empirically. In particular, we address two main research questions. Does the insurance advice mechanism increase the number of buyers who enter transactions with sellers? Are sellers more likely to cooperate with buyers under the insurance advice mechanism?

Although in online marketplaces such as Amazon and eBay, buyers' insurance purchase decisions can be easily made observable to sellers, we take into account the fact that sellers do not always observe the buyers' insurance purchase decisions when the insurance is provided by a third party. Theoretically, the insurance advice mechanism can help build trust and improve efficiency even if the seller does not observe the buyer's actual insurance purchase decision. This is the case because the seller expects the psychological cost to be associated with not shipping the product and becomes more likely to ship the product when she anticipates that the buyer may buy the product without insurance. In turn, knowing that the seller may ship the product, the buyer is also willing to follow the insurance advice with some non-zero probability. The improvement, however, is not as effective compared to when sellers perfectly observe the insurance purchase decisions. We empirically test whether the effectiveness of the mechanism varies based on the observability of the buyer's insurance purchase decision.

The experiment consisted of three treatments. The control treatment was a buyer-seller game with insurance. In the game, the buyer decided whether to purchase a product, and the seller decided whether to ship the product upon receiving the payment. If the buyer purchased the product, he could also purchase insurance against the risk that the seller might not ship the product after receiving the payment. We designed an insurance advice mechanism in which the seller had to advise the buyer whether to purchase the insurance before starting the buyer-seller game. Upon receiving the advice, the buyer decided whether to buy the product and, if so, whether to purchase the insurance. We tested the mechanism in two treatments: insurance advice (IA) treatment and insurance advice with hidden information (IA_HI) treatment. In the IA treatment, if the buyer purchased the product, the seller was informed of the buyer's insurance purchase decision before deciding whether to ship the product. In the IA_HI treatment, the seller never learned about the buyer's insurance purchase decision. This is the only difference between the two treatments. We used shipping as a simple way to introduce defections in the game. If the proposed mechanism works in this setting, it should also effectively reduce other types of defections, such as selling faulty products.

Our findings are consistent with our hypotheses. In the IA treatment, sellers advised not to purchase insurance 81% of the time. Compared with the control treatment, the rate of product purchases increases by approximately 31% in the IA treatment. Whereas buyers purchased the product 74% of the time when sellers advised not to purchase insurance, they purchased it only 35% of the time when the advice was to purchase insurance. The number of sellers who shipped the product also increases by almost 40%. These improvements increase the proportion of efficient trade and the average profit for both buyers and sellers. The mechanism remains effective in the IA_HI treatment. About 71% of sellers advised not to purchase insurance. Compared to the control, the product purchase rate increases by 33%, and the shipping rate increases by approximately 22% in the IA_HI treatment, resulting in an increase in market efficiency. However, as our theoretical model predicts, compared to the IA treatment, the IA_HI treatment is less efficient because buyers were less likely to follow the advice of no insurance, and sellers were slightly less likely to ship the product.

This paper contributes to two strands of the literature. One is research on market design aimed at solving market failures due to information asymmetry. A number of innovative solutions have been proposed and tested, including the widely studied reputation mechanism (for a review, see Chen et al., 2021). Previous studies have examined how to improve the reliability of reputation mechanisms that are subject to problems such as missing information (Resnick and Zeckhauser, 2002; Bolton et al., 2004; Dellarocas and Wood, 2008; Cabral and Hortacsu, 2010; Li and Xiao, 2014; Bolton et al., 2018; Bolton et al., 2019) and manipulating reviews (Mayzlin et al., 2014).

The simple mechanism we propose complements this literature by pointing out a new direction for solutions. For example, on eBay, buyers are offered extended warranties via Squaretrade or xcover.com. To implement the insurance advice mechanism, eBay could allow sellers to recommend to the buyer whether he should purchase the extended warranty. The advice mechanism can be especially beneficial for new sellers before they are able to establish a positive reputation via a feedback mechanism. The mechanism can also work in offline markets, such as the used car market. For instance, the original car owner may suggest whether the potential buyer should purchase an extended warranty from a third party.

Although our main interest is to propose and test the effectiveness of the insurance advice mechanism, it is interesting to consider how the advice mechanism relates to other types of communication that have been shown to be effective in promoting cooperation (Ellingsen and Johannesson, 2004; Binmore, 2006; Charness and Dufwenberg, 2006; Bicchieri and Lev-On, 2007; Vanberg, 2008; Sanchez-Pages and Vorsatz, 2009; Erat and Gneezy, 2012; Battigalli et al., 2013; López-Pérez and Spiegelman, 2013). Sally (1995) conducted a meta-analysis and found that communication was the most effective factor in promoting cooperation in prisoner's dilemma experiments. In particular, the analysis shows that elicited promises have a strong additional effect on cooperation. Recently, there has been emerging experimental research on the relationship between promises and cooperation. For example, researchers have shown that people follow their promise to either avoid lying costs (Ellingsen and Johannesson, 2004; Vanberg, 2008; 2013; Serra-Garcia et al., 2013) or as a result of guilt aversion (Charness and Dufwenberg, 2006; Battigalli et al., 2013). In our experiment, when the seller advises not to purchase insurance, the buyer may interpret this message as an implicit promise to ship the product.

It is worth noting that the literature on communication and promises highlights that compared to unconstructed free-form communication, restricted-form communication, such as binary messages, is often much less or not effective at all (Bracht and Feltovich, 2009). For example, a pre-formulated promise, such as "I promise to cooperate," may have a smaller effect than free-form communication or no effect at all on increasing cooperative behavior, specifically in strategic environments (Lundquist et al., 2009; Charness and Dufwenberg, 2010; Belot et al., 2010; Chen and Zhang, 2021; Brandts et al., 2019). The advice in our setup is given in a binary form. Sellers only choose between "Advise the buyer to purchase the insurance" or "Advise the buyer not to purchase the insurance." Thus, if the buyer perceives the advice as an implicit promise, it is, at best, a weak and indirect bare promise. The significant effect of a plain insurance advice message suggests that there may be some fundamental differences between advice and bare promise and that additional psychological channels may play a role.

According to the philosophy of language (Searle, 1975), the advice mechanism theoretically differs from bare promises. When a seller utters a bare promise to cooperate, she 'commits' to cooperate (without explicitly asking the buyer to take a certain action). This promise can be seen as a commissive speech act, defined as a speech act that the speaker intends to commit (Searle, 1975).[2] By contrast, when advising the buyer not to purchase insurance, the seller persuades the buyer to perform a specific action (e.g., not to take action to protect against potential losses). For Searle (1975), advice falls under the category of directive speech acts, defined as communication persuading another party to act in a particular manner. If a directive speech act is viewed as playing a more active role in the buyer's outcomes than a commissive speech act, omission bias and accountability theory predict that the advice mechanism can promote cooperation even when a bar promise is ineffective.

Further, although a bare promise may encourage more buyers to purchase the product and more sellers to cooperate with buyers, it is unclear how it affects insurance purchase decisions. One advantage of the insurance advice mechanism is that, in addition to promoting more transactions, it increases buyers' welfare by saving the cost of purchasing insurance—as observed in the comparisons between the IA treatment and the control. This could also be the difference between advising not to buy the insurance and other common advertising strategies used to persuade buyers to purchase a product. In our framework, sellers' psychological cost of not shipping depends on whether buyers follow the advice not to buy insurance. If the sellers' advice is simply to buy the product, buyers can follow the advice by purchasing the product with or without the insurance. That is, under the advice to purchase the product, any psychological cost of not shipping the product may not depend on whether buyers purchase the insurance. It would be interesting to conduct future research to compare the effects of the advice mechanism with these other forms of communication, such as bare promises (both structured and free forms) or direct advice to buy products.

[2] Reassuring messages that aren't promises, such as "I plan to invest", as seen in Bracht and Feltovitch (2009) would also be considered Commissive speech acts, as the statement is about the speaker's intended action.

2. Experiment

2.1 Experimental design

Our experiment is based on a buyer-seller game (modified from Bolton et al., 2004; Li and Xiao, 2014). At the beginning of each treatment, subjects were randomly assigned to the role of either buyer or seller. Following Li and Xiao (2014), each treatment consisted of 10 rounds. Repeated games allowed us to obtain a larger number of observations and provided participants with opportunities to learn to converge to equilibrium. Both buyers and sellers received a full history of their decisions, which was provided and updated at the end of every round (see Appendix A for screenshots of the decision-making stage). To minimize the potential reputation effect, we randomly matched each buyer with a seller at the beginning of each round. At the end of the experiment, one round was randomly selected as the payment round, such that the earnings outcome in one round was unlikely to have any income effect on the decisions in later rounds. The instructions are provided in Appendix B.

In the control treatment (illustrated in Figure 1), at the beginning of each round, buyers and sellers were endowed with E$35 (experimental dollars), and the buyer could choose to purchase a product with insurance, purchase a product without insurance, or not purchase the product. The buyer valued the product at E$40, which cost them E$25 to purchase. Following the previous literature (Li and Xiao, 2014; Lafky, 2014), we set the price of the product to be fixed to exclude the possibility that sellers could use the price to signal their intention to cooperate, which would complicate the study of the advice mechanism. If the buyer decided not to purchase the product, the round ended, and each participant's earnings remained at the E$35 endowment. If the buyer decided to purchase the product (with or without insurance), the seller received the payment of E$25 from the buyer and then decided whether to ship the product[3]. Shipping the product cost the seller E$10. Thus, if the seller shipped the product, her earnings for that round were E$50, and if she did not ship the product, her earnings were E$60.

The insurance cost the buyer E$8. If the buyer purchased the product, but the seller did not ship it, the insurance would cover the loss of the E$25 that the buyer had paid to the seller. Once the buyer decided to purchase the insurance, he would pay the cost of E$8,

[3] Although we used the shipping context (also see Bolton et al., 2004; Li and Xiao, 2014), the nature of the decision making, however, can also extend to other settings such as the choice of the quality of the products or the speed of shipping.

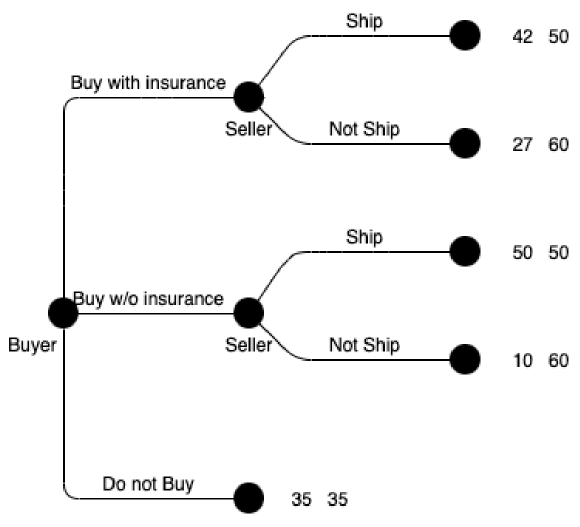
regardless of whether the seller shipped the product. All these factors were common knowledge.

The payoff structure was designed so that the buyer's decision (whether that be to purchase the product without insurance, purchase the product with insurance, or not purchase the product) differed depending on his belief in the likelihood that the seller would ship the product. This is discussed in more detail in Section 3.

The IA treatment—the timing of the game is described in Figure C1 in Appendix C—is the same as the control treatment, except that we added a stage before the buyer made the product and insurance purchase decisions. At this stage, the seller had to advise the buyer whether to purchase the insurance. The buyer then made his decision after he observed the seller's advice. The seller was informed of the buyer's insurance purchase decision before she made the shipping decision. All this was common knowledge. The rest of the game was the same as the control treatment.

The IA_HI treatment has the same structure as the IA treatment, except that the seller never knew whether the buyer decided to buy the insurance throughout the experiment.

Figure 1: Buyer-seller game with insurance (control treatment)



2.2 Experimental procedure

The experiment was conducted at the Monash Laboratory for Experimental Economics (MonLEE) using z-tree (Fischbacher, 2007). The experimenter read the instructions aloud, and the subjects completed a comprehension quiz (see Appendix D) to ensure that they understood the task and the payoffs associated with each decision.

We ran 24 sessions in total—8 sessions per treatment—and we recruited, on average, 14 subjects in each session. Each session lasted less than one hour. Subjects were randomly assigned the role of either buyer or seller and maintained this role for the entirety of the experiment. In each round, a buyer was randomly and anonymously rematched with a seller. At the end of the experiment, one round was randomly selected as the payment round. In total, we recruited 332 subjects: 108 for the control treatment, 116 for the IA treatment, and 108 for the IA_HI treatment. Each subject was paid $4 AUD for participating, adding to the earnings from the games. The exchange rate was E$1 = $0.4 AUD. Subjects were paid privately, earning about $20 AUD on average.

3. Theoretical framework and hypotheses

In this section, we present a theoretical framework for deriving predictions for sellers' and buyers' decisions in each treatment. We start with a comparison between the control and the IA treatments. Later, we discuss the IA_HI treatment.

Consider a bilateral transaction between a buyer and a seller. The buyer demands one unit of the products that the seller produces and attaches a value ($v > 0$) to it. The seller attaches zero value to the product and can produce it at zero cost. We assume that both parties are risk-neutral. Following the previous literature (Lafky, 2014; Li and Xiao, 2014), the product prices are set as fixed in the experiment. Specifically, the product price is exogenously given by $p \in (0, v)$. The fixed price excludes the possibility that prices could be used as a signal for seller type and allows us to provide clean evidence for the effect of the insurance advice[4].

If the buyer purchases the product, the seller can ship the product at a cost of $d \in (0, p)$. Following the standard approach of modeling seller reputation in an asymmetric information environment with both moral hazard and adverse selection problems (Bar-Isaac and Tadelis, 2008), we assume that there are two types of sellers: a good type (type-g) who always ships the product and a strategic type (type-s) who maximizes her own utility, including potentially a psychological cost, which we explain below. Only the seller knows her type. The buyer does not know the seller's type, but he does know that the probability of

[4] In the field, sellers may use price to signal their types and affect buyers' purchase decisions. In particular, high prices can be the efficient means of signaling high quality because a loss in sales could hurt low cost, low-quality sellers more than high cost, high-quality sellers (Bagwell and Riordan, 1991, and Bagwell, 1992). Assuming that a reasonable fraction of consumers can identify the true product quality before making purchases, if a low-quality seller pretends to be a high-quality seller by setting a high price, she will lose these well-informed buyers. That is, the loss in sales due to the high price will hurt low-cost, low-quality sellers more than high-cost, high-quality sellers, and high prices can then be used to effectively signal quality.

encountering a type-g seller is $q_g \in (0,1)$, and that the probability of encountering a type-s seller is $q_s = 1 - q_g$.

Along with purchasing the product, the buyer has the option to buy insurance at price w, which allows the buyer to recoup p in case the product is not shipped.[5] We assume that the insurance is not too expensive, that is, $w \leq p(1 - \frac{p}{v})$, such that at least some buyers will buy the insurance in the control treatment.[6] The IA treatment has a special feature in that the seller can advise the buyer whether to buy the insurance before making any purchase decision. We denote the advice $a \in \{Y, N\}$, where Y means "buy the insurance" and N means "do not buy the insurance." Henceforth, we denote the seller's advice of not purchasing insurance as "*N*" and her advice of purchasing insurance as "*Y*." In contrast to the control treatment, in which the seller cannot have any influence on the buyer's decisions, the seller's advice can change the buyer's expectation of the likelihood of receiving the product. As a result, the seller becomes more accountable for the buyer's payoffs. Although the advice would not affect a type-g seller who always ships the product, we hypothesize a type-s seller will incur a psychological cost ($\alpha > 0$) for not shipping the product if (i) she advises N and (ii) the buyer does not insure. The buyer does not know the exact value of α. However, for tractability, we assume he knows whether α is above or below d.

It is possible that the seller experiences a psychological cost, even if the buyer purchases the insurance. We assume the cost will be higher if the buyer follows the advice and does not purchase the insurance than purchase the insurance. In this sense, α can be understood as the incremental psychological cost between the two cases. Note that for simplicity, we assume a type-s seller does not incur any psychological cost associated with the buyers' insurance purchase decisions (made without the sellers' influence) in the control treatment. That is, we assume that type-s sellers' shipping decisions are not affected by buyers' insurance decisions in the control. This is because such a cost if any, should be the

[5] We assume the seller does not receive commissions from selling third-party insurances. If she does, the advice *N* should serve as an even stronger signal of being cooperative in the shipping stage. In reality, the buyer may also infer the distribution of the seller's type q_g from w. For example, the buyer may hold the belief of a low q_g in a market with high w. This will make him less likely to purchase the product in the control treatment, as we show below. However, it will not affect our hypotheses regarding the effects of the insurance advice mechanism.

[6] Without this assumption, buyers never buy insurance in the control. We keep this assumption to make sure insurance is not redundant. This assumption was satisfied in our experiment with w = 8, p = 25 and v = 40. In theory, if, instead, $w > p(1 - \frac{p}{v})$, buyers will not buy insurance in any of the three treatments because they receive a negative payoff. However, in this case, the advice mechanism is still beneficial in that it promotes more buyers to purchase the product and more sellers to ship the product. We discuss this in Appendix E4.

same as in the IA treatment. This simplicity allows us to focus on the effect of the advice mechanism.

The timing of the game in the IA treatment is as follows. First, the seller advises whether to buy insurance. Next, the buyer receives the advice and decides whether to purchase the product and, if so, whether to buy the insurance. The seller observes the buyer's product purchase and insurance purchase decisions and decides whether to ship the product if the buyer purchases the product. The equilibrium concept is the weak perfect Bayesian equilibrium (WPBE).

In the control treatment, without the advice stage, the buyer's purchase decision relies on the prior belief about the seller's type, q_g. The type-g seller always ships the product, whereas the type-s seller never ships the product. Given our assumption that $w \le p\left(1 - \frac{p}{v}\right)$, it is straightforward to show that the buyer's optimal decision is as follows (see Appendix E1 for the details):

$$\begin{cases} \text{purchase the product without insurance,} & \text{if } q_g \ge 1 - \frac{w}{p} \\ \text{purchase the product with insurance,} & \text{if } \frac{w}{v-p} \le q_g < 1 - \frac{w}{p} \\ \text{do not purchase the product,} & \text{if } q_g < \frac{w}{v-p} \end{cases} \qquad (1)$$

That is, the buyer: purchases the product without insurance when q_g is relatively high; purchases the product with insurance if q_g is at some intermediate level; and does not purchase the product if q_g is very low.

Now consider the IA treatment. It is straightforward to show that there is no separating equilibrium in this case. If the type-s seller's separating-equilibrium advice is *Y*, the buyer's optimal choice is not to purchase the product, as he anticipates that the type-s seller will not ship the product. Thus, the type-s seller will advise *N* instead. If the type-s seller's separating-equilibrium advice is *N*, she will again be better off by instead advising *Y*, in which case she will get the full amount of payment p by not delivering, without incurring any psychological cost.

In the IA treatment, there exists a pooling equilibrium in which both types of sellers advise *N*. Given that type-g sellers advise *N* in equilibrium, type-s sellers are better off pooling with them and advising *N*. When the psychological cost is relatively large ($d \le \alpha$), type-s sellers' optimal choice after advising *N* is to ship the product and incur the shipping cost. Thus, in this case, buyers purchase the product without insurance upon receiving advice N, and both types of sellers advise N and subsequently deliver the product.[7] When $d > \alpha$, the sellers and the buyers behave the same as in the control treatment.

The above analysis focuses on the IA treatment, in which the seller observes whether the buyer purchases the insurance before shipping the product. In the IA_HI treatment, the seller does not know the buyer's insurance purchase decision. As in the IA treatment, the equilibrium outcome remains the same as in the control when $d > \alpha$. The more interesting case arises when $d \leq \alpha$. First, recall that if the prior (q_g) is relatively high (i.e., $q_g \geq 1 - \frac{w}{p}$), buyers will buy the product without insurance in the control treatment. Thus, even though the seller is not informed of the buyer's insurance purchase decision, she anticipates that the buyer will not purchase the insurance. As a result, in the IA_HI treatment, buyers and sellers will behave the same as in the IA treatment: both types of sellers advise N, all buyers purchase the product without insurance, and both types of sellers ship the product.

Now consider when the prior (q_g) is relatively low (i.e., $q_g < 1 - \frac{w}{p}$). In this case, both types of sellers advise N, but there can be multiple equilibria in the subgame after sellers advise N. We select the symmetric mixed-strategy equilibrium that, unlike other equilibria, does not require extreme forms of participants' (mis-)coordination.[8] In this equilibrium, buyers mix between "purchasing the product without insurance" and "purchasing the product with insurance," while type-s sellers mix between "ship" and "not ship." Specifically, all buyers will buy the product without insurance with the probability of $\frac{d}{\alpha}$. All type-s sellers will ship the product with a probability of $1 - \frac{w}{p(1-q_g)}$. The greatest advantage of selecting this equilibrium is that the proportion of each strategy realization is endogenously determined and can be used to make comparisons with other treatments using the data from the experiment.

By comparing the equilibrium in all three treatments, we derive the following hypotheses. The details of the equilibrium analysis can be found in Appendix E. We would like to point out that our theoretical results do not qualitatively depend on the assumption that

[7] The pooling equilibrium with both types of sellers advising N Pareto-dominates the other pooling equilibrium with both types advising Y under the condition that buyers do not buy the product in the absence of insurance advice (i.e., $q_g < \frac{w}{v-p}$). The Y-type of pooling equilibria can also be ruled out using forward induction. The details can be found in the Appendix E2.

[8] If sellers are optimistic and believe that buyers will follow the advice N, there exists an equilibrium such that when $d \leq \alpha$ all sellers advise N, buyers purchase the product without purchasing insurances, and all sellers ship the product. Similarly, if sellers are pessimistic and believe that buyers will not follow the advice N, there exists another equilibrium such that when $d \leq \alpha$ all participants behave as in the control treatment despite all sellers advising N. These equilibria are less convincing as they rely on sellers holding extreme beliefs. (See Appendix E for more details)

there exist type-g sellers who always ship the product. The insurance advice mechanism works by allowing type-s sellers to commit to shipping the product, which does not depend on the existence of type-g sellers. We discuss the details in Appendix E4.

Hypothesis 1: In both the IA and IA_HI treatments, sellers will advise *N*.

As long as α is sufficiently large (α >d) for some sellers:

Hypothesis 2: Both the IA and IA_HI treatments increase the frequency of buyers purchasing the product compared to the control treatment:

freq(*BuyProd*|*Control*) < *freq* (*BuyProd* |*IA_HI*) = *freq*(*BuyProd*|*IA*).

Hypothesis 3: The frequency of buyers purchasing the product without insurance (*BuyProd & NoIns*) is highest in the IA treatment and lowest in the control treatment:

freq(*BuyProd&NoIns*|*Control*) < *freq*(*BuyProd&NoIns*|*IA_HI*) < *freq* (*BuyProd&NoIns*|*IA*).

Hypothesis 4: The frequency of sellers shipping the product is highest in the IA treatment and lowest in the control treatment:

freq(*Ship*|*Control*) < *freq*(*Ship*|*IA_HI*) < *freq*(*Ship*|*IA*).

An implication of these hypotheses is that the insurance advice mechanism can improve market efficiency. We can measure market efficiency by the frequency of efficient trades. In our setup, there are two types of efficient trade. One is characterized by the number of buyers purchasing the product (regardless of the insurance purchase decisions) and the number of sellers shipping the product. The other is characterized by the number of buyers purchasing the product without insurance and the number of sellers shipping the product. When considering the total welfare of buyers and sellers, this latter definition of efficiency is a Pareto improvement over the first definition, as the buyer's earnings increase while the seller's earnings do not change. [9] To differentiate these two definitions of efficiency, we refer to the first type as *standard efficient trades* and to the second type as *optimal efficient trades*. According to Hypotheses 2, 3, and 4, we expect the frequency of efficient trades to be highest

[9] Here we only consider the total welfare of buyers and sellers since the insurance is exogenously provided by the experimenter. In a natural setting, if the insurance market is very competitive or insurers serve a large number of markets, a reduced number of insurance purchases in one market only leads to a negligible loss for the insurance company.

in the IA condition and lowest in the control condition. Consequently, the insurance advice mechanism is most effective in the IA condition, especially when considering the proportion of optimal efficient trades.

Hypothesis 5: The frequency of standard and optimal efficient trades *freq(Eff)*:

freq(*Eff*|*Control*) < *freq*(*Eff*|*IA_HI*) < *freq*(*Eff*|*IA*).

4. Results

We first report what advice sellers gave buyers in the two advice treatments. Then, we compare buyers' purchase decisions. Next, we examine how insurance advice affects sellers' shipping decisions and whether shipping frequency differs between the treatments. Lastly, we report the treatment effect on market efficiency. For the non-parametric tests, we always calculated the average at the individual level and treat each individual as an independent observation (unless stated otherwise).[10]

Table 1 summarizes the main descriptive results for each treatment. In total, there are 108 subjects in the control; 116 subjects in the IA and 108 subjects in the IA_HI treatment.

Table 1: Descriptive summary of decisions

Treatment	Sellers advised N (%)	Buyers purchased product (%)	Buyers purchased product without insurance (%)	Sellers shipped product (%)	Standard efficient trades (%)	Optimal efficient trades (%)
Control	-	51.1 (4.3)	20.2 (3.5)	43.9 (5.2)	22.4 (2.9)	9.1 (2.1)
IA	81.2 (3.2)	66.9 (3.7)	48.3 (4.1)	61.4 (5.0)	42.1 (3.2)	33.3 (3.4)
Advice *N* *	-	74.2 (4.2)	59.4 (5.2)	64.2 (5.2)	50.2 (3.7)	41.2 (4.2)
Advice *Y* *	-	35.0 (5.7)	2.7 (1.4)	25.0 (7.8)	9.5 (3.7)	0
IA_HI	71.1 (4.7)	67.8 (4.3)	35.6 (4.2)	53.5 (5.3)	37.8 (3.3)	22.8 (3.4)
Advice *N* *	-	73.2 (4.7)	43.6 (5.1)	58.0 (6.2)	46.2 (4.1)	29.4 (4.3)
Advice *Y**	-	52.0 (5.6)	13.6 (3.4)	26.2 (6.0)	16.7 (3.5)	5.4 (2.1)

[10] As a robustness check, we also conducted t-tests. All results were robust unless we noted otherwise.

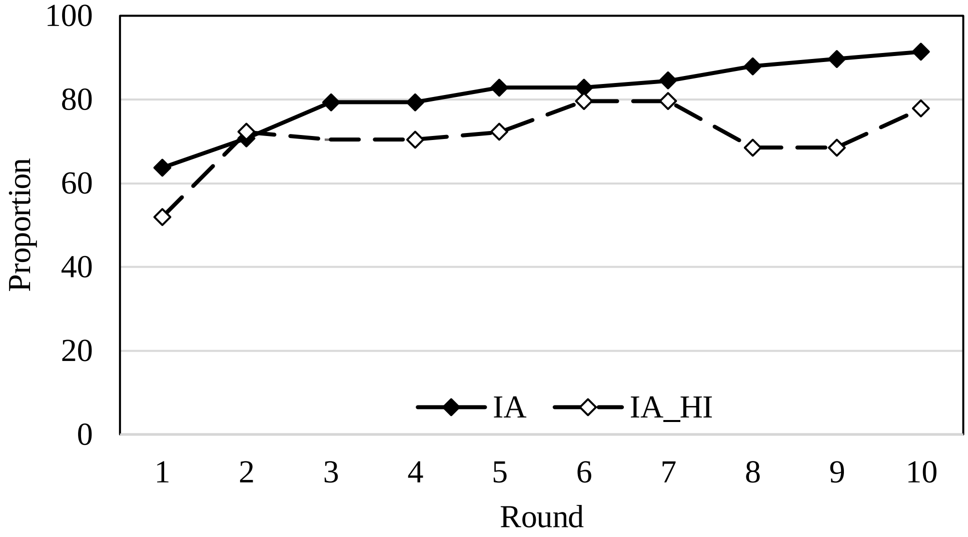
Note: The number in parentheses is the standard error. Standard errors are calculated at the individual level, where each individual is an independent observation.
*There are in total 54 buyers/sellers in the Control; 58 buyers/sellers in the IA and 54 buyers/sellers in the IA_HI. The numbers of subjects in these three cases are smaller than the whole sample because some sellers never advised *N* or never advised *Y*, and some buyers never received advice *N* or never received advice *Y*. Specifically, in the IA treatment, 27 sellers never advised *Y* and 9 buyers who never received advice *Y*, leaving 49 buyers and 31 sellers in the Advice *Y* condition. In the IA_HI treatment, 4 sellers never advised *N* and 20 sellers never advised *Y*, leaving 54 buyers and 50 sellers in the Advice *N* condition, and 54 buyers and 34 sellers in the Advice *Y* condition.

4.1 Insurance advice

Supporting Hypothesis 1, over the 10 rounds, we observe that in IA sellers advised *N* 81.2% of the time. The proportion of sellers that advised *N* remains high in the IA_HI treatment (71.1%). Although the frequency is slightly lower in the IA_HI than in the IA treatment, this difference is not significant (Mann-Whitney U test, p=0.157)[11]. In both treatments, the proportion is higher than that of a strategy randomizing the advice given with 50%, suggesting that sellers preferred to advise *N* (81.2% vs. 50%, binomial test, p <0.000; 71.1% vs. 50%, binomial test, p <0.000). Figure 2 plots the proportion of sellers who advised *N* in each round. In both treatments, the frequency of advising *N* is relatively lower in the first round and increases over time. By the end of the experiment, the frequency of sellers that chose advice *N* is approximately 50% higher than in the first round in both treatments (91.4% vs. 63.7% in IA, Wilcoxon signed-rank test, p<0.001; 77.8% vs. 51.9% in IA_HI, Wilcoxon signed-rank test, p<0.001).

[11] The difference is significant at the 10% level using a t-test (t-test, p = 0.075) and is significant at the 5% level in Table 2 Regression 1.

Figure 2: Proportion of sellers who advised *N*



Note: # of obs. IA: 58; IA_HI: 54.

To provide further statistical evidence, we analyze sellers' insurance advice decisions over time using a random-effects linear probability model with standard errors clustered at the session level.[12] We report the results in Table 2 below. The dependent variable is whether the seller advised *N* or *Y* in each round. Regressions 1 and 2 compare the IA treatment to the IA_HI treatment. The independent variable in Regression 1 includes only IA treatment dummy variable. We find the coefficient of IA is significantly positive, meaning that sellers in the IA treatment are significantly more likely to advise *N* than those in the IA_HI treatment. In Regression 2, we add the independent variables Round and IA*Round. We find that as the rounds progressed, sellers were significantly more likely to advise *N* in both the IA treatment (H0: $\beta_2 + \beta_3=0$: p=0.001) and in the IA _HI treatment($\beta_{2:}$ p=0.032). We report in the next section that a buyer was more likely to purchase the product when he received advice *N* compared to when he received advice *Y*. The increasing rate of advising *N* suggests that sellers gained experience and learned to advise buyers *N* over time.

[12] For all the regressions reported in this paper, we also test the robustness of the results by 1) including control variables that include gender, major and how well the individual understood the experiment instructions. All the main results are robust when including these controls (see Appendix F). We also conduct probit regressions and all results are robust (see Appendix H).

Table 2: Random individual effects LPM regression analysis of insurance advice decisions

Independent variables	Dependent variable: Advice $N_{i,t}$ =1, if seller *i* advised *N* in round *t* *=0, o.w.*	
	(1)	(2)
β_1: IA	0.101**	0.0322
	(0.0401)	(0.0841)
β_2: Round		0.0141**
		(0.00658)
β_3: IA_Round		0.0125
		(0.0106)
Constant	0.711***	0.633***
	(0.0231)	(0.0456)
H0: $\beta_2 + \beta_3$=0		p=0.001
N	1,120	1,120

Note: IA_HI is the constant. Robust standard errors clustered at the session level are reported in the parentheses. *** p<0.01, ** p<0.05, * p<0.1

Result 1: *In both the IA and IA_HI treatments, the majority of sellers advised N. The frequency of advising N increases over time in both treatments.*

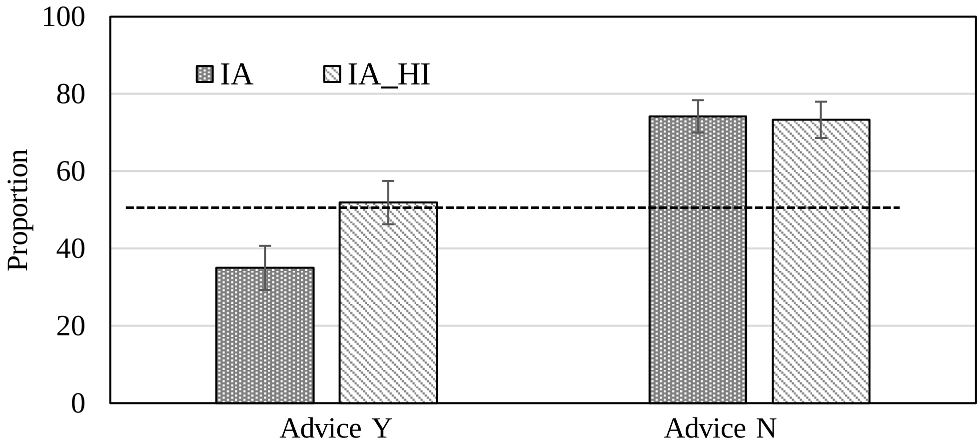
4.2 Purchase decision

Supporting Hypothesis 2, buyers were significantly more likely to purchase the product in the IA and IA_HI treatments compared to the control treatment (IA vs. Control: 66.9% vs. 51.1%, Mann–Whitney U test, p = 0.009; IA_HI vs. Control: 67.8% vs. 51.1%, Mann–Whitney U test, p <0.000). The purchase rate is not significantly different between the two advice treatments (66.9% vs. 67.8%, Mann–Whitney U test, p = 0.857).

Figure 3 plots the product purchase decision conditional on the advice that buyers received. As buyers did not receive any advice in the control treatment, we use the dotted line to mark the average product purchase rate in the control. Compared with the control, buyers in the two advice treatments were significantly more likely to purchase the product when the sellers advised *N.* (IA vs. Control: 74.2% vs. 51.1%, Mann–Whitney U test, p = 0.002; IA_HI vs. Control: 73.3% vs. 51.1%, Mann–Whitney U test, p <0.000). By contrast, when buyers received advice *Y* in the IA treatment, the purchase rate was significantly lower than that in the control (35.0% vs. 51.1%, Mann–Whitney U test, p = 0.008). There was no difference in the purchase rate between the control treatment and the IA_HI when the advice was *Y* (51.9% vs. 51.1%, Mann–Whitney U test, p = 0.931). These results suggest that the increase in the product purchase rate in the IA and IA_HI treatments is mainly driven by buyers who received advice *N*. When the seller advised *N*, the buyer's expectations of the seller shipping the product increased, and consequently, were more likely to purchase the product.[13]

Result 2: *Buyers were more likely to purchase the product in the IA and IA_HI treatments than in the control treatment. This increase in the product purchase rate is mainly driven by advice N.*

Figure 3: Product purchase rate conditional on advice



Note: The dotted line marks the purchase rate (51.1%) in the control treatment. Error bars are standard errors. # of obs. Advice_*Y* (IA: 49; IA_HI: 54; Control: 54); Advice_*N* (IA: 58; IA_HI: 54; Control: 54)

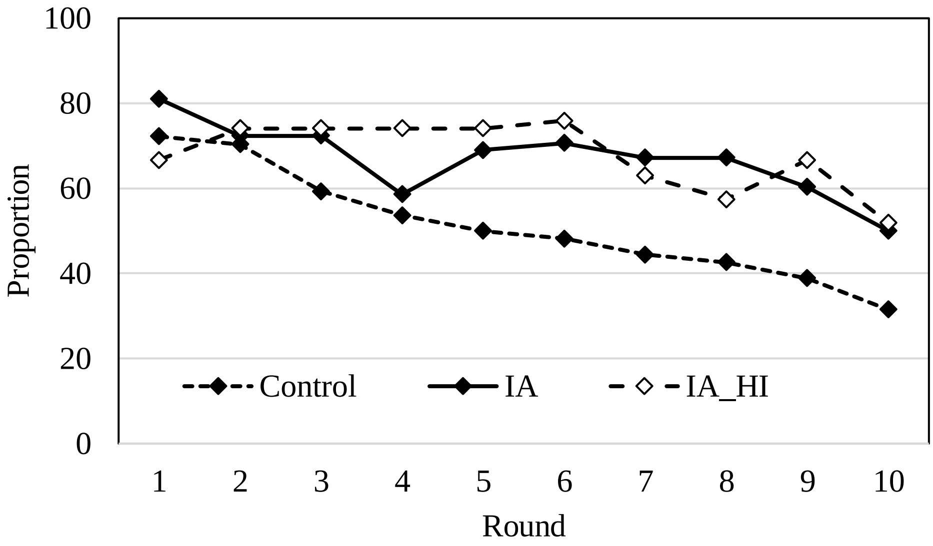
Next, we compare the dynamics of the product purchase decisions in each treatment. Figure 4(a) plots the proportion of product purchases over 10 rounds, while 4(b) and 4(c) plot

[13] It is interesting to observe that upon receiving advice *Y*, 35% of buyers in the IA and 51.9% of buyers in the IA_HI treatment purchased the product when in theory, they should not. However, the sample size is small; thus, caution must be observed when drawing inferences from these observations. Nevertheless, we make the following two notes. In the IA treatment, the proportion of buyers who purchased the product after receiving advice *Y* is relatively higher in the earlier rounds: 47.2% in the first five rounds and 13.5% in the last five rounds, with no buyers choosing to purchase the product in the final two rounds. This result suggests that buyers learned not to purchase the product when they received advice *Y* as the rounds progressed. In the IA_HI treatment, however, we still observe that 20% of buyers purchased the product in the last round. The three buyers who purchased the product in the IA_HI treatment when the seller advised *Y* appeared to be more cautious as all of them also decided to purchase insurance. By contrast, in the control treatment, 5 out of 17 buyers who bought the product in the last round did not purchase the insurance.

the same proportion when the advice was *N* or *Y*, respectively. Although we observe a rapid decay in the purchase proportion in the control treatment, the decay is relatively slower in the IA and IA_HI treatments. Upon separating the cases based on sellers' insurance advice, we find that the decay is slower only when the sellers advised *N*.

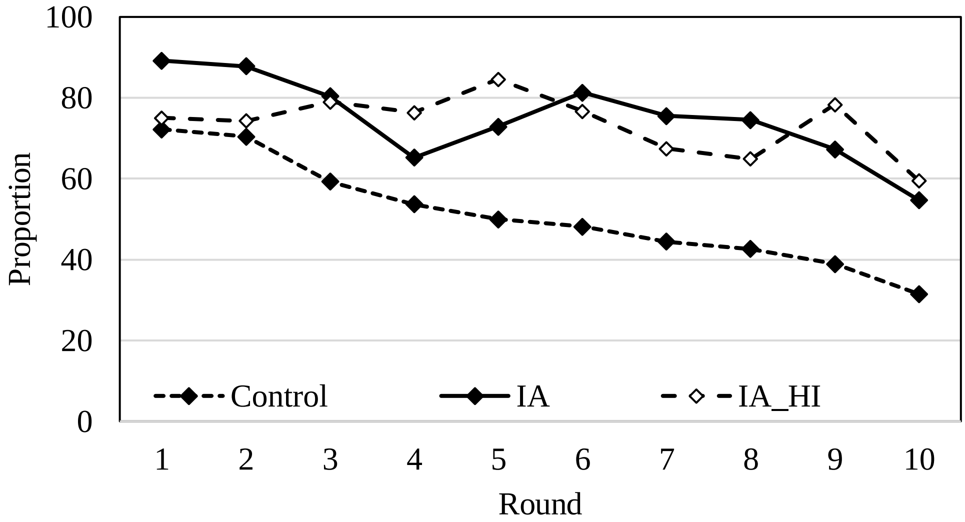
Figure 4. Proportion of buyers who purchased the product per round

(a) Proportion of buyers who purchased the product per round (total)



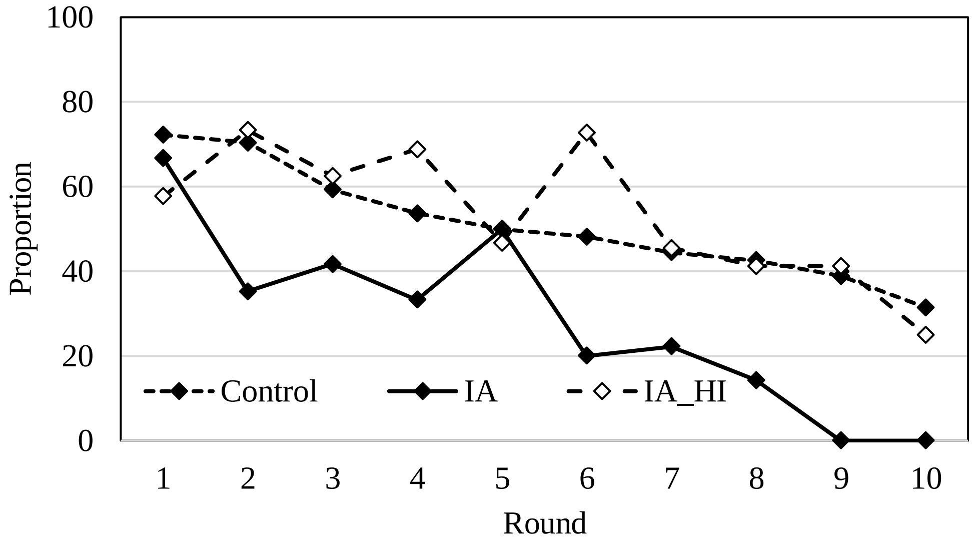
Note: # of obs.: IA: 58; IA_HI: 54; Control: 54.

(b) Proportion of buyers who purchased the product per round (Advice *N*)



Note: # of obs.: IA: 58; IA_HI: 54; Control: 54.

(c) Proportion of buyers who purchased the product per round (Advice *Y*)



Note: # of obs.: IA: 49; IA_HI: 54; Control: 54.

To provide further statistical evidence, we analyze the buyer's product purchase decisions (including when the advice was *Y*) using a random-effects linear probability model with standard errors clustered at the session level. We report the results in Table 3 below. The dependent variable is whether the buyer purchased the product in each round. Regressions 1 and 2 compare the IA treatment to the control. The independent variables in Regression 1 include the treatment dummy, round, and the interaction between the treatment and round. As shown in Table 3, the coefficient of "Round" is negative and statistically significant, indicating that the product purchase rate decays significantly over time in the control treatment. There is also significant decay in the IA treatment ($\beta_3 + \beta_4$; p = 0.026). Consistent with the observation in Figure 2, the coefficient of the interaction variable IA*Round (β_4) is positive and marginally significant (p = 0.093). Regression 2 includes the dummy variable Advice *N* to control for advice and the interaction variable Advice *N**Round. We find that IA*Round is not statistically significant (and the direction was negative), indicating that advising Y did not slow down the rate of decay. By contrast, Advice *N* and the interaction variable Advice *N**Round are both positive and statistically significant.

Table 3: Random individual effects LPM regression analysis of product purchase decisions

Independent variables	Dependent variable: $Buy_{i,t}$ =1, if buyer *i* purchased the product in round *t* = 0, o.w.			
	(1) IA and Control	(2) IA and Control	(3) IA_HI and Control	(4) IA_HI and Control
β_1: IA	0.045	-0.130		
	(0.081)	(.019)		
β_2: IA_HI			0.033	0.0111
			(0.089)	(0.087)
β_3: Round	-0.042***	-0.042***	-0.042***	-0.042***
	(0.007)	(0.007)	(0.007)	(0.007)
β_4: IA*Round	0.020*	-0.018		
	(0.012)	(0.149)		
β_5: IA_HI*Round			0.024**	-0.001
			(0.010)	(0.014)
β_6: Advice *N*		0.289***		0.042
		(0.079)		(0.058)
β_7: Advice *N**Round		0.033***		0.033**
		(0.009)		(0.017)
Constant	0.744***	0.744***	0.744***	0.744***
	(0.068)	(0.068)	(0.068)	(0.068)
H0: $\beta_3 + \beta_4$=0	p=0.026	p<0.001		
H0: $\beta_3 + \beta_5$=0			p=0.012	p<0.001
N	1120	1120	1080	1080

Note: Robust standard errors clustered at the session level are reported in the parentheses, *** p <0.01, ** p <0.05, * p <0.1.

Regressions 3 and 4 provide similar analyses of the IA_HI treatment compared to the control. Regression 3 shows that although there is still a significant rate of decay in IA_HI ($\beta_3 + \beta_5$; p=0.012), it is slower in the IA_HI treatment compared to the control (β_5 was significantly positive). Similar to the findings of the IA treatment, when we control for the advice in Regression 4, we find that the reduction of the decay rate in the IA_HI treatment is significant only when sellers advised *N* (β_5 is negative and not significantly positive; β_7 is significantly positive).

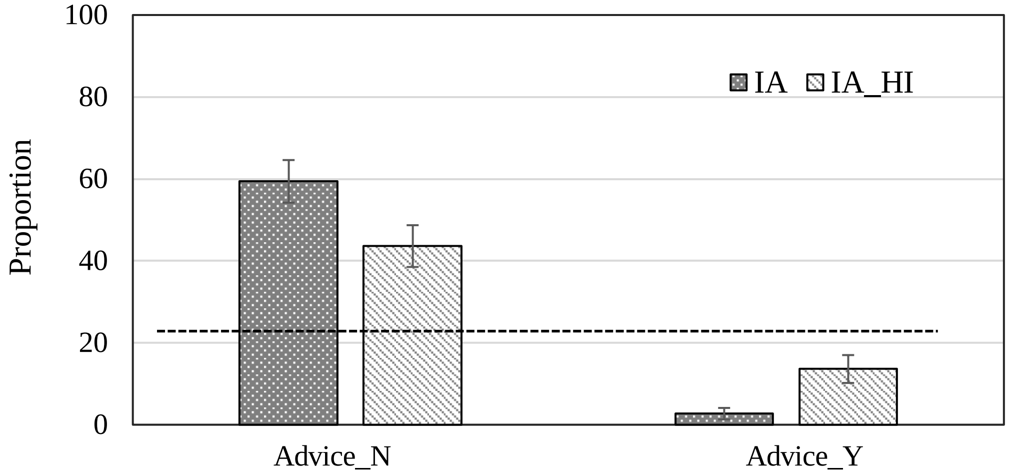
These results are consistent with our theoretical analysis, in which, for both the IA and IA_HI treatments, advice *N* leads to a higher product purchase rate compared to the control treatment.

We next tested Hypothesis 3 by comparing the proportion of buyers that purchased the product without insurance across treatments. Assuming that sellers shipped the product, buyers achieved the highest earnings in this scenario. Supporting Hypothesis 3, the proportion of buyers that purchased the product without insurance is highest in the IA treatment and lowest in the control treatment. The order is significant (IA: 48.3%; IA_HI: 35.6%; Control: 20.2%; Jonckheree–Terpstra test, p <0.001). We report the dynamics of this proportion over the 10 rounds in each treatment in Figure G1 in Appendix G. As shown in Figure G1, the order is very similar over the 10 rounds. This result suggests that one benefit of the IA mechanism is that buyers saved expenses on insurance (without increasing the risk of losing payment when encountering strategic sellers, as reported below).

Figure 5 further shows the proportion of buyers who purchased the product without insurance, conditional on the advice received. Since there was no advice in the control treatment, we calculate the average proportion of product purchases without insurance (marked by the dotted line in Figure 5). As shown in Figure 5, in both the IA and the IA_HI treatments, the proportion of buyers who purchased the product without insurance after receiving advice *N* is significantly higher than in the control treatment (59.4% vs. 20.2%, Mann–Whitney U test, p <0.001; 43.6% vs. 20.2%, Mann–Whitney U test, p = 0.002). By contrast, when receiving advice *Y*, significantly fewer buyers purchased the product without insurance compared to the control treatment (3.7% vs. 20.2%, Mann–Whitney U test, p <0.001; 13.6% vs. 20.2%, Mann–Whitney U test, p = 0.011). These results show that the lower insurance purchase rates in the IA and the IA_HI treatments reported above are due to buyers receiving advice *N*.

Result 3: *Buyers were more likely to purchase the product without insurance in the two advice treatments than in the control treatment. The increase is mainly driven by the effect of advising N.*

Figure 5: Proportion of buyers who purchased the product without insurance conditional on advice



Note: The dotted line marks the product purchase rate (20.2%) in the control treatment (no advice was given in the control). Error bars are standard errors. # of obs.: Advice *Y* (IA: 49; IA_HI: 54; Control: 54); Advice *N* (IA: 58; IA_HI: 54; Control: 54).

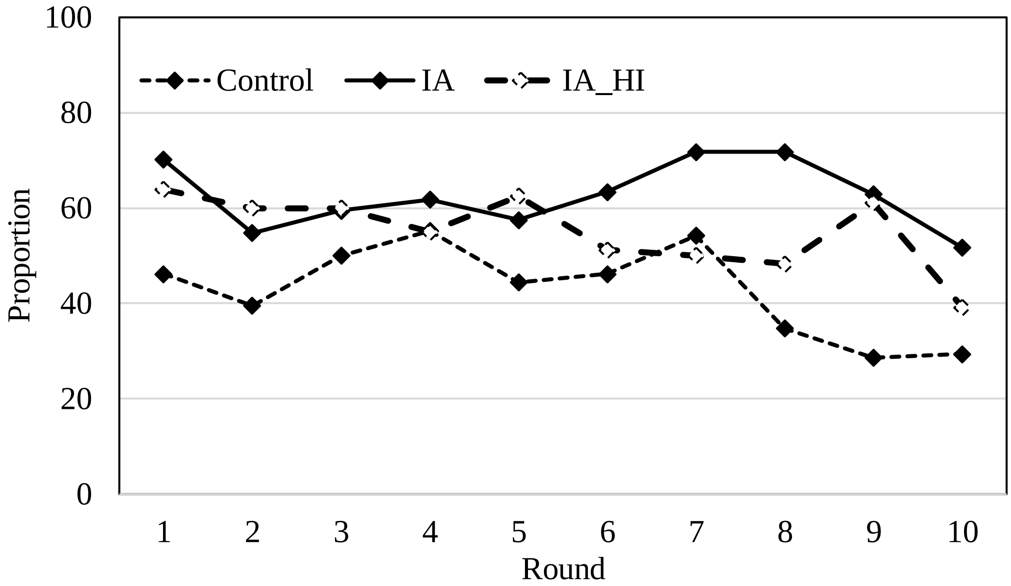
4.3 Shipping decision

Supporting Hypothesis 4, the overall shipping rate is highest in the IA and lowest in the control treatment (IA: 61.4%; IA_HI: 53.5%; Control: 43.8%, Jonckheree–Terpstra test, p <0.007). The increase in the shipping rate is mainly driven by advising *N* (IA (advice N) vs. Control: 64.2% vs. 43.9%, Mann–Whitney U test, p = 0.006; IA_HI (advice N) vs. Control: 58.0% vs. 43.9%, Mann–Whitney U test, p = 0.069). By contrast, when sellers advised *Y*, the shipping rate in the two advice treatments is significantly lower than in the control (IA (advice Y) vs. Control: 25.0% vs. 43.9%, Mann–Whitney U test, p = 0.045; IA_HI (advice Y) vs. Control: 26.2% vs. 43.9%, Mann–Whitney U test, p = 0.053). These results are consistent with our theoretical framework, in which the seller incurs a psychological cost for not shipping the product after she advised *N*.

To compare the dynamics of the shipping rate by treatment, Figure 6 plots the shipping rate over the 10 rounds. Figure 6(a) reports the overall shipping rate. We observe that the overall shipping rate is highest in the IA treatment in 7 out of the 10 rounds. By separating the cases into advice *N* (Figure 6(b)) and advice *Y* (Figure 6(c)), we found that the higher shipping rate in the IA treatment is mainly driven by advising *N*. These results are consistent with our theoretical framework and suggest that Advice *N* causes the increase in the shipping rate.

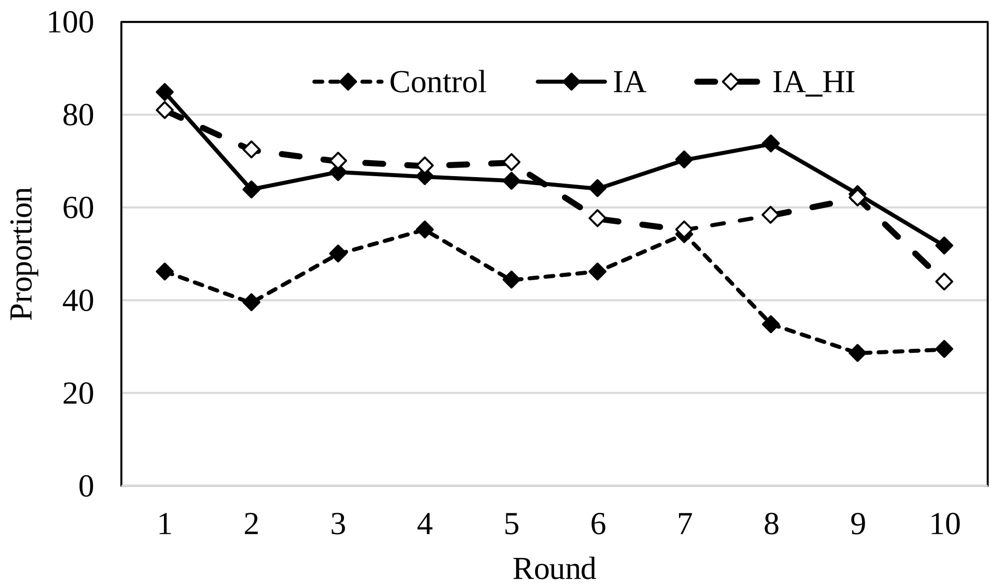
Figure 6. Proportion of sellers who shipped the product in each round

(a) Proportion of sellers who shipped the product in each round (Total)



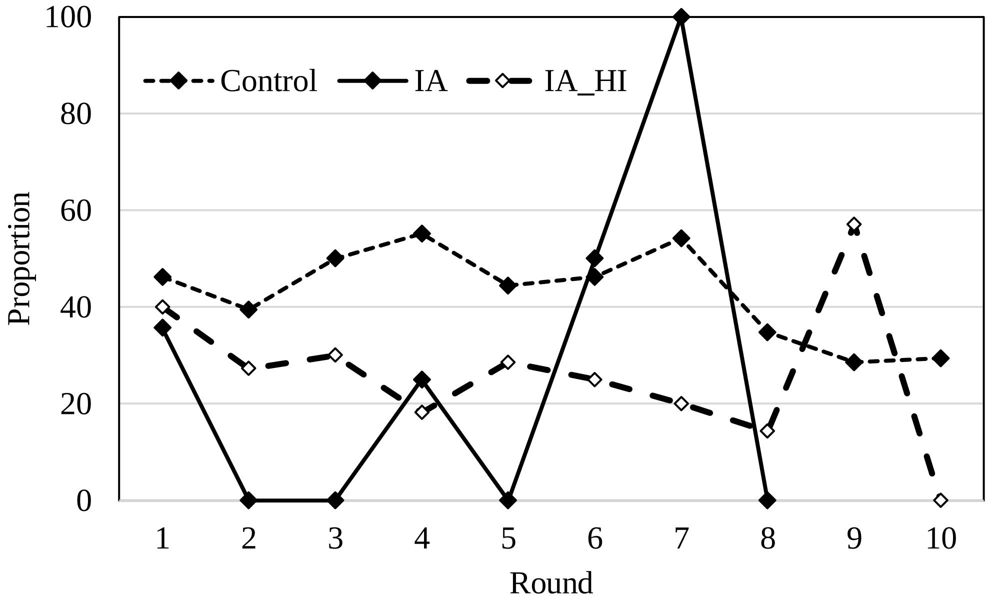
Note: # of obs.: IA: 58; IA_HI: 50; Control: 54.

(b) Proportion of sellers who shipped the product in each round (Advice *N*)



Note: # of obs.: IA: 58; IA_HI: 34; Control: 54.

(c) Proportion of sellers who shipped the product in each round (Advice *Y*)

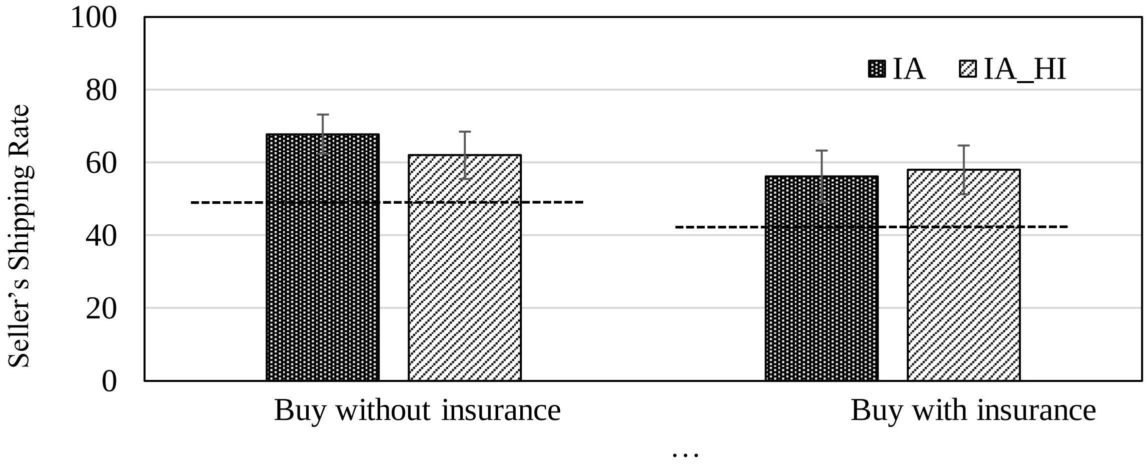


Note: # of obs.: IA: 31; IA_HI: 34; Control: 54. In rounds 9 and 10 of the IA treatment, there was no observation in which the seller advised *Y* and the buyer purchased the product.

In our theoretical framework, we assume that the psychological cost is higher when the seller observes that the buyer follows her advice of *N* than when the buyer does not follow her advice. This assumption would predict that, in the IA treatment, sellers who advise *N* would be more likely to ship the product after observing the buyer who purchased the product without insurance than observing buyers who purchased the product with insurance. Our data are consistent with this prediction. To illustrate this, Figure 7 reports the average shipping rates of sellers who advised *N* in the IA treatment when buyers purchased the product with and without insurance. For comparison, the dotted lines mark the average shipping rate when buyers purchased the product with and without insurance in the control treatment. We also include data from the IA_HI treatment. As sellers never knew the buyer's insurance purchase decision in the IA_HI treatment, we do not expect to see any correlation between the sellers' shipping decisions and the buyers' insurance purchase decision.

Figure 7 shows that the seller's shipping rate varies according to the buyer's insurance purchase decisions, mainly in the IA treatment, and the difference is much smaller and not statistically significant in both the control and the IA_HI treatments. (IA: 67.8% vs. 56.2%, Wilcoxon sign rank test, p = 0.032; IA_HI: 62.0% vs. 58.0%, Wilcoxon sign rank test, p = 0.873; Control: 48.4% vs. 42.0%, Wilcoxon sign rank test, p = 0.353).

Figure 7: Shipping rates when sellers advised *N*



Note: The dotted line marks the shipping rate in the control treatment when the buyer did not purchase insurance (48.4%, on the left) and when the buyer purchased insurance (42.0%, on the right). Error bars are standard errors. # of obs.: Purchase without insurance (IA: 58; IA_HI: 44; Control: 46); purchase with insurance (IA: 46; IA_HI: 44; Control: 52).

To provide further statistical evidence for the above findings, we conduct a regression analysis of the sellers' shipping decisions using a random effects linear probability model with standard errors clustered at the session level. For each of the advice treatments, we start with a regression that only includes "Advice *N*" = 1 if the seller advised *N* and a treatment dummy. Results are reported in Table 4. Consistent with the above results from the non-parametric tests, the results from Regressions (1) and (3) show that, in both the IA and the IA_HI treatments, the positive advice effect was driven by sellers who advised *N* (β_6 is statistically significant in both treatments).

Next, we add three independent variables: "Noinsurance" = 1 if the buyer did not purchase insurance; and two interaction terms— "Noinsurance*IA" (or Noinsurance *IA_HI) and "Noinsurance*Advice *N*." Regression (2) shows that, in the IA treatment, sellers who advised *N* are significantly more likely to ship when buyers did not purchase insurance (β_7 is significant). However, this is not the case in the IA_HI treatment. (β_7 is not significant in Regression (4)). Moreover, the buyer's decision not to purchase insurance does not have a significant impact on the seller's shipping decision in either the control treatment or when the sellers advised *Y* in the IA or IA_HI treatments (neither β_3 nor β_4 is significant in Regression (2), and neither β_3 nor β_5 is significant in Regression (4)).

Table 4: Random individual effects LPM regression analysis of shipping decisions

Independent variables	Dependent variable: $Ship_{j,t}$ =1, if the seller j shipped the product in round t; =0, o.w			
	(1) IA and Control	(2) IA and Control	(3) IA_HI and Control	(4) IA_HI and Control
β_1: IA	-0.062	-0.043		
	(0.073)	(0.086)		
β_2: IA_HI			-0.059	-0.075
			(0.073)	(0.096)
β_3: Noinsure		0.045		0.045
		(0.057)		(0.057)
β_4: Noinsure*IA		-0.032		
		(0.092)		
β_5: Noinsure*IA_HI				0.068
				(0.196)
β_6: Advice *N*	0.273***	0.143**	0.216***	0.221**
	(0.061)	(0.059)	(0.074)	(.0109)
β_7: Noinsure *Advice *N*		0.148**		-0.066
		(0.072)		(0.199)
Constant	0.436***	0.420***	0.437***	0.420***
	(0.036)	(0.049)	(0.036)	(0.049)
H0: $\beta_6 + \beta_7 = 0$		$p < 0.001$		$p = 0.235$
H0: $\beta_6 + \beta_7 = \beta_3$		$p = 0.002$		$p = 0.440$
H0: $\beta_7 = \beta_3$		$p = 0.263$		
N	664	664	642	642

Note: Noinsure = 1 if the buyer did not purchase insurance; = 0, o.w. Advice *N* = 1 if the seller advised *N*; = 0 if the seller advised Y. Robust standard errors in parentheses clustered at the session level are reported in parentheses. *** p <0.01, ** p <0.05, * p <0.1.

In summary, our data suggest that advice *N* provided by the sellers causes an increase in the shipping rate. Furthermore, for sellers, the buyers' insurance purchase decisions did matter when they advised buyers *N* and could observe whether the advice was followed.

Lastly, we explore individual differences in shipping behavior. For each seller, we calculate the frequency of shipping the product when the paired buyer decided to purchase the product. The distribution of the shipping rate in each treatment is shown in Appendix G (Figures G2). In all treatments, the two most common behavior profiles are to never or always ship. Table 5 summarizes the proportion of sellers who "always shipped" and "never shipped" in each treatment. In the two advice treatments, we report the proportions for the case when sellers advised *N* and *Y*, respectively.[14]

Our theoretical framework predicts that type-s sellers who never ship in the control treatment will advise *N* and subsequently always ship in the IA treatment, provided that the psychological cost of not shipping is sufficiently large. In the IA_HI treatment, there is a mixed strategy equilibrium where type-s sellers advise *N*, but only some will always ship the product. Thus, compared to the control treatment, we expect to see a higher proportion of "always ship" and a lower proportion of "never ship" when sellers advise *N* in the IA treatment. The effect of advice, albeit positive, is weaker in the IA_HI treatment. We thus compare the proportion of "always ship" and "never ship" when sellers advise *N* in the two advice treatments with the control treatment.

Supporting the theoretical framework, we find that in IA and IA_HI, when the advice was *N*, the proportion of "always ship" is highest in the IA treatment and lowest in the control, and the ascending order is statistically significant (41.4% >34.0% >18.5%, Jonckheree–Terpstra test, $p = 0.005$). Similarly, the proportion of "never ship" is highest in the control and lowest in the IA treatment, and the ascending order is also statistically significant (33.3 >27.7% >19.0%, Jonckheree–Terpstra test, $p = 0.042$).[15][16]

[14] Calculating the two types using the pooled data in the two advice treatments can be misleading. Take an extreme case as an example. Suppose all sellers advise *N* in 8 rounds and advise *Y* in 2 rounds. Also suppose all sellers always ship when advising *N* and never ship when advising *Y*. In this case, when calculating the overall proportion of "always ship" and "never ship", we will get 0% of both "always ship" and "never ship" in the advice treatments.

[15] Sellers behaved very differently when they took the off-equilibrium strategy of advising *Y*. The proportion of "always ship" is highest in the control treatment and lowest in the IA_HI (Control: 18.5%; IA: 10%; IA_HI: 4%). For the proportion of "never ship", it is highest in the IA and lowest in the control (IA: 60%; IA_HI: 48.6%; Control: 33.3%)

[16] In the IA treatment, we find that 11 out of 58 sellers never shipped when advising N. Among these 11 sellers, 5 only advised N. Among the other 6 sellers who sometimes advised N and sometimes advised Y, 5 of them

Result 4: *Sellers were more likely to ship the product in the two advice treatments than in the control. The increase in the shipping rate is driven by those who advised N.*

Result 5: *In the IA treatment, sellers who advised N were more likely to ship the product when the buyer followed the advice than when he did not follow the advice.*

Table 5: Frequency of sellers who either always or never shipped the product

Treatment (# of obs.)	Always Ship (%)	vs. Control (p-value)	Never Ship (%)	vs. Control (p-value)
Control (54)	18.5	-	33.3	-
IA (58)				
Advice_*N* (58)	41.4	0.009	19.0	0.083
Advice_*Y* (20)	10.0	0.377	60.0	0.038
IA_HI (54)				
Advice_*N* (47)	34.0	0.075	27.7	0.539
Advice_*Y* (25)	4.0	0.083	48.0	0.212

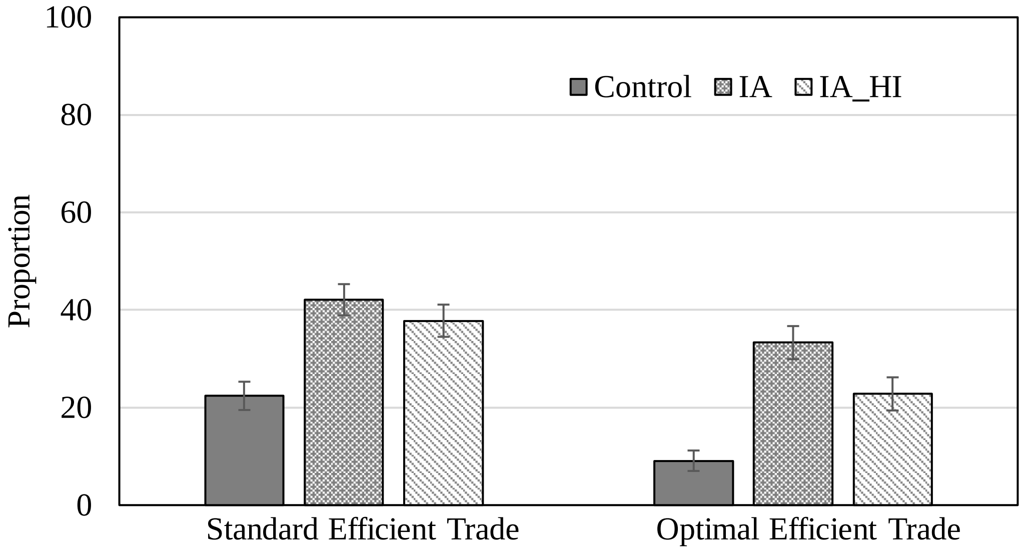
Note: For Advice_*N* (Advice_*Y*), independent observations only considered the sellers' shipping decisions when the advice was *N* (*Y*) and a buyer purchased the product. The p-value was based on a chi-squared test.

4.4 Market Efficiency

Figure 8 plots the proportion of standard efficient trades and optimal efficient trades in each treatment. As defined in Section 3, standard efficient trade occurs when the product is bought and shipped, and optimal efficient trade occurs when the product is bought without insurance and shipped. The pattern in Figure 8 supports Hypothesis 5 that the frequency of efficient trades is highest in the IA and lowest in the control treatment (standard efficient trades: 22.4% <37.8% <42.1%, Jonckheree–Terpstra test, $p < 0.001$; optimal efficient trades 9.1% <22.8% <33.3%, Jonckheree–Terpstra test, $p < 0.001$).

never shipped and the other one shipped 50% of the time after advising Y. Thus, we may argue 10 out of 58 (17%) sellers had $d > \alpha$. This indicates that there is a small proportion of sellers who had $d > \alpha$.

Figure 8: Proportion of efficient trades by treatments



Note: Error bars are standard errors. # of obs.: IA: 58; IA_HI: 54; Control: 54.

Although the difference in the frequency of standard efficient trades between the IA and IA_HI treatments is relatively small and not significant (42.1% vs. 37.8%, Mann–Whitney U test, p = 0.389), the IA treatment results in significantly more optimally efficient trades (33.3% vs. 22.8%, Mann–Whitney U test, p = 0.041). The lower frequency of optimal efficient trades in the IA_HI treatment is consistent with the results that the proportion of buyers purchasing the product without insurance is lower in the IA_HI treatment than in the IA treatment.

As a result of the increase in the number of efficient trades, both buyers and sellers made higher profits in the two insurance advice treatments than in the control. The average earnings per round for the buyer increase by 9.1% in the IA treatment compared to the control (36.1 vs. 33.1, Mann–Whitney test, p <0.001). The average earnings per round for the seller increase by 4.4% in the IA treatment (47.5 vs. 45.5, Mann–Whitney U test, p = 0.011).

We observe similar results in the IA_HI treatment. Compared to the control, the average earnings per round for the buyers increase by 5.4% (34.9 vs. 33.1, Mann–Whitney U test, p = 0.006), and the average earnings per round for the seller increase by 5.9% (48.2 vs. 45.5, Mann–Whitney test, p = 0.003) in the IA_HI treatment.

Result 6: *The advice mechanism significantly increases the frequency of efficient trades and the average earnings of both buyers and sellers, especially when buyers' insurance purchase decisions were known to the sellers.*

5. Discussion and Conclusion

We designed and tested a novel insurance advice mechanism aimed at promoting efficient trade in a market with asymmetric information. We show both theoretically and experimentally that under this mechanism, buyers purchased the product significantly more often, and sellers were also more likely to ship the product than in the control treatment. The insurance advice mechanism also has an indirect welfare effect on buyers by reducing the frequency of purchasing insurance. The comparison between the two advice treatments further suggests that the mechanism is most effective when sellers could observe buyers' insurance purchase decisions. This finding suggests that online marketplaces may want to make buyers' insurance purchase decisions salient to sellers, alongside the introduction of the insurance advice mechanism.

Our study points out a new direction for designing market mechanisms to overcome asymmetric information problems. Existing instruments, such as reputation mechanisms, warranties, and insurance, designed to promote market efficiency, are often costly to sellers and/or buyers (Li and Xiao, 2014; Bolton et al., 2018; Bolton et al., 2019; Andreoni, 2018). Although some big companies or manufacturers can provide insurance or warranties, many small sellers that populate online marketplaces, such as eBay and Amazon, cannot do so. Sellers can sometimes use prices to signal their quality. However, this type of signaling can be quite costly: good sellers have to distort their prices to differentiate themselves from bad sellers (Bagwell and Riordan, 1991, Bagwell, 1992). Importantly, price signaling does not change the non-cooperative behavior of strategic sellers. The insurance advice mechanism can be a low-cost complement to these existing instruments. A simple message on the online sellers' page can do the job. With the rapid growth of the digital economy, more third-party insurance companies—such as Squaretrade and xcover. com—have emerged to protect consumers against risks not covered by the manufacturer's warranty. These insurance products provide a natural opportunity to introduce the advice mechanism with minimal changes to the current platform design. Future field research could investigate how insurance advice works in combination with other mechanisms.

A potential barrier to implementing the advice mechanism is whether third-party insurance companies will agree to it. One concern may be that third-party insurance companies will be worse off if fewer people purchase insurance. However, it is unclear whether the introduction of the insurance mechanism necessarily makes the insurance company worse off. In the Advice_HI treatment, on average, more products were purchased with insurance (32.2%) than in the control treatment (30.1%). This means that if there is no observability, insurance advice may result in companies like Squaretrade being better off (or at least not worse off) because more buyers participate in the market. Finally, it is the online platform that would implement the mechanism, not the third-party insurance company. Assuming that online platforms such as eBay benefit from more buyers purchasing products, we should expect that there is a potential incentive to introduce the advice mechanism.

Future research could be valuable by examining factors that may impact the mechanism's effectiveness. A critical condition for the insurance advice mechanism to be effective is that the psychological cost of not shipping after advising no insurance is greater than the cost of shipping. In our experiment, the seller's shipping cost was relatively small.[17] It would be interesting to explore whether the psychological cost is sufficient to discourage non-cooperative behavior in markets where the cost of cooperation is much greater (e.g., when products are expensive). Previous studies on lying aversion have shown that although people are more likely to lie when they have more to gain, they are also less inclined to lie when the other person has more to lose (Gneezy, 2005; Lundquist et al., 2009). If the psychological costs increase with these gains from non-delivery, the advice mechanism may remain effective, even for relatively large-value transactions.

In our experiment, there was no uncertainty associated with receiving compensation under the insurance policy. However, asymmetric information problems are also common in the insurance market. In particular, consumers are often unsure about the coverage. It would be valuable to examine the relationship between the effect of the advice mechanism and trust in the insurance policy. Although we forced the sellers to provide advice in our experiment, it may be more feasible to introduce a mechanism in which insurance advice is presented as an option or upon request from the buyers and sellers can choose to be silent. It would be fruitful to compare the effect of the advice mechanism when advising is mandatory as opposed to when it is optional.

[17] Although the cost of shipping is only 10E$($4 AUD), previous studies have shown that people are willing to incur a high cost to cooperation. For example, Abeler et al. (2019) find that people are willing to act honestly at the cost as high as $50 USD,

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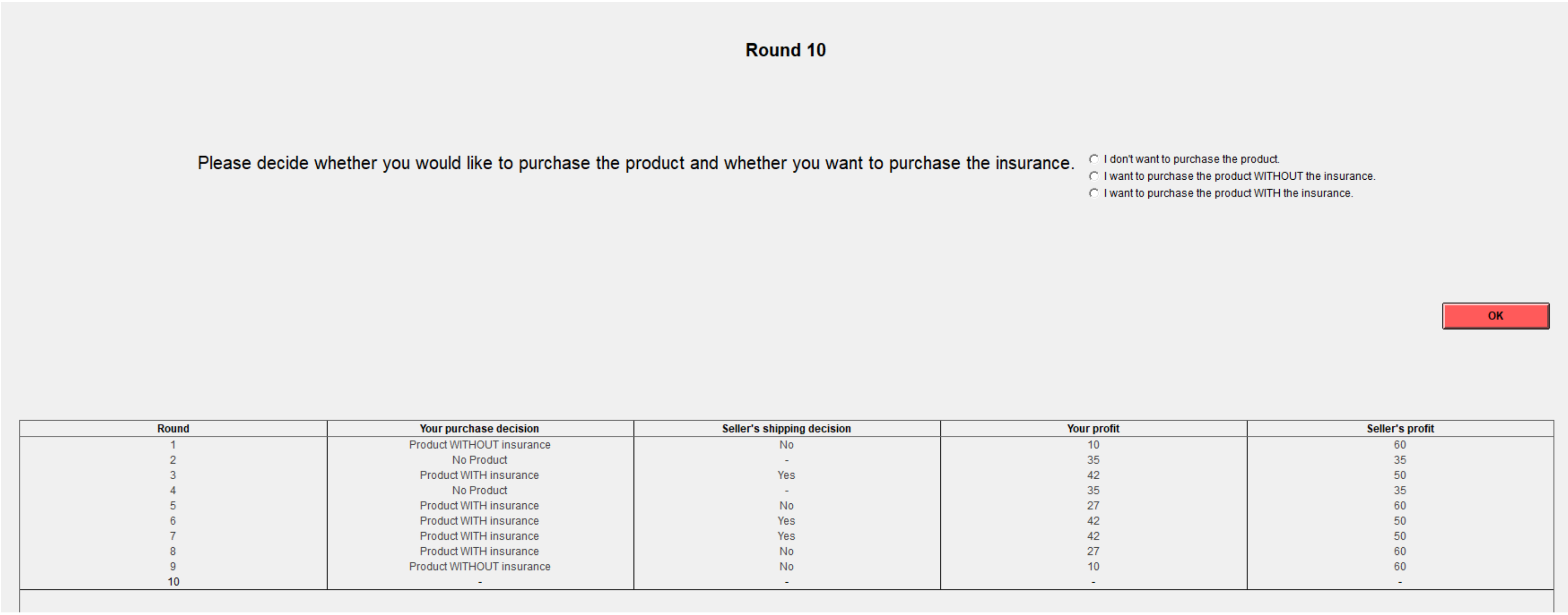
Appendix

Appendix A: Screenshots of the Z-tree program

Figure A1: Buyer's product purchase decision screen (control)



Round	Your purchase decision	Seller's shipping decision	Your profit	Seller's profit
1	Product WITHOUT insurance	No	10	60
2	No Product	-	35	35
3	Product WITH insurance	Yes	42	50
4	No Product	-	35	35
5	Product WITH insurance	No	27	60
6	Product WITH insurance	Yes	42	50
7	Product WITH insurance	Yes	42	50
8	Product WITH insurance	No	27	60
9	Product WITHOUT insurance	No	10	60
10	-	-	-	-

Figure A2: Seller's shipping decision screen (control)

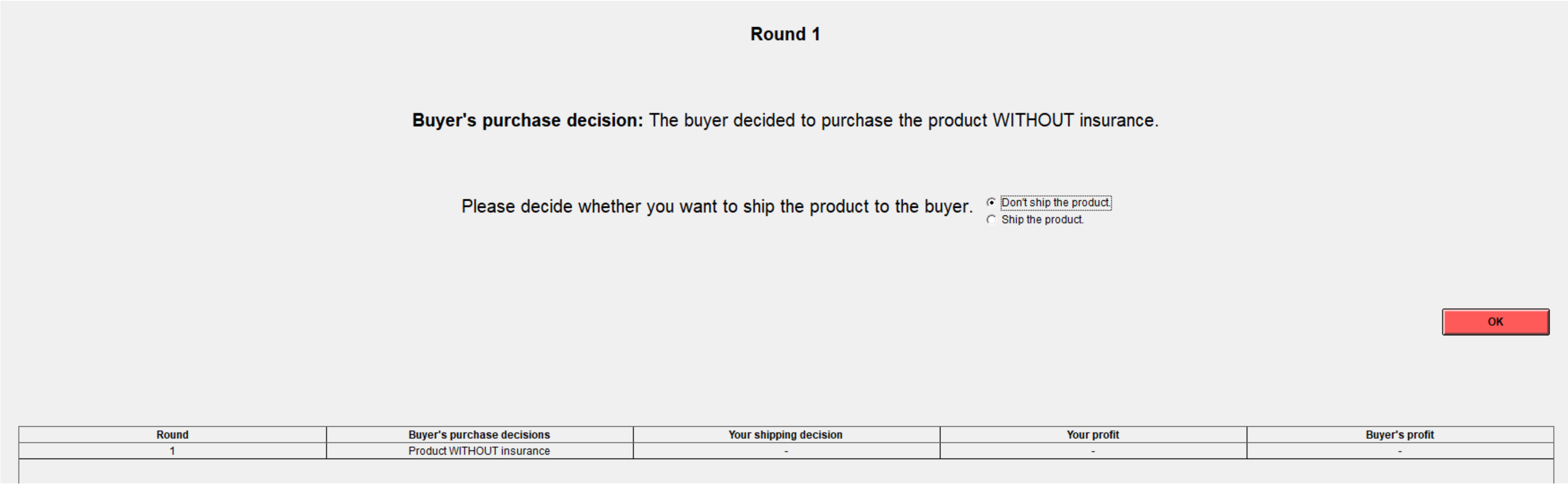
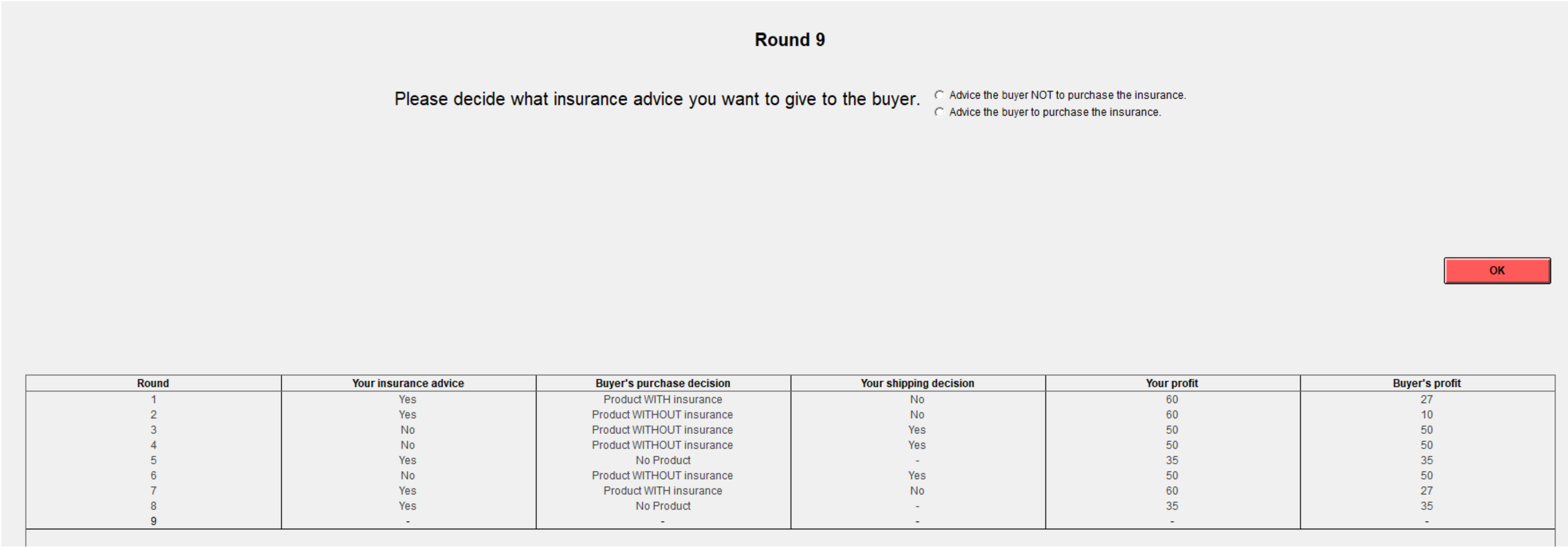
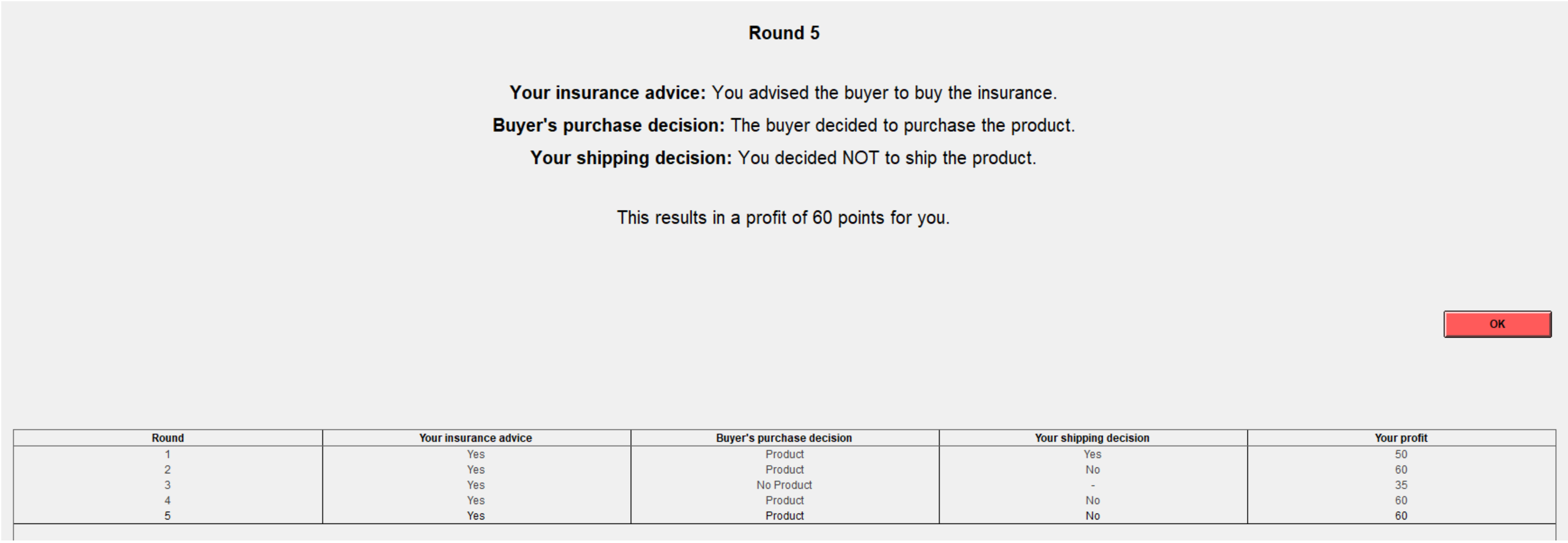


Figure A3: Seller's advice decision screen (IA treatment)



Round	Your insurance advice	Buyer's purchase decision	Your shipping decision	Your profit	Buyer's profit
1	Yes	Product WITH insurance	No	60	27
2	Yes	Product WITHOUT insurance	No	60	10
3	No	Product WITHOUT insurance	Yes	50	50
4	No	Product WITHOUT insurance	Yes	50	50
5	Yes	No Product	-	35	35
6	No	Product WITHOUT insurance	Yes	50	50
7	Yes	Product WITH insurance	No	60	27
8	Yes	No Product	-	35	35
9	-	-	-	-	-

Figure A4: Seller's outcome summary screen after decisions (IA_HI treatment)



Appendix B: Instructions

(All treatments)

GENERAL INSTRUCTIONS FOR PARTICIPANTS

You are taking part in an economic experiment in which you can earn money. Please read the following instructions carefully. Your earnings depend on your decisions and on the decisions of another participant. At the end of the experiment, the amount of money earned will be paid to you in cash. Additionally, you will receive a show-up fee of 4 AUD.

Throughout the experiment, monetary amounts are not quoted in AUD, but points. Eventually, the amount of money earned during the experiment will be converted into Euro, where:

1 Point = 0.4 AUD

In this experiment, there are two types of participants, **buyers and sellers**, who make different decisions. You will only get to know your type shortly before the start of the experiment. The types will be randomly assigned and kept throughout the experiment. Please read the instructions about the decisions of both types carefully. All participants receive the same instructions.

Talking is not permitted during the experiment. Failure to comply will result in exclusion from the experiment and the loss of all earnings. If you have any questions, please address them to us: raise your hand and an experimenter will come to you.

THE EXPERIMENT

The experiment consists of 10 rounds. At the beginning of each round participants are endowed with 35 points and randomly matched in **groups of two**. Each pair consists of one buyer and one seller. At the end of the experiment only one of the 10 rounds will be randomly chosen to determine the earnings from the experiment. All rounds are equally likely to be chosen.

Product Purchase

The buyer decides whether to purchase a product from the seller at a price of 25 points.

- If the buyer chooses not to purchase the product, the decision task is over. The buyer and the seller keep their 35 points endowment and do not make any further decisions.
- If the buyer chooses to purchase the product, the seller decides whether to ship the product. Receiving the product is worth 40 points to the buyer while not receiving the product does not yield any points to the buyer. Before the seller makes the shipping decision, the buyer can decide whether to purchase an insurance.

Insurance Purchase

The insurance makes sure that the buyer is refunded the price of 25 points in case the seller does not ship the product. If the seller ships the product, the buyer will not be compensated by the insurance as no monetary loss is incurred.

The costs for the insurance are 8 points. Irrespective of whether the seller ships the product, if the insurance is purchased, the buyer needs to pay the insurance fee of 8 points.

The buyer's earnings in each round are calculated as follows:

Without insurance:

If the product is shipped: 35 (endowment) + 40 (the product value) - 25 (the price paid to the Seller) = 50 points.

If the product is not shipped: 35 (endowment) + 0 (no product value) - 25 (the price paid to the Seller) = 10 points.

With insurance:

If the product is shipped: 35 (endowment) + 40 (the product value) - 25 (the price paid to the Seller) – 8 (the insurance fee) = 42 points.

If the product is not shipped: 35 (endowment) + 0 (no product value) - 25 (the price paid to the Seller)- 8 (the insurance fee) + 25 (the refund by the insurance) = 27 points.

(IA treatment and IA_HI treatments)

Insurance Advice

Before the buyer decides whether to purchase the product, the seller is asked to give insurance advice to the buyer. The seller can advise the buyer to either not purchase or purchase the insurance. The advice is transmitted to the buyer who subsequently makes the insurance and product purchase decision.

(IA_HI treatment)

Sellers, however, will NOT know whether the buyer decided to purchase the insurance or not during or after the experiment.

Product shipping

The seller's cost for shipping the product is 10 points. If the seller does not ship the product he/she does not incur any costs. The seller's earnings in each round are calculated as follows:

- If the seller chooses to ship the product: 35 (endowment) + 25 (price paid by the buyer) – 10 points (the cost of shipping the product) = 50 points
- If the seller chooses to not ship the product: 35 (endowment) + 25 (price paid by the buyer) – 0 points (no shipping costs) = 60 points

In each round, the decisions will be made in the following order:

You are randomly divided into buyer-seller pairs. Each round proceeds in the following order:

(Control treatment)

<u>1. Buyer</u>: You decide whether to purchase the product. If you choose to not purchase the product the respective round is over. If you choose to purchase the product you further decide whether you want to purchase the insurance.

<u>2. Seller</u>: You are informed about whether the buyer has chosen to purchase the product and if yes, whether the buyer has purchased the insurance. You then decide whether to ship the product.

<u>3. Buyer</u>: You are informed about the seller's shipping decision.

(IA treatment and IA_HI treatment)

1. Seller: You advise the buyer whether to purchase the insurance.

2. Buyer: You are informed about the seller's advice.

3. Buyer: You decide whether to purchase the product. If you choose to not purchase the product the respective round is over. If you choose to purchase the product you further decide whether you want to purchase the insurance.

(IA treatment)

1. Seller: You are informed about whether the buyer has chosen to purchase the product and if yes, whether the buyer has purchased the insurance. You then decide whether to ship the product.

2. Buyer: You are informed about the seller's shipping decision.

(IA_HI treatment)

1. Seller: You are informed about whether the buyer has chosen to purchase the product. You will NOT know whether the buyer has purchased the insurance. You then decide whether to ship the product.

2. Buyer: You are informed about the seller's shipping decision.

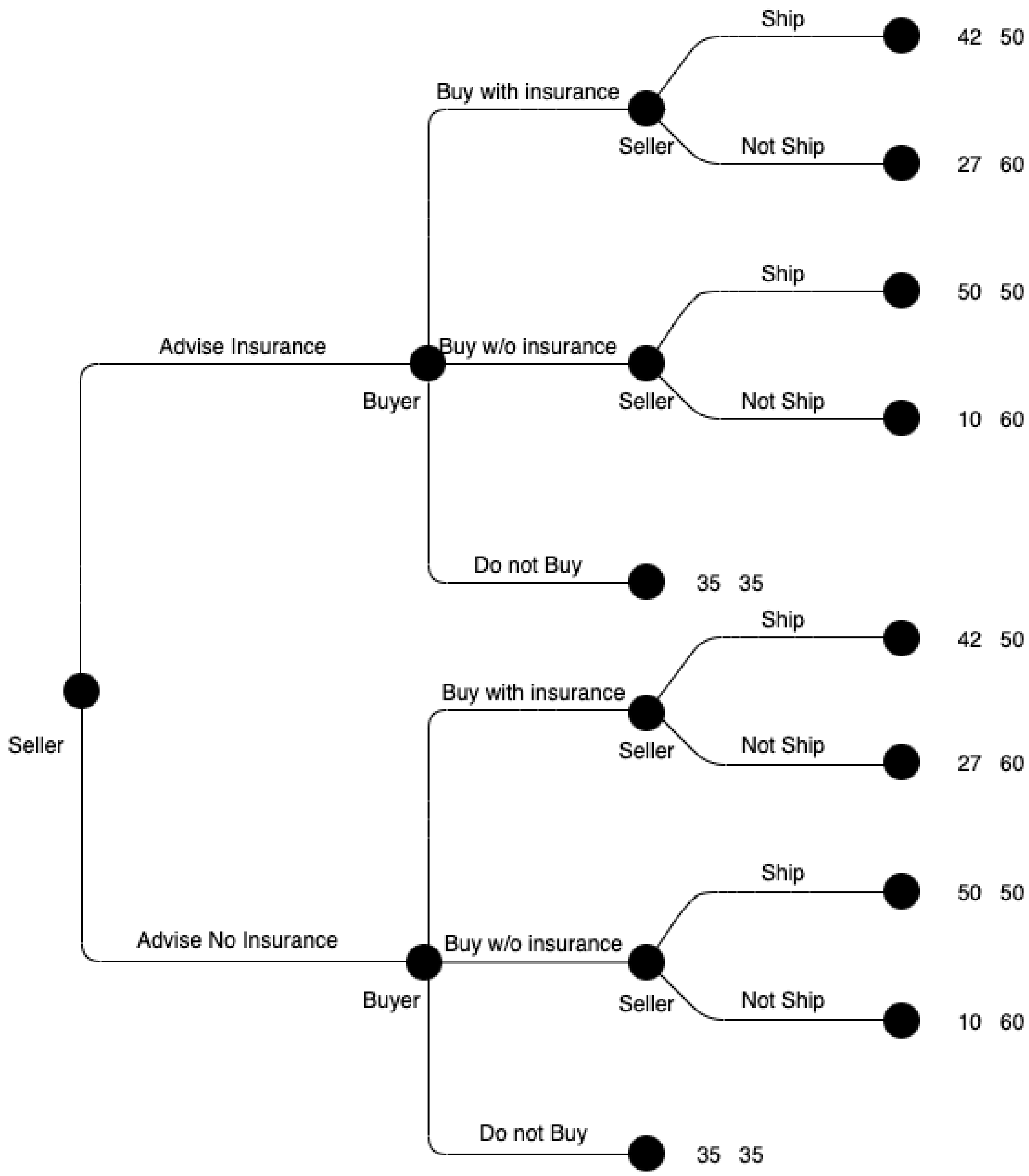
(All treatments)

After each round, buyers and sellers are randomly matched with another seller and buyer respectively. The procedure is repeated 10 times.

At the end of the experiment, participants will receive all earnings-information from all rounds of the experiment and get to know which round was randomly chosen to be relevant for payment. We kindly ask you to then remain seated until you are called.

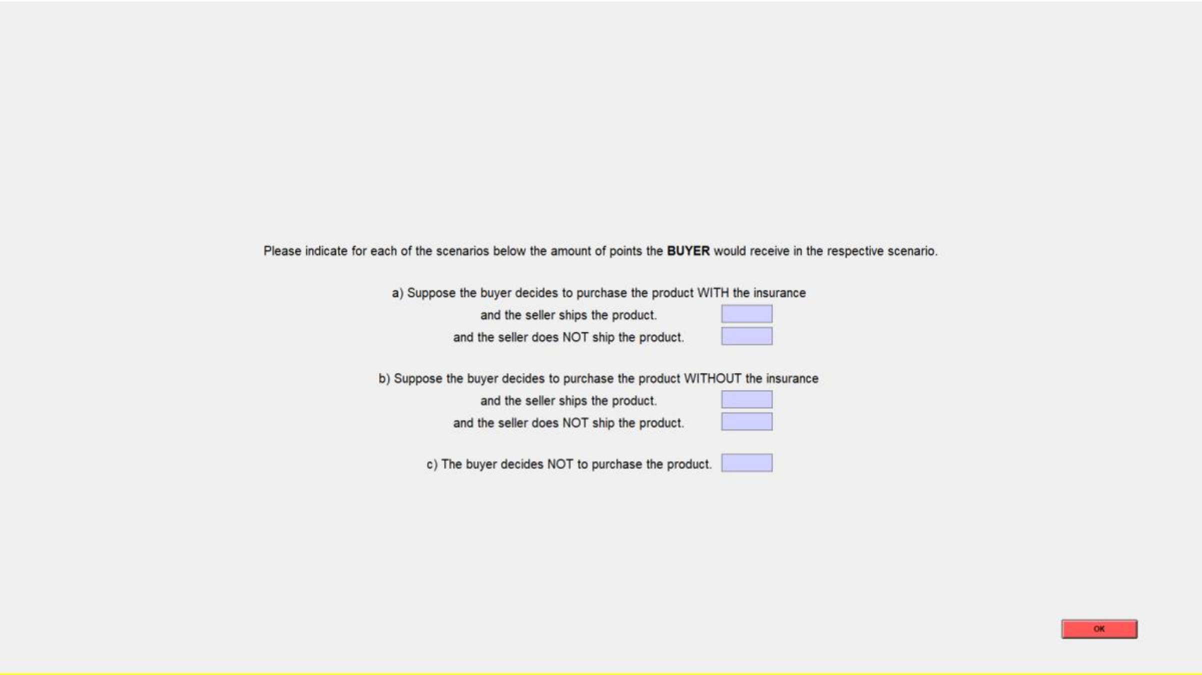
Appendix C: Buyer-Seller game with insurance advice

Figure C1: Buyer-seller game with insurance advice



Appendix D: Comprehension quiz screenshots.

D1: Comprehension questions in the control treatment



D2: Comprehension questions in the IA and the IA_HI treatments.

Please indicate for each of the scenarios below the amount of points the **BUYER** would receive in the respective scenario.

Suppose the seller advises the buyer NOT to buy the insurance.

a) The buyer decides to purchase the product WITH the insurance
and the seller ships the product.
and the seller does NOT ship the product.

b) The buyer decides to purchase the product WITHOUT the insurance
and the seller ships the product.
and the seller does NOT ship the product.

c) The buyer decides NOT to purchase the product.

Suppose the seller advises the buyer to buy the insurance.

a) The buyer decides to purchase the product WITH the insurance
and the seller ships the product.
and the seller does NOT ship the product.

b) The buyer decides to purchase the product WITHOUT the insurance
and the seller ships the product.
and the seller does NOT ship the product.

c) The buyer decides NOT to purchase the product.

OK

Please indicate for each of the scenarios below the amount of points the **SELLER** would receive in the respective scenario.

Suppose the seller advises the buyer NOT to buy the insurance.

a) The buyer decides to purchase the product WITH the insurance
and the seller ships the product.
and the seller does NOT ship the product.

b) The buyer decides to purchase the product WITHOUT the insurance
and the seller ships the product.
and the seller does NOT ship the product.

c) The buyer decides NOT to purchase the product.

Suppose the seller advises the buyer to buy the insurance.

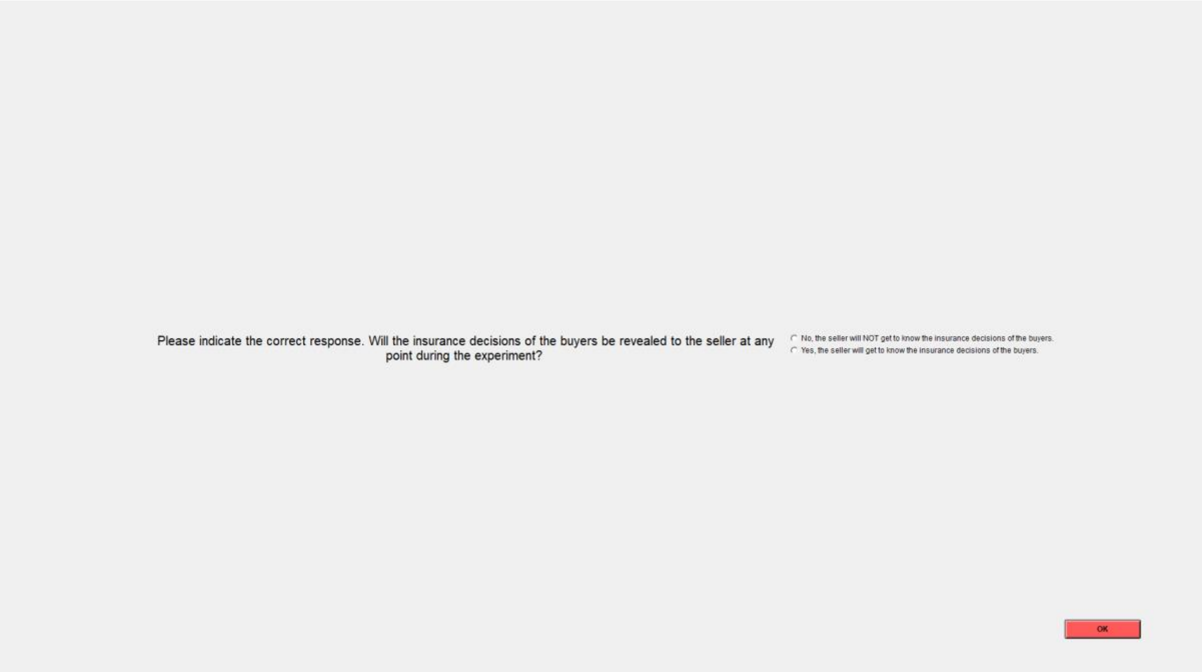
a) The buyer decides to purchase the product WITH the insurance
and the seller ships the product.
and the seller does NOT ship the product.

b) The buyer decides to purchase the product WITHOUT the insurance
and the seller ships the product.
and the seller does NOT ship the product.

c) The buyer decides NOT to purchase the product.

OK

D3: Additional comprehension question in the IA_HI treatment.



Appendix E: Omitted details of the model

E1: Theoretical analysis of the control treatment

Consider the control treatment in which the seller cannot give insurance advice to the buyer before the purchase decision is made. The proposition below characterizes the equilibrium.

Proposition 1.

In the control treatment, buyers' purchase decisions are summarized by (1). Type-g sellers always ship the product, while type-s sellers never ship the product.

Proof of Proposition 1.

A type-g seller always ships the product, while a type-s seller never ships the product, given that shipping does not increase revenue but is costly. The buyer's expected payoffs are $q_g v - p$ if purchasing the product without insurance, $q_g(v-p) - w$ if purchasing the product and the insurance, and 0 if not purchasing the product. The buyer buys the product only if $q_g \geq \max\left\{1 - \frac{w}{p}, \frac{p}{v}\right\}$; buys the product with insurance if $\frac{w}{v-p} \leq q_g < 1 - \frac{w}{p}$; and buys nothing if $q_g < \min\{\frac{p}{v}, \frac{w}{v-p}\}$. Under the assumption $w \leq p(1 - \frac{p}{v})$, we obtain the expression in (1). ∎

Note that, if the assumption $w \leq p(1 - \frac{p}{v})$ is violated, a buyer's payoff from buying the product with insurance is negative when $q_g < \frac{w}{v-p}$, and is lower than that of buying the product without insurance when $q_g \geq \frac{w}{v-p}$. That is, the buyer never buys insurance if $w > p(1 - \frac{p}{v})$.

Our framework also provides insights into how the behaviour of the sellers and buyers changes with insurance premium w, product price p, or delivery cost d. Since all type-s sellers do not ship the product, a change in w, p, or d has no impact on shipping rates. However, an increase in w decreases the possibility for buyers to buy the product without insurance or not to buy the product at all, and thus increases the possibility for them to buy the product with insurance. An increase in the product price p increases consumers' possibility of not buying anything, decreases their possibility of buying the product without insurance and has an ambiguous effect on the possibility of buying the product with insurance. The delivery cost d does not enter buyers' decision-making.

E2: Theoretical analysis of the IA treatment

The proposition below characterized the pooling equilibrium with all sellers advising N.

Proposition 2.

Suppose the seller can advise the buyer whether to purchase the insurance before he decides whether to buy the product:

- When $d \leq \alpha$, both types of sellers advise N and ship the product. Buyers purchase the product without insurance when receiving advice N, and do not buy the product when receiving advice Y as they believe the seller is of type s.
- When $d > \alpha$, both types of sellers advise N, type-g sellers ship the product, and type-s sellers do not ship the product. Buyers behave the same way as in the control treatment when receiving advice N, and do not buy the product when receiving advice Y as they believe the seller is of type-s.

Proof of Proposition 2.

We show that the prescribed strategy profile above constitutes a pooling equilibrium. Both types of sellers advise N on the equilibrium path. If the buyer follows the advice and purchases the product without insurance, the type-s seller's profit is $p - d$ if she delivers the product, and $p - \alpha$ if she does not deliver the product. She will deliver the product, provided $d \leq \alpha$. Knowing $d \leq \alpha$, the buyer will purchase the product without insurance when receiving advice N. If receiving advice Y, the buyer will not buy the product as he believes that the seller is a type-s seller and understands such a seller incurs no psychological cost after advising Y. Now suppose $d > \alpha$. After advising N, the type-s seller still does not ship the product. Upon observing N, the buyer's belief is Pr $[\theta = g \,|\, N] = q_g$. Given that type-s sellers never deliver the product when $d > \alpha$, the buyer's choice is the same as in the control treatment. The buyer will not buy the product once receiving advice Y as he believes the seller is a type-s seller. ■

We next explain how sellers' and buyers' behaviour is affected by the parameters of the model in the IA treatment. Provided $d > \alpha$, the impacts of changes in p or w on the purchasing and shipping decisions are the same as in the control. Now suppose $d \leq \alpha$. All sellers advise N and ship the product, and all buyers buy the product without insurance. So, again, the purchasing and shipping decisions are unaffected by a change in p or w. Whether sellers ship the product depends on the comparison between the shipping cost d and the psychological cost α. A change in d does not affect any behaviour as long as it does not reverse the relation between d and α. However, a substantial increase in d, which reverses $d \leq \alpha$ to $d > \alpha$, will nullify the insurance mechanism, and decrease both the purchasing and shipping rates.

Now, we discuss other possible types of equilibria in the IA treatment. First, we show there does not exist a separating equilibrium. Consider a separating equilibrium, in which on the equilibrium path a type-g buyer advises *N* and ships the product, while a type-s seller advises *Y*. Note that a type-s seller never incurs the psychological cost when advising *Y*, irrespective of what the buyer does. As a result, a type-s seller will never ship the product given that delivery is costly. Therefore, the buyer will not purchase the product upon receiving the advice *Y*. If he purchases the product without insurance, his payoff is $-p < 0$. If he purchases the product with insurance, his payoff is $-w < 0$. Anticipating that the buyer will not purchase the product, a type-s seller will want to deviate to advising *N* instead. Therefore, there does not exist a separating equilibrium in which a type-g seller advises *N* and a type-s seller advises *Y*. Moreover, there does not exist a separating equilibrium in which a type-g seller advises *Y* and a type-s seller advises *N*. Note that a type-s seller can be strictly better by deviating to advise *Y*. By doing so, the type-s seller pretends to be a type-g seller, thereby increasing the probability of making sales, but never incurring the psychological cost.

Next, we show that there does not exist a semi-separating equilibrium except for a trivial case, in which the type-g seller advises *N* and the type-s seller advises *N* with probability β and advises *Y* with probability $1 - \beta$. Note that by advising *Y*, the type-s seller reveals her type and the buyer will not purchase the product. This implies the profit of advising *Y* is zero for the type-s seller. Since the type-s seller randomizes between *N* and *Y*, her expected profit from advising *N* must be also zero. Below we show this cannot be the case.

If $d \leq \alpha$, the type-s seller will deliver after advising *N*. The buyer's payoff is $v - p > 0$ if he only purchases the product, $-w$ if he purchases the product with insurance, and zero if he does not purchase the product. So, the buyer will purchase the product only. The type-s seller's expected profit from advising *N* is $p - d > 0$. Therefore, there does not exist a semi-separating equilibrium when $d \leq \alpha$ as the type-s seller's profit from advising *N* is strictly positive and therefore will not randomize.

If $d > \alpha$, the type-s seller will not deliver the product no matter what the buyer does. The buyer's behavior will be the same as in the control. The type-s seller's expected profit is either p (i.e., the buyer buys the product with the insurance), $p - \alpha$ (i.e., the buyer only buys the product), or 0 if the buyer does not buy the product. So, the type-s seller randomizes only in the last case when there is no transaction at all.

Finally, there exists another pooling equilibrium in which both types of sellers advise *Y*, type-s sellers do not deliver, and buyers behave the same as in the control. Let us call the pooling equilibrium with all sellers advising *N* an *N*-pooling equilibrium and the other with all sellers advising *Y* a *Y*-pooling equilibrium. The *N*-pooling equilibrium Pareto dominates the *Y*-pooling equilibrium when $q_g < \frac{w}{v-p}$. This is the most interesting case as only for this range of q_g the insurance advice mechanism changes buyers' product purchase behaviour (if we select the *N*-pooling equilibrium). When $q_g \geq \frac{w}{v-p}$, sellers prefer the *Y*-pooling equilibrium to the *N*-pooling equilibrium as in a *Y*-pooling equilibrium they can avoid the shipping/psychological costs and buyers still buy the product.

The *Y*-pooling equilibrium can, however, be ruled out by applying refinement using forward induction. To utilize forward induction, assume that type-g sellers prefer buyers buying the product to not buying the product when the price is fixed and prefers buyer not to buy the insurance if shipping choices are fixed. Suppose in equilibrium both types of sellers advise *Y*. Imagine that buyers somehow observe the off-path advice *N*. We claim that buyers should believe the seller is of type-g. This is because, any buyer response that can induce a type-s seller to deviate to advise *N* will also induce a type-g seller to deviate, while the reverse is not true, since type-s sellers can potentially incur a psychological cost. Thus, the set of buyer responses that induce type-g sellers to advise *N* is strictly larger than the set of buyer responses that induce type-s sellers to advise *N*. Knowing buyers' responses upon receiving *N*, both types of sellers will deviate to advise *N* when $q_g < \frac{w}{v-p}$. Type-g sellers will deviate to advise *N* when $q_g \geq \frac{w}{v-p}$. These profitable deviations break the *Y*-pooling equilibrium.

In contrast, in an *N*-pooling equilibrium, the set of buyer responses that can induce a type-g seller to advise *Y* is a null set as a type-g seller reaches its maximum profit on the equilibrium path. Thus, upon receiving *Y*, buyers must believe that the seller is a type-s seller and therefore do not buy the product. This implies the *N*-pooling equilibrium survives forward induction.

In addition, in our experiment, we set up w=8, p=25, and v=40 (thus, $\frac{w}{v-p}$ =53%) such that the condition $q_g < \frac{w}{v-p}$ is not satisfied only if there is a relatively high proportion of q_g (>53%). That is, $q_g < \frac{w}{v-p}$ is not satisfied only if the majority of the sellers in the control are already type-g. The high proportion of type-g sellers is inconsistent with our motivation of designing mechanisms to promote cooperation in a market with a significant proportion of strategic sellers. Indeed, in our control treatment, we find the proportion of type-g sellers who always ship is only 18.5%, much smaller than 53%. Thus, we may argue that the *N*-pooling equilibrium is Pareto-dominant with the parameters set up in the experiment.

Comparison between control and IA treatments

When $d > \alpha$, the equilibrium outcome remains the same as in the control treatment. Thus, we focus on the condition $d \leq \alpha$. In the IA treatment, sellers advise *N*. In the control treatment, only buyers with $q_g \geq \frac{w}{v-p}$ purchase the product and among them those with $q_g < 1 - \frac{w}{p}$ also buy insurance. In the IA treatment, all buyers purchase the product without purchasing insurance. In the control treatment, type-s sellers never ship the product. In the IA treatment, all sellers ship the product.

E3: Theoretical analysis of IA_HI treatment

The following proposition characterizes the equilibrium in the IA_HI treatment where buyers' insurance purchasing decisions are unobservable to sellers.

Proposition 3.

Suppose sellers can provide insurance advice but they cannot observe whether the buyer purchases the insurance. The equilibrium is given as follows:

- Suppose $d \leq \alpha$. If $q_g \geq 1 - \frac{w}{p}$, sellers and buyers behave as in the IA treatment. If $q_g < 1 - \frac{w}{p}$, both types of sellers advise *N*. Upon receiving *N*, buyers purchase the product without insurance with the probability $\frac{d}{\alpha}$ and purchase the product with insurance with a probability of $1 - \frac{d}{\alpha}$. Type-g sellers always ship the product, while type-s sellers ship the product with a probability of $1 - \frac{w}{p(1-q_g)}$ and do not ship the product with a probability of $\frac{w}{p(1-q_g)}$. Upon receiving advice *Y*, buyers believe the seller is a type-s seller and do not purchase the product.

- Suppose $d > \alpha$. Both types of sellers advise *N*, type-g sellers ship the product, and type-s sellers do not ship. Buyers behave the same way as in the control treatment when receiving advice *N*, and do not buy anything when receiving advice *Y* as they believe the seller is a type-s seller.

Proof of Proposition 3.

In the IA_HI treatment, it is clear that the insurance advice mechanism cannot work if the psychological cost is not sufficiently high, i.e., $d > \alpha$, Then, everything remains the same as in the control. Let us focus on the case when $d \leq \alpha$.

Firstly, consider the case when $q_g \geq 1 - \frac{w}{p}$. Note that for this range of parameters, buyers purchase the product without insurance in the control treatment. A types-s seller does not want to advise *Y* as that will reveal her type. Buyers continue to hold the same prior belief after observing *N* and purchase the product without insurance. The type-s seller is better off shipping the product as she will incur the psychological cost otherwise.

Secondly, consider the case when $q_g < 1 - \frac{w}{p}$. We denote γ as buyers' probability of buying without insurance and δ as type-s sellers' probability of shipping the product. A buyer's expected payoff is $[q_g + (1 - q_g)\delta]v - p$ if he follows the advice of *N* and purchases the product without insurance, and $[q_g + (1 - q_g)\delta](v - p) - w$ if he does not follow the advice and purchases the product with insurance. The buyer chooses $\gamma \in (0,1)$ if he is indifferent between the choices, which implies $\delta = 1 - \frac{w}{p(1-q_g)}$. A type-s seller's expected profit is $p - d$ if she ships the product and $p - \gamma\,\alpha$ if she does not ship. She randomizes between the choices only if she is indifferent, which implies $\gamma = \frac{d}{\alpha}$.

On the off-equilibrium path, i.e., if an advice *Y* is observed, the buyer believes the seller is a type-s seller and does not buy the product. Recall that the type-s seller's equilibrium profit is $p - d = p - \gamma\,\alpha$. So, any off-path belief that leads to buyers choosing "buy without insurance" with a probability lower than $\gamma = \frac{d}{\alpha}$ can support this equilibrium. ■

Note that there does not exist a mixed-strategy equilibrium in which buyers mix between "purchase the product without insurance" and "not purchase the product". This is because for this equilibrium to exist the type-s seller must randomize between "ship" and "not ship". However, the shipping decision is conditional on purchasing the product. If the product is not purchased and given that the type-s seller can see that, the type-s seller will choose "ship" with zero probability. Consequently, this means the buyer cannot choose to "not purchase the product” with non-zero probability. For the same reason, buyers cannot randomize between “purchase the product with insurance” and “not purchase the product” in equilibrium. Also, this mixed-strategy equilibrium play only exists when the advice is N. If both N and Y can appear on the equilibrium path (i.e., type-s sellers randomize between N and Y), and given that type-s sellers have no psychological cost following advising Y, they will choose “ship” with probability zero. This breaks the mixed-strategy equilibrium.

In the IA_HI treatment, both sides use a mixed strategy in equilibrium. The shipping rate decreases in w and increases in p, while buyers purchase insurance less frequently when the shipping cost increases. It is well-known that in an equilibrium with both sides mixing the comparative statics are often counter-intuitive as players need to adjust their strategies to keep the opponent indifferent when there is an exogenous shock.

Comparison between control, IA, and IA_HI treatments

In both the IA and IA_HI treatments, all buyers purchase the product. In the control, only buyers with $q_g \geq \frac{w}{v-p}$ purchase the product. In both the IA and IA_HI treatments, sellers advise N. In the IA treatment, all buyers purchase the product without insurance, while in IA_HI some buyers purchase the product with insurance as they are mixing between “purchase without insurance” and “purchase with insurance”. In the IA treatment, all sellers ship the product, while in the IA_HI treatment, only some type-s sellers ship the product as she is mixing between “ship” and “not ship”. In the control, however, no type-s sellers ship the product. The predictions in Hypotheses 1 to 4 thus follow.

E4

Discussions of some assumptions on the theoretical model

In our framework, we made a few assumptions. Below we discuss what happens when the assumptions are violated.

Assumption 1: Some sellers always ship and some sellers are strategic.

This assumption is consistent with the recent findings from behavioral economics literature that many people are prosocial. If instead, we assume all sellers are of type-s, this will not qualitatively change the model’s predictions. To see this, suppose q_g=0 and therefore all sellers are strategic type-s sellers. Buyers never purchase in the control treatment as no sellers will ship the product. In the IA treatment, there exists an equilibrium where all sellers advise N, therefore committing to shipping the product, and all buyers buy the product when $d \leq \alpha$. However, if $d > \alpha$, no seller will ship the products and no buyer will buy the product. In the IA_HI treatment, the mixed-strategy equilibrium involves sellers shipping the product with probability $\delta = 1 - \frac{w}{p}$ and buyers buy the product without insurance with probability $\gamma = \frac{d}{\alpha}$.

Assumption 2: the insurance is not too expensive, i.e., $w \leq p(1 - \frac{p}{v})$.

This assumption means that in each treatment at least some buyers will buy insurance. Our experiment is consistent with the design of the experiment, as noted in footnote 8. We now consider in theory what happens if the insurance is more expensive, i.e., $w > p(1 - \frac{p}{v})$.

In the control, this means no buyer will buy the insurance as we explained in the proof of Proposition 1.

In the IA treatment, although rational buyers would not buy the insurance, type-s sellers will still advise *N* and subsequently ship the product so long as $d \leq \alpha$. The reason is that buyers won't buy the product if sellers advise *Y*. Thus, the equilibrium outcome is the same as in the case of $w \leq p(1 - \frac{p}{v})$ and the insurance advice mechanism still helps promote cooperative behaviour.

In the IA_HI treatment, buyers can no longer randomize between "buying the product with insurance" and "buying the product without insurance" as the former option implies a negative payoff due to $w > p(1 - \frac{p}{v})$. The remaining equilibria are the two pure-strategy ones resulting from extreme beliefs. If sellers believe that all buyers will follow the advice *N* and buy the product without insurance, then the equilibrium is the same as in the IA treatment, i.e., all buyers purchase the product without purchasing insurance, and all sellers ship the product. If sellers believe that no buyers will follow the advice *N* and will buy insurance in case they purchase the product, then in equilibrium sellers will advise *N* and both sides will behave as in the control, and in particular, no buyers buy the product when $p_g < \frac{w}{v-p}$. However, different sellers might hold different beliefs about buyers' choices, and therefore the realized play is a mixture of the two pure-strategy equilibria, which is consistent with our experimental findings in the IH_HI treatment.

Appendix F: Regressions with control variables

F1: Random individual effects linear probability regression analysis of insurance advice decisions with controls

Independent variables	Dependent variable: Advice $N_{i,t}$ =1, if seller *i* advised *N* in round *t* =0, o.w.	
	(1)	(2)
IA	0.128***	0.0714
	(0.0430)	(0.0827)
Round		0.0133*
		(0.00707)
IA_Round		0.0102
		(0.0100)
Constant	0.650***	0.577***
	(0.0681)	(0.0923)
Controls	Y	Y
N	1,090	1,090

Note: IA_HI is the baseline. Controls include gender, major, and how well the individual understood the experiment instructions. Robust standard errors clustered at the session level are reported in the parentheses*** p<0.01, ** p<0.05, * p<0.1

F2: Random individual effects LPM regression analysis of product purchase decisions with controls

Independent variables	Dependent variable: $Buy_{i,t}$ =1, if buyer *i* purchased the product in round *t* = 0, o.w.			
	(1) IA and Control	(2) IA and Control	(3) IA_HI and Control	(4) IA_HI and Control
β_1: IA	0.054	-0.122		
	(0.075)	(.105)		
β_2: IA_HI			0.034	0.010
			(0.073)	(0.078)
β_3: Round	-0.042***	-0.042***	-0.042***	-0.042***
	(0.007)	(0.007)	(0.007)	(0.007)
β_4: IA*Round	0.020*	-0.018		
	(0.012)	(0.153)		
β_5: IA_HI*Round			0.024**	-0.001
			(0.010)	(0.014)
β_6: Advice *N*		0.286***		0.043
		(0.079)		(0.017)
β_7: Advice *N**Round		0.033***		0.032*
		(0.009)		(0.017)
Constant	0.787***	0.778***	0.733***	0.732***
	(0.078)	(0.078)	(0.081)	(0.082)
H0: $\beta_3 + \beta_4$=0	p=0.026	p<0.001		
H0: $\beta_3 + \beta_5$=0			p=0.012	p<0.001
Controls	Y	Y	Y	Y
N	1120	1120	1080	1080

Note: Controls include gender, major, and how well the individual understood the experiment instructions. Robust standard errors clustered at the session level are reported in the parentheses, *** p <0.01, ** p <0.05, * p <0.1.

F3: Random individual effects LPM regression analysis of shipping decisions with controls

Independent variables	Dependent variable: $Ship_{j,t}$ =1, if the seller j shipped the product in round t; =0, o.w			
	(1) IA and Control	(2) IA and Control	(3) IA_HI and Control	(4) IA_HI and Control
β_1: IA	-0.002	-0.001		
	(0.076)	(0.085)		
β_2: IA_HI			-0.050	-0.068
			(0.079)	(0.096)
β_3: Noinsure		0.044		0.045
		(0.059)		(0.060)
β_4: Noinsure*IA		-0.079		
		(0.093)		
β_5: Noinsure*IA_HI				0.080
				(0.210)
β_6: Advice *N*	0.285***	0.147**	0.217***	0.226**
	(0.067)	(0.063)	(0.073)	(.011)
β_7: Noinsure *Advice *N*		0.205***		-0.074
		(0.057)		(0.211)
Constant	0.344***	0.333***	0.546***	0.535***
	(0.056)	(0.063)	(0.086)	(0.093)
H0: $\beta_6 + \beta_7 = 0$		$p < 0.001$		$p = 0.271$
H0: $\beta_6 + \beta_7 = \beta_3$		$p<0.001$		$p = 0.478$
H0: $\beta_7 = \beta_3$		$p = 0.046$		
Controls	Y	Y	Y	Y
N	651	651	635	635

Note: Controls include gender, major, and how well the individual understood the experiment instructions. Robust standard errors clustered at the session level are reported in the parentheses, *** p <0.01, ** p <0.05, * p <0.1.

Appendix G: Other Graphs

Figure G1: Proportion of buyers who purchased the product without insurance in each round

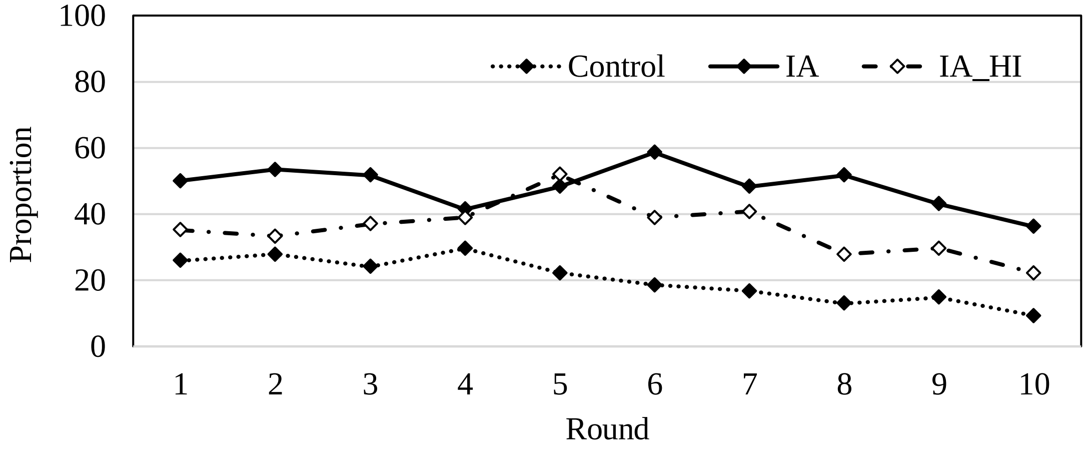
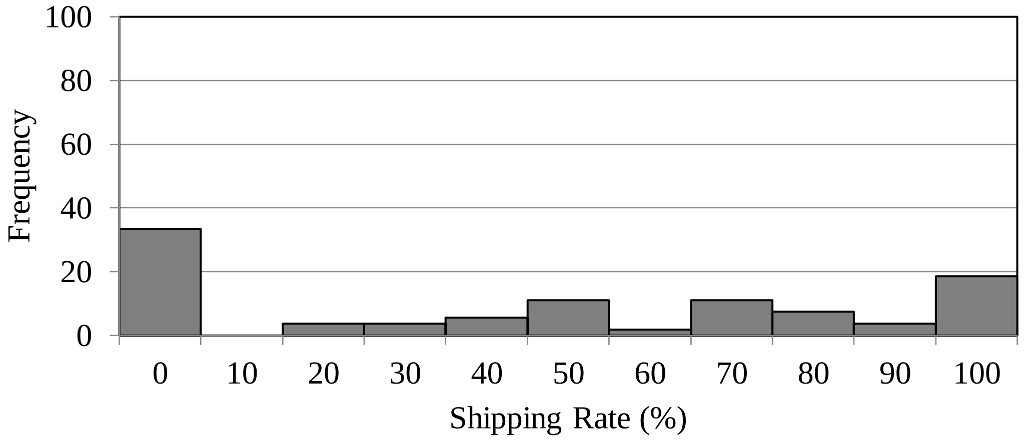


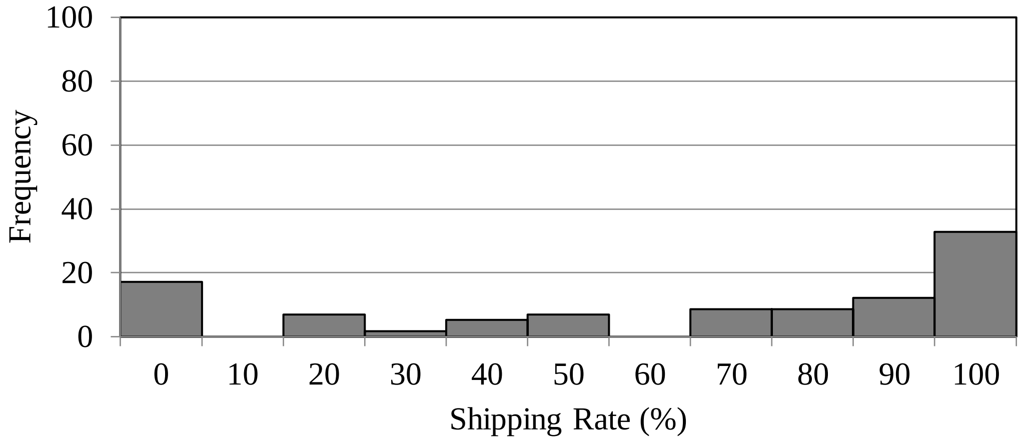
Figure G2: Distribution of shipping rate

a) Control treatment



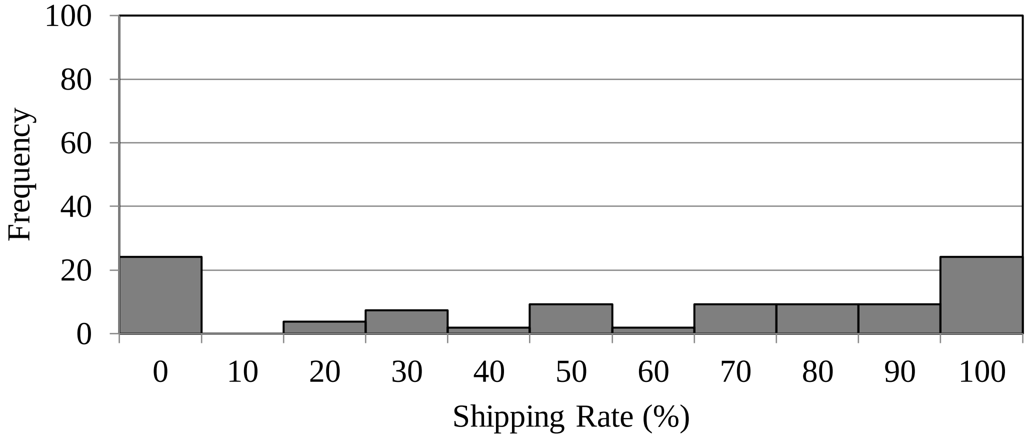
Note: # of observations=54

b) IA treatment



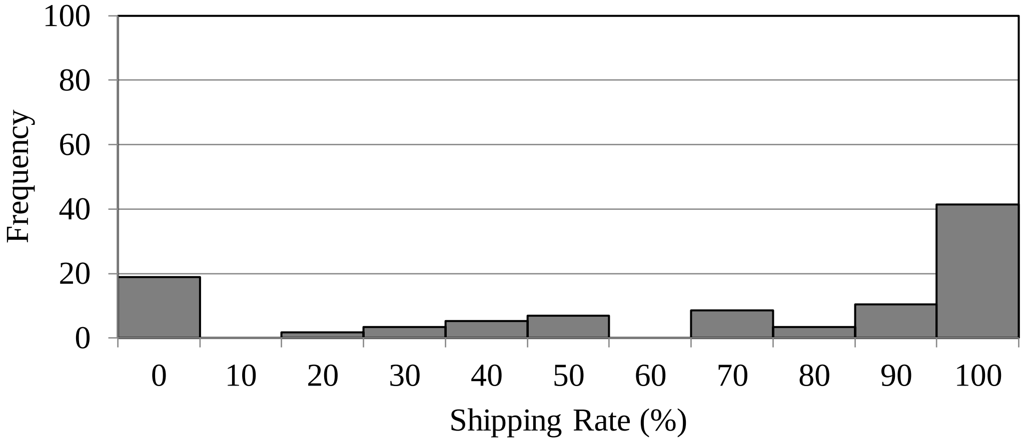
Note: # of observations=58

c) IA_HI treatment



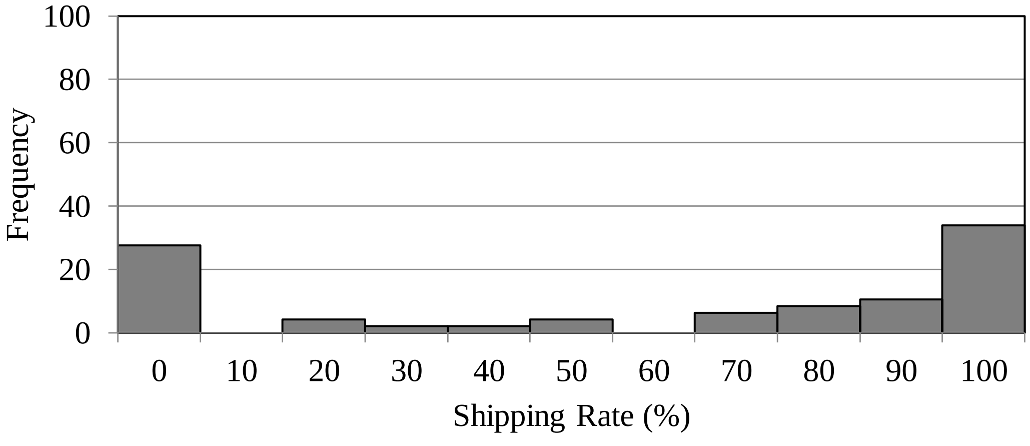
Note: # of observations=54

d) IA treatment (sellers advised *N*)



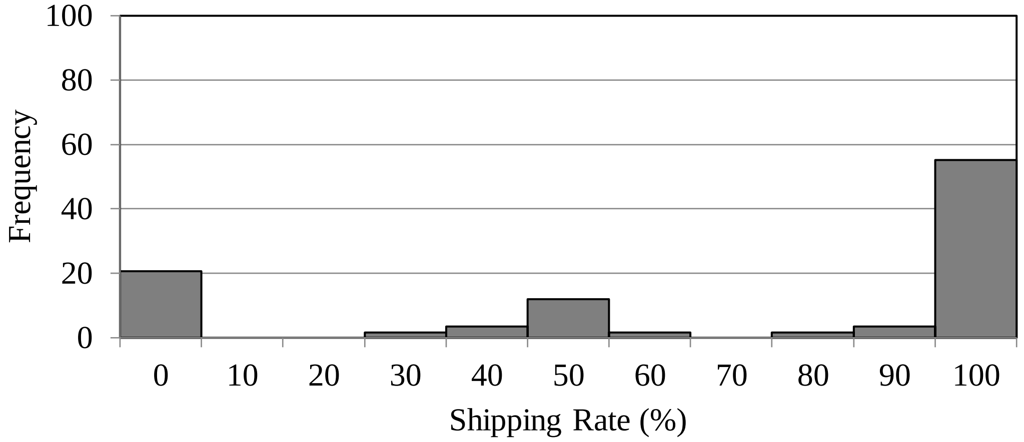
Note: # of observations=58

e) IA_HI treatment (sellers advised *N*)



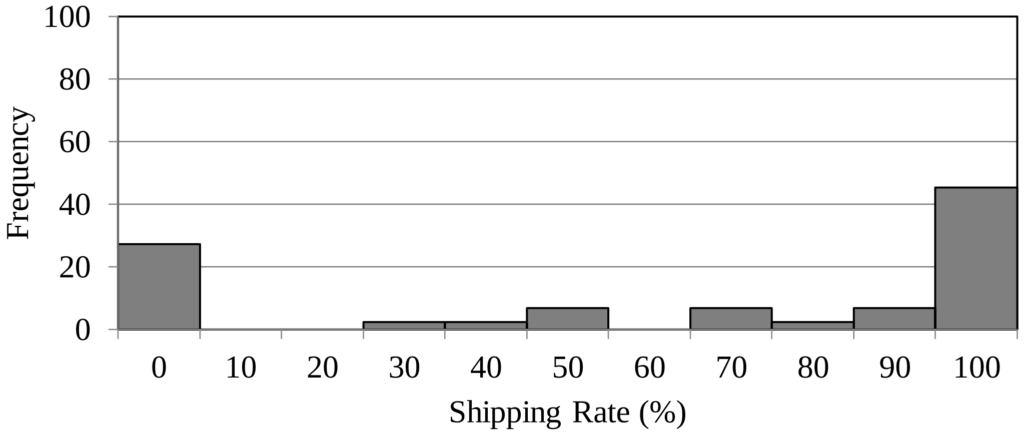
Note: # of observations=47

f) IA treatment (sellers advised *N* and buyers purchased the product without insurance)



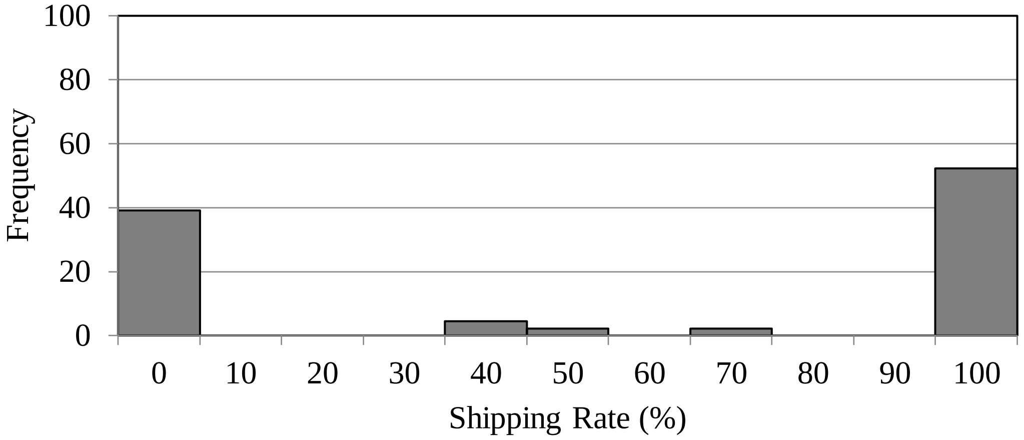
Note: # of observations=58

g) IA_HI treatment (sellers advised *N* and buyers purchased the product without insurance)



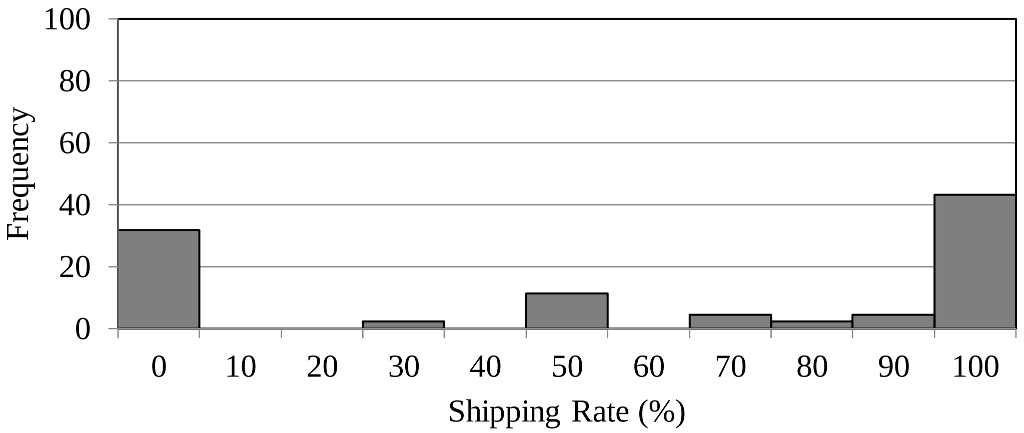
Note: # of observations=44

h) IA treatment (sellers advised *N* and buyers purchased the product with insurance)



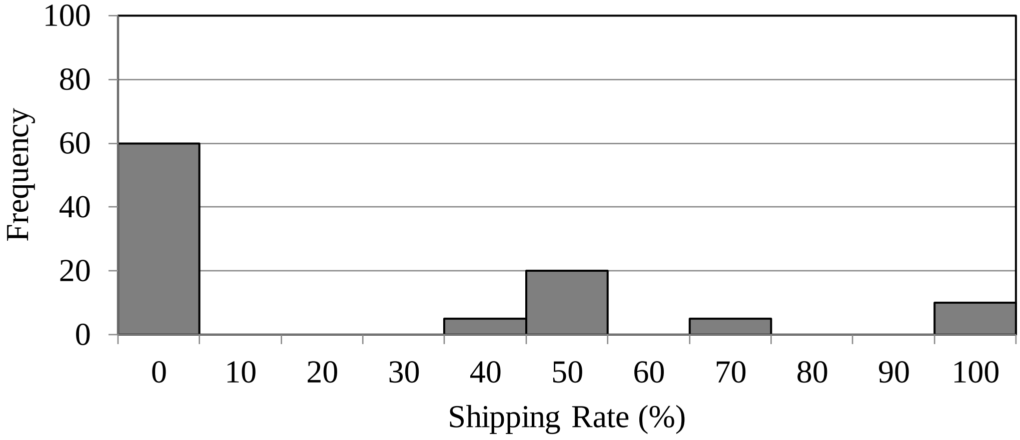
Note: # of observations=46

i) IA_HI treatment (sellers advised *N* and buyers purchased with insurance)



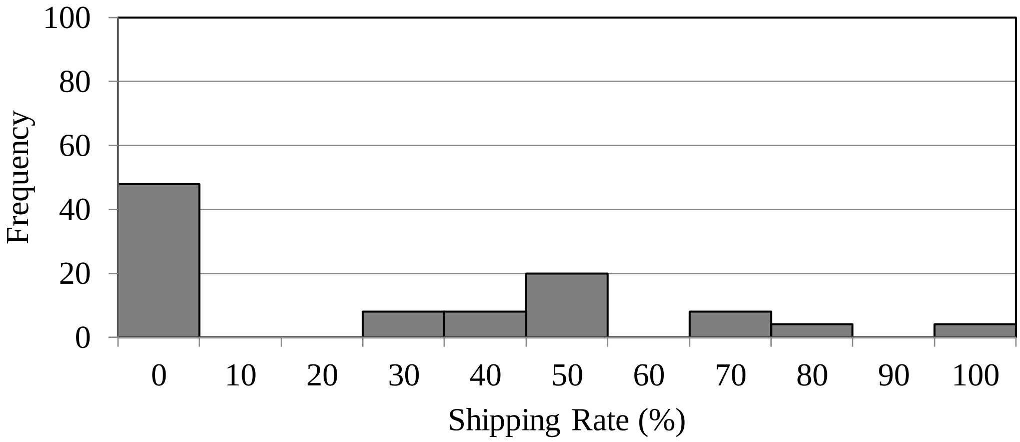
Note: # of obs.=44

j) IA treatment (sellers advised *Y*)



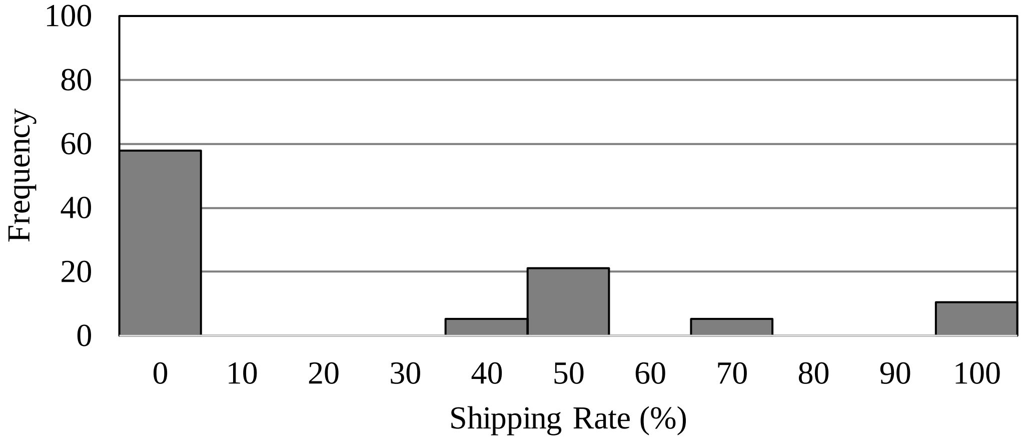
Note: # of observations=20

k) IA_HI treatment (sellers advised *Y*)



Note: # of observations=25

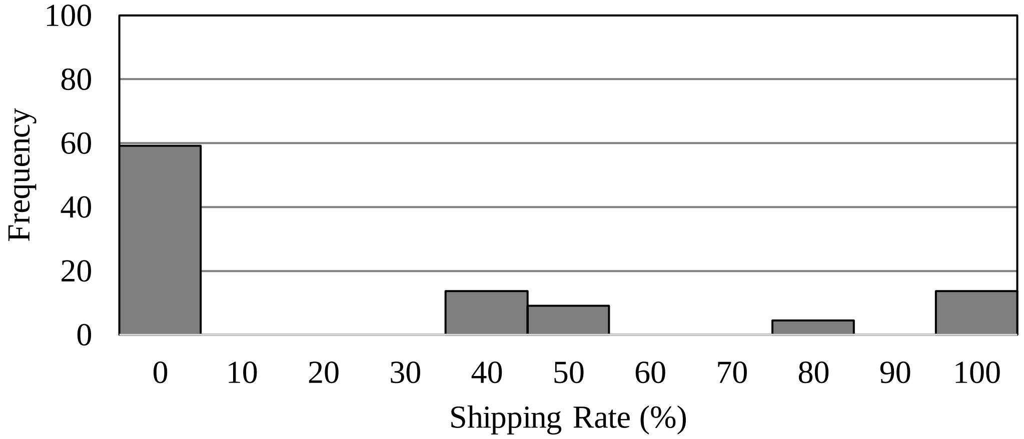
l) IA treatment (sellers advised *Y* and buyers purchased with insurance)



Note: # of observations=19.

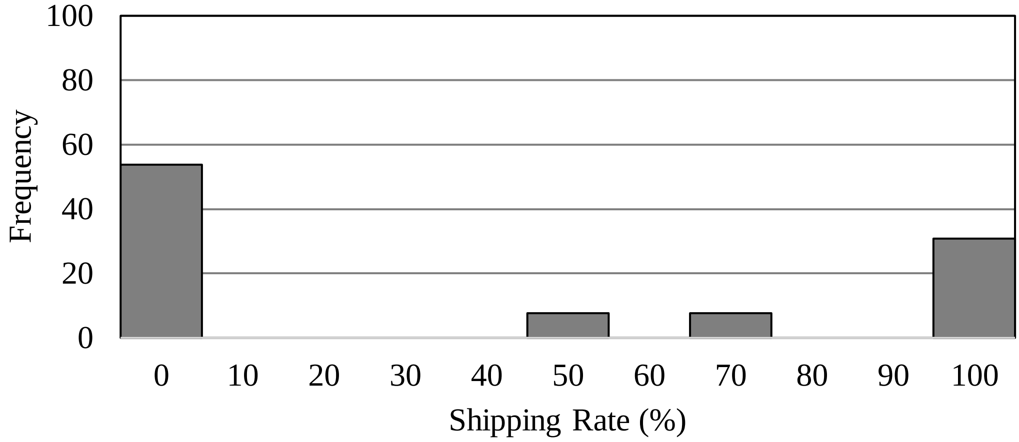
We do not include the distribution of shipping decisions for the IA treatment when sellers advised Y and buyers purchased the product without insurance because there are only four observations.

m) IA_HI treatment (sellers advised *Y* and buyers purchased the product with insurance)



Note: # of observations=22.

n) IA_HI treatment (sellers advised *Y* and buyers purchased the product without insurance)



Note: # of observations=13.

Appendix H: Probit Regressions:

H1: Random individual effects probit regression analysis of insurance advice decisions

Independent variables	Dependent variable: Advice $N_{i,t}$ =1, if seller *i* advised *N* in round *t* =0, o.w.			
	(1) Probit	(2) Marg. Eff	(3) Probit	(4) Marg. Eff.
β_1: IA	0.329**	0.100**	0.027	0.008
	(0.139)	(0.039)	(0.247)	(0.073)
β_2: Round			0.041**	0.012**
			(0.019)	(0.006)
β_3: IA_Round			0.061*	0.018*
			(0.034)	(0.010)
Constant	0.557***		0.335***	
	(0.068)		(0.125)	
N	1120	1120	1120	1120

Note: IA_HI is the baseline.. Robust standard errors in parentheses clustered at the session level are reported in the parentheses. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

H2: Random individual effects probit regression analysis of product purchase decisions

Independent variables	Dependent variable: $Buy_{i,t}$ =1, if buyer *i* purchased product in round *t* =0, o.w.			
	(5) IA and Control	(6) Marg. Eff	(7) IA_HI and Control	(8) Marg. Eff.
β1: IA	-0.500	-.115		
	(0.428)	(0.094)		
β2: IA_HI			-0.084	-0.019
			(0.0371)	(0.084)
β3: Round	-0.164***	-0.038***	-0.167***	-0.038***
	(0.028)	(0.006)	(0.028)	(0.007)
β4: IA*Round	-0.097	-0.023*		
	(0.054)	(0.135)		
β5: IA_HI*Round			0.005	0.001
			(0.049)	(0.011)
β6: Advice *N*	1.26***	0.290***	0.356	0.081
	(0.346)	(0.067)	(0.284)	(0.064)
β7: Advice *N**Round	0.128***	0.029***	0.100	0.024
	(0.031)	(0.007)	(0.323)	(0.016)
Constant	0.980***		1.00***	
	(0.313)		(0.323)	
N	1120	1120	1080	1080

Note: Advice *N*=1 if Advice is N, and 0 o.w. Robust standard errors in parentheses clustered at the session level are reported in the parentheses. *** p<0.01, ** p<0.05, * p<0.1.

H3: Random individual effects probit regression analysis of shipping decisions

Independent variables	Dependent variable: Ship$_{j,t}$ =1, if the seller j shipped the product in round t =0, o.w			
	(1) IA and Control	(2) Marg. Eff	(3) IA_HI and Control	(4) Marg. Eff
β1: IA	0.014	0.003		
	(0.425)	(0.084)		
β2: IA_HI			-0.186	-0.040
			(0.408)	(0.090)
β3: Noinsure	0.210	0.041	0.203	0.044
	(0.249)	(0.048)	(0.240)	(0.051)
β4: Noinsure*IA	-4.949***	-0.978***		
	(0.391)	(0.118)		
β5: Noinsure*IA_HI			0.227	0.049
			(0.705)	(0.153)
β6: Advice *N*	0.445	0.088	0.805**	0.174**
	(0.289)	(0.062)	(0.400)	(.086)
β7: Noinsure *Advice *N*	5.600***	1.104**	-.179	-0.039
	(0.340)	(0.120)	(0.718)	(0.155)
Constant	-0.419		0.400	
	(0.248)		(0.237)	
N	664	664	642	642

Note: Noinsure =1 if the buyer did not purchase the insurance; =0, o.w. Advice *N*=1 if Advice is N and 0 o.w. Robust standard errors in parentheses clustered at the session level are reported in the parentheses. *** p<0.01, ** p<0.05, * p<0.1.