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# The Role of Feedback in Finitely Repeated Trading Behaviors

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## ABSTRACT

This paper investigates the effect of feedback systems and exogeneous shock in the finitely repeated game. We ran three treatments in the experiments, namely, the stranger market (control), the feedback market and the partner market. In the stranger market, a buyer and a seller were rematched in every round. In the feedback market, the setting was similar to that of the stranger market, except the buyers were provided with seller's history. Buyers and sellers play with the same partner throughout the experiment in the partner market. The stranger and partner market enables us to observe the different between direct and indirect feedbacks. The results show that, first, feedbacks can increase cooperation. Second, direct and indirect feedbacks yield indifferent results. Trading efficiency and the number of buyer's order are not statistically different between those two feedback sources. Lastly, we find that the exogeneous uncertainty does not have a strong effect on buyers' decision

**Keywords:** Reputation; Feedback Mechanism; Finitely Repeated Game; Experiments

**JEL Classification:** D12, C79, C91

## 1. Introduction

Online market platform has become a major mean for trading goods around the world. On average Thais spend 10 hours a day online and approximately 50% of that time is on online trading platforms with an average spending of 1,500THB per month according to Thailand's Ministry of Digital Economy and Society (Electronic Transactions Development Agency, 2018). One of the factors that encourage the use of online market platforms is the barrier to entry to the market is very low e.g. less startup capital required or more flexibility in terms of venue and time of operating businesses. The survey by the Electronic Transactions Development Agency under the Ministry of Digital Economy and Society reports in 2018 that the growth of online market platform was 14% in comparison to 4.1% GDP growth shows that the platform is now an integral part for the economy.

One of the main advantages of the online platform is faster matching mechanism between buyers and sellers with the platform itself act in place of a middleman. This results in lower transaction costs for buyers where the storage cost and the risk of expired inventory is reduced for sellers. However, online market platform requires higher level of trust between sellers and buyers than in the traditional marketplace. Theoretically, the online transaction risks in hidden characteristic (adverse selection) and hidden action (moral hazard). As the seminal paper, "The market for Lemons" (Akerlof, 1970), pointed out that sellers who have more information can conceal the true characteristics of product to buyers. This is even more crucial in online transactions because buyers may have never physically seen the product before she made a decision. Next, a seller can hide her action after the transaction has occurred. There are many ways to cheat buyers; for example, she does not delivery the product, she delivers low-quality product, etc. These risks are quite

prominent in the online market platform and affect trust between buyers and sellers. The USA's Department of Justice reports in 2002 that the court filing cases or disputes from the online market platform are more than 12 times when compared to the traditional market platform.

To ease the trust problem, online market platforms implement the feedback system to both buyers and sellers' side. This benefits both buyers and sellers as they can obtain more information, moving the game closer to the complete information type in the sense that buyers know the history of the game (past sellers' behavior) before they place purchase order. Kreps et al. (1982) shows that there could be cooperation for this type of game as a result of feedbacks and reputation building. Although feedback provider's does not have a direct and immediate benefit from providing the feedback, the statistics from eBay has shown that more than 50% of users of the platform provide feedback after transactions (Resnick and Zeckhauser, 2002). This shows why online market platforms obtain consistent rapid growth in recent years. Having said that, the feedback used in the online market platforms is different from that in the traditional market (or face-to-face trading). The online market platforms provide an indirect feedback information. Buyers can study the history or record of feedbacks for each seller before deciding and vice versa. On the other hand, traditional market platform only can provide buyers or sellers with direct feedback information, namely, from buyers' or sellers' own experience in trading with each partner.

The purpose of this paper is to study the role of feedbacks in online market platforms. The main research question for this paper is can online trading platforms be equivalent to the traditional trading. Or in other words, can indirect feedback information (the type often employed in the online market platform) substitute direct feedback information (the type used

in the traditional platform or face-to-face trading)? We also investigate the role of exogeneous shock (the product quality risk) on trust between sellers and buyers in online trading.

Online market trading can be viewed as a game between buyers and sellers. This situation is closely simulated the finite repeated game where the buyers' strategy is whether to buy and the sellers' strategy is whether to honour the contract by delivering the goods. Without trust, if both players are rational, the dominant strategy for the sellers will be to cheat and because of the buyers' awareness of this, they will not place the purchase order in the first place. Hence, there is a discrepancy between traditional theoretical prediction and actuality in this case.

We ran three treatments in the experiments, namely, the stranger market (control), the feedback market and the partner market. All subjects make a decision repeatedly for forty rounds. In the stranger market, a buyer and a seller were rematched in every round and feedback on sellers were not provided. In the feedback market, the setting was similar to that of the stranger market, except the buyers were provided with seller's history. We treated seller's history[1] as a no-noise feedback or a no-noise seller's reputation; consequently, buyer utilized this information to update information about the seller. The feedback in our experiment is not in form of either rating scale or text and the seller's reputation is defined as updating the probability that the seller delivers a goods. Buyers and sellers were engaged with the same partner throughout the experiment in the partner market.

We found that feedback is related to reputation in the theory of reputation which increases cooperation in finitely repeated games. We conclude that the feedback system in the online platform (indirect feedback) is equivalent to the direct experience in traditional market. In addition, buyers' decision

[1] The record of delivery behavior of sellers.

does not depend on exogeneous shock. Our results can explain the growth of online market platform which is also concurred by the theory of reputation.

This paper establishes two contributions to literatures. First, in repeated game theory, when a player recalls the history of the game, there is no difference between information that she herself has played and information transmitted from other players. We investigate this by comparing the buyers' behavior between feedback and partner market. In addition, we report on the role of exogenous risk on the trust between sellers and buyers.

## 2. Literature Review

In this literature review section, we start by providing a review of trust and sharing issue in information studies and economics, follow by the equilibrium analyses when reputation is involved. We then provide a background of the role of feedback from the economics' perspective. After that, we explore the experimental works relating to reputations or feedbacks.

Trust plays a crucial role in economics. As quoted from Arrow (1974) - "Trust is an important lubricant of a social system". He pointed out that without trust and ethic, people take advantage from inside information over others. Without trust, consumers cast doubt in quality, quantity and price of products they are purchasing, and therefore face a "moral hazard" and an "adverse selection" problems in that exchange.

In recent years, trust still plays important role in any form of exchange. Online trading has large volume and there are several platforms that can serve diverse demand for exchange of goods and services such as Amazon, eBay, Airbnb, peer-to-peer (P2P) etc. All of the platforms comprise three components: buyers, sellers and platform. The success of an

exchange hinge on the trust between sellers and buyers, and both parties and platform. Hawlitschek et al. (2018) pointed out that trust in trading partners and trust in product quality play a major role when people trade online. The results are confirmed by various literatures; trust in peers (Erst et.al, 2017, Kim et.al, 2011) and trust in quality (Hawlitschek, 2016, Gefen and Straub, 2004). This research contributes to this category where we study the effect of no-noise feedbacks in the perspectives of both customer and seller. In addition, this study also adds the study of the trust in products, which in this case we incorporate uncertainties in products' quality into consideration.

McMillan (2003) shows that traditionally, price and value is reflected from the amalgamation of information from various sellers and buyers who in the past gather in trade fairs to exchange information. Most of the information pass directly through direct communication. When buyers confident enough to buy a product, trading partners are formed for long-term as neither side would not deviate from honoring the contract to damage their own reputation. However, in online market, most of trading partners are short-term (Resnick and Zeckhauser (2002)). Most of the information or feedback is indirect i.e., through word of mount or reviews. Therefore, this study wants to compare the effects of both direct (the effects of feedbacks receive from the same trading partners) and indirect feedback (the effect of seller's behavior when faced with different trading partners).

To remedy the trust problem, Kreps et. al (1982) shows the importance of reputation in game with incomplete information. Even in the finitely repeated game, a seller pretends to be a trustworthy type to preserve the reputation (if the time horizon is long enough) before cheating in the last rounds. The reason is straightforward. With trigger strategy a buyer firstly trust until she is cheated. On the other hand, a

seller plays cooperation if the benefit of that strategy is higher than cheating. However, the benefit of cooperation is smaller when the time horizon closes to termination. We also explore the last period effect in the experiment. The excellent survey in theory of reputation is provided in Mailath and Samuelson (2006).

In terms of empirical, Tadelis (2016) studied the characteristics and information in feedbacks in online market. The paper suggested that both components contribute to an improvement in market efficiency as they reduce asymmetric information problem between trading partners. The research further suggested that regulators can play an important role in addressing this problem by encouraging the release of important seller information to potential customers. This leads to the increase of trust between trading partners and more efficient trading activities. One important aspect of feedback that arose from this research which has been further studied in literatures (i.e., Nosko and Tadelis (2015), Dellarocas and Wood (2008)) is that the majority of the feedbacks are positively bias. This is because, if the feedback is not compulsory or properly rewarded, partners with good experience are more likely to leave feedback on the platform. On the other hand, partners with bad experience view that the punishment by leaving feedback too soft and therefore, prefer to use other means of punishment such as filing a complaint. This study uses zero noise or unbiased feedback which is the actual history of trading activities done by an agent to compare result to the body of literature. Participants in the experiment is informed that the feedback information they received is the actual trading activities of their partners. Hence, their reaction is toward this unbiased feedback.

Bolton et al. (2005) studies the amount of information affecting cooperation decision in stranger market using

subgame perfect equilibrium as a benchmark. The paper first shows that information is necessary for cooperation in models using subgame perfection but the information needed is quite demanding. However, this problem can be remedied using information about a partner's immediate past action. The paper then proceeds to experiment on the proposed frameworks. In the perfect information scenario, players receive full information of partners' two prior periods trading behavior. Whereas in the limited information scenario, players only receive information of trading partner prior period trading behavior. The result showed that partial information improves the trading efficiency but the cooperation is conditional on the cost of cooperation itself while in the perfect information scenario, players cooperate more even though the cost of cooperation is high. Bolton et al. (2004) explores the use of electronic feedbacks as a proxy of reputations and finds that this type of reputation created in online market can increase transaction efficiency which is the number of trades. This shows that people who strangely met online still can cooperate and overcome the trust problem using this type of reputation information. This paper utilizes the reputation creation in online markets using automatically generated feedbacks from past behavior of sellers and buyers similar to Bolton et al. (2004).

Resnick et al. (2006) uses randomized control field experimental method in investigating merchant's reputation in ebay. The research creates new postcard sellers account to compare with existing accounts already with reputations, controlling for other factors such as delivery time, packaging, postcard styles. In the 12 weeks period, the result of the study shows that the willingness to pay for the same postcard in the existing stores (with reputation) is 81 times higher than the newly created stores. In addition, the experimenters also create negative feedback given to some new stores and find that this

negative feedback do not affect the pricing and selling volume of the existing stores. Although the shortcoming of this feedback study is that there were only one or two negative feedbacks given to some stores in which customers might overlook these feedbacks entirely.

Tadelis and Zettlemeyer (2015) reports that the change in sellers' revenue when sellers are given out more information of the products using field experiment in secondhand car market. In this market, the quality of the products is opaque and depends mostly on sellers how much information they want to give out. The hypothesis is that if sellers give out more information, asymmetric information problem reduces and buyers who is suited with specific car and budget will enter into bidding competition more. If the information is not given out as much, buyers will be reluctant to enter into bidding competition. This in turns create higher revenue for the sellers who give out more information. The result partly confirms the hypothesis. Only relevant and more detailed information creates higher revenue to the sellers whereas giving out more general information does not affect buyers behavior.

This research applies the body of knowledge from these literatures to observe role of different feedbacks[2] in online market. We also use reputation game setting in laboratory experiments which is the first to our knowledge. The advantage of the laboratory experiment is that we can control other factors which could affect individual's behavior. This enables us to be able to focus on the effects of our variable of interests which in this case is the feedbacks from past behavior. Furthermore, studies related to online markets as well as the exogeneous shocks are mostly using qualitative method through interview local entrepreneurs. Quantitative studies are fewer but for example, Choe et al. (2009) uses Korean survey

[2] Namely, no-noise direct and indirect feedbacks.

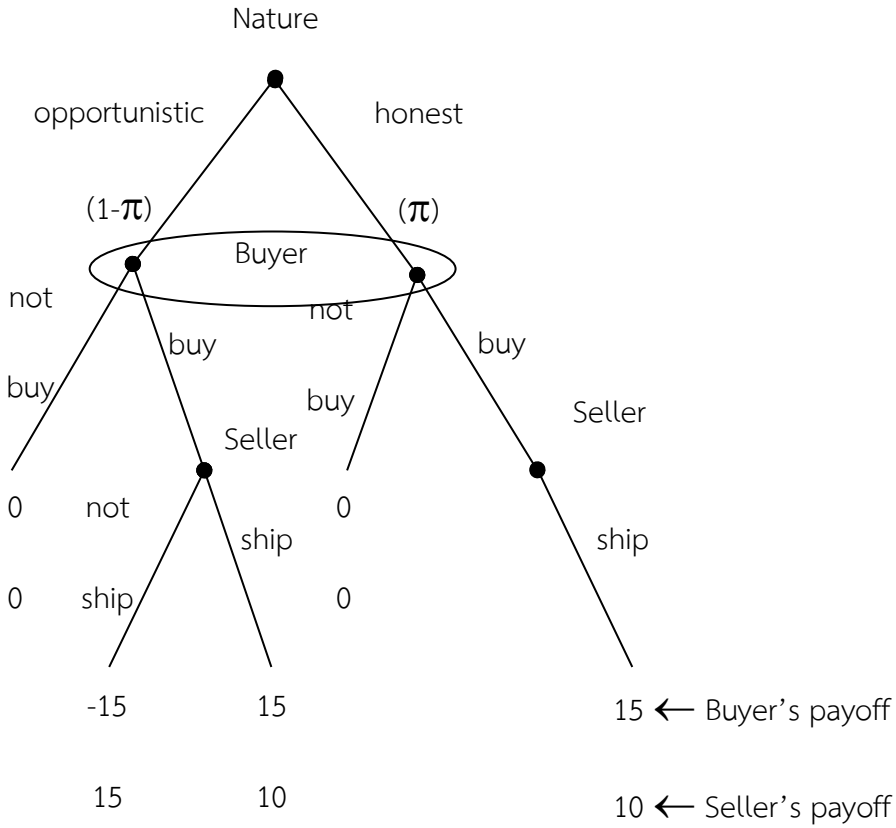
data and finds that uncertainties in product qualities and information asymmetry are significant in reducing customers willingness to pay. Trust building by providing information can create price premium. This research expands Choe et al. (2009) by incorporating reputation game into our experiment. The evidence from Jin and Leslie (2003) further emphasizes the importance of reputation. They report that food poisoning rate is lower in Los Angeles area as the regulation to display cleanliness score in restaurants came into effect in 1997. They also report that part of the explanation is that customers are sensitive to cleanliness reputation of the restaurants.

This research will shed light on how to effectively build trust. This could benefit regulators in promoting more efficient online trading platform. As Zagata and Lostak (2012) points out that regulator is a key player who can create trust in the platform. However, trust promoting today focuses more on somewhat noisy means such as encouraging honesty or using of social pressure. We want to show that zero-noise feedback can be a better alternative in creating more transactions for the markets.

## 3. Theoretical Framework

In a finitely repeated game with complete information, players are predicted not to cooperate in any round because the cooperative strategy is not supported by the subgame perfect Nash equilibrium. However, when information is asymmetric, it turns out that the cooperation strategy constitutes (weak) Perfect Bayesian equilibrium, given the trigger strategy as shown in Kreps et.al (1982). In this section, we simplify the model of Kreps et.al (1982) to illustrate the importance of feedback system and reputation to the equilibrium in a finitely repeated game with asymmetric information.

Figure 1: Trading game with asymmetric information




In a trading game with many sellers and buyers where they are randomly matched, the buyer decides whether to order the goods. We assume that the number of sellers is greater than buyers. The seller falls into one of the two types: honest and opportunistic. The honest type will always deliver the goods. On the other hand, the opportunistic type contemplates the payoff in which she will receive; as a result, she might or might not deliver the goods. For convenience, we normalize the total number of sellers to one. We then denote the proportion of the

honest type to be "π" . Since the total number of sellers is one, "π" represents the matching probability of buyers to the honest seller.

We suppose that a buyer' s willingness to pay is 30, the price of goods is 15 and the shipping cost is 5. If a buyer decides not to place a buying order, then the game ends. Both players payoffs are 0. If the buyer places an order and the seller delivers the goods, then the buyer's payoff (consumer surplus) is 15 (30-15), whereas the seller's payoff (profit) is 10 (15-5). On the other hand, if the seller defects, her payoff will be 15. Figure 1 shows the information structure and sequence of the game.

According to Figure 1, this game's information is asymmetric in two levels. Buyers do not know the type of a seller and buyers also do not know whether a seller will deliver the goods or not. Hence, the buyer will place the order if and only if

$$15\pi-15(1-\pi)\geq 0$$
$$\text{or } \pi\geq 1/2.$$

This simple condition shows that the buyer can place a buying order even in one shot game. She is willing to take the risk, if the number of the honest type of seller is at least half. The more interesting points are that the number of honest type is less important when the game is extended to be a repeated game, and buyers' decision (trust) can be influenced by the feedbacks (when she has information on seller' s behavior in the past).

We now suppose that the game repeated twice or a two-stage game. To exemplify the role of feedback system and

reputation, we consider the trigger strategy in the same spirit of infinite repeated game.[3] The buyer's strategy is

"I do not care which type of seller whom I am matching to. I will reorder if that seller delivers the goods in the first round. Otherwise, I will not."

Following the strategy, the buyer will place the order, in term of present value, if and only if

$$15\pi+15\delta\pi-15(1-\pi)\geq 0$$

, where $\delta$ is discount rate and $0<\delta<1$. The buyer will place the order when $\pi\geq 1/(2+\delta)$ . Compared this to the one-shot game, if the buyer assigns the weight of present payoff to be more than that of the future ($\delta>0$), the proportion of the honest type that she requires to make a purchase order decreases. In other words, the buyer will trust the seller more even the likelihood of honest type is smaller. Moreover, Kreps (1990) proved that the importance of the honest type proportion will even be less important when the number of periods is larger. Given the trigger strategy, buyer updates her belief through seller's behavior in the past. Abusing in earlier period is interpreted as seller was playing strategically, and backward induction implies that she will cheat for the rest of the game. Therefore, to have a chance of selling in any period, the opportunistic type must keep the good reputation, and the feedback system is a crucial tool that buyers use to update her belief of the type of sellers - through seller's performance in the past.

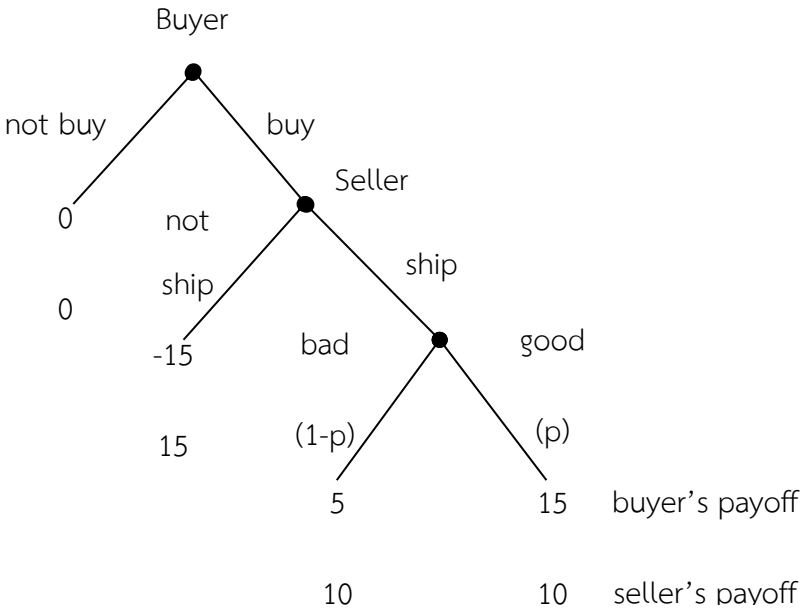
[3] The concept of equilibrium is different. The trigger strategy supports Subgame Perfect Nash equilibrium in an infinite repeated game. However, it constitutes (weak) Perfect Bayesian Nash equilibrium in a finite repeated game.

## 4. Experimental Design

We designed the experiment following the theoretical framework explained in the above section. We assumed that there can be two types of subjects, namely, honest and opportunistic. However, since we wanted to explore the real behavior of subjects, we did not explicitly assign the type of seller to subjects. Subjects who are assigned to be sellers decide arbitrary whether they are the honost type in which they deliver the goods or the opportunistic type in which they do not honor the contract. We therefore designed the experimental game as complete but asymmetric information.

We modified the seller-buyer game proposed by Bolton et al. (2005), which is similar to that of Figure 1, for the experiments. A session of each experiment composed of 40 rounds. In each round, two players were matched together as a pair of traders in which one was a buyer, and another was a seller. The game was a sequential move game with the extension of external uncertainty as shown in Figure 2. To investigate the role of uncertainty on trust between sellers and buyers, we entered the exogeneous risk to the game. The risk could interpret as damages from delivery or below-expected quality of a product, which can be common when buyers place order in online trading. This uncertainty therefore was treated as an exogeneous variable that affected a buyer' s payoff.

Figure 2. Seller-Buyer game.




The payoff was similar to the example given in the theoretical framework part. The buyers had a willingness to pay of 30 tokens for good-quality product and 20 tokens for bad-quality product. Assumed that the price was 15 and the shipping cost was 5. The buyer moved first and decided whether to place a purchase order. If the buyer did not place the order, the game ended and both players' payoffs are zero. On the other hand, if the buyer places the order, the seller next decided whether to ship the product. In the case that the buyer ordered but the seller did not ship, the buyer payoff is -15, whereas the seller payoff is 15. The external shock entered to the last stage of the game. The probability that the buyer received good-quality product is p. From the seller's view,

there is no difference between good or bad quality as her payoff remained the same. However, buyer payoff is 15 for good-quality and 5 for bad-quality product.

A subject randomly switched the role between buyer and seller. She might employ both roles in the experiment. In addition, a subject was randomly assigned to one out of the three treatments: stranger, feedback, and partner market. In the stranger market, a subject was randomly reshuffled to match with stranger in each round. However, there were some subjects who match with the same partner in some rounds, but they did not know whom they match with.[4] In feedback market, the matching mechanism was similar to the stranger market, but subjects had more information. Before making decision whether to place the order, subjects were informed seller's behavior the last five rounds. Lastly, subject matched to the same partner throughout the experiment in partner market. Note we did not provide partner's behavior in the previous rounds, but subjects could take note by themselves.

The experiments were between-subjects. By categorizing three markets, we could investigate the effect of feedback source. Theoretically, when a player recalled the history of the game, she based her decision on her own experience. To retaliate a seller, a buyer would not order product from a seller who cheats her in previous rounds. In feedback market, we however investigated the question what if the history of game was transited from other players. In other words, would buyer trust a seller who had cheated other buyers in the past? This question was still vague in game theory. This issue would be clear by comparing buyers' behavior in feedback and partner market from our experiment. In addition,

[4] Since the number of subjects was 26 in each session, whereas they played repeatedly 40 times, some subjects were matched with the same partner. However, we did not mention this fact to subjects during the experiment.

we examined the effect of external uncertainty on buyer's decision by varying the probability value of quality of product.

In terms of the experimental procedure, after the subjects were randomly seated and signed the consent form, they were first instructed to read an instruction by themselves. They were then given a demonstration and further clarification of the game by the experimenters. In the instructions, subjects were told that the experiment simulates online trading of an arbitrary goods with the value to subjects equal to the payoffs and that they were randomly assigned to be a seller who has to decide whether to send the goods when a purchase order comes in or a buyer who decide whether or not to buy a goods. The payoffs were clearly stated in the instructions and on the screen at all times and were stressed to them during the demonstration. They also were told that the payoffs they get from each round will be randomly selected for their payment. Depending on their treatment groups, they were told whether they will trade with the same partner throughout the game or randomly match a partner on each round.

The quality of the goods that the buyers will receive was also explained depending on the treatment groups. In treatments without uncertainty, the instructions stated that a buyer will always receive good quality product should a seller delivers the goods. In treatments with uncertainty, the instructions stated, although a seller delivers the goods, there is a delivery risk to the product's quality. Hence, the product quality in our experiment is exogenously driven.

In terms of feedback (reputation), we did not state to subjects explicitly as in real-world example of 'review' section. However, we provided subjects with player's history. This is the mechanism we use as a proxy for 'feedback' or 'reputation'. Subjects were provided on-screen their trading partner behavior from the last 5 rounds for the feedback and partner treatment. For the feedback treatment, subjects will be

aware of their partner behavior in the past when the partner might trade with someone else. We classify this as an indirect reputation mechanism. Whereas in the partner market, subjects have the record of their own trading partner throughout the game, therefore, we classify this as a direct reputation mechanism. We analyze the difference between these 2 types of feedback or reputation in Table 1.

Table 1. The number of subjects in each treatment

| | Stranger market | Feedback market | Partner market |
|---|---|---|---|
| p = 1 | 52 | 52 | 52 |
| p = 0.5 | - | 52 | 52 |

## 5. Hypothesis

According to the structure of the experiment (Figure 2.), the subgame perfect Nash equilibrium of the game in stranger market is that buyer do not order and both players receive nothing.

*Hypothesis 1: In stranger market, a buyer would not trust a seller, regardless of the value of probability of quality.*

Because the game theory does not specify the difference between players' own experience and others' experience, we hypothesize that there is no difference between them.

*Hypothesis 2: There is no statistical different in the number of buyers' order between feedback and partner market.*

When p = 0.5, buyer's expected payoff is 10 (0.5*5+0.5*15) which is lower than the buyer's payoff when p = 1 (15). We hypothesize that the number of orders is higher when p =1.

*Hypothesis 3: In all markets, the number of buyers' order is higher in treatment p = 1 than in treatment p = 0.5.*

## 6. Results

The experiments for this research were done in March 2020 at the computer laboratory[5] of the Faculty of Economics, Prince of Songkla University, Thailand. We recruited 260 subjects[6] and ran the experiment using zTree (Fischbacher (2007)). We used the random ncentive mechanism plus show-up fee to incentivize subjects. The average payment per subject was 384.62THB.[7]

We first analyze the behavior of buyers and sellers in different treatments starting with the percentage of successful trading from the experiment which is when there is a purchase order from a buyer and the goods was delivered by the matching seller. In each treatment, a subject entered 40 trading rounds. Therefore, the percentage of successful trading in each treatment is derived from the number of rounds where goods was sent by the seller over these 40 trading rounds. We can see

[5] Partitions were used to ensure discreetness for subjects.

[6] Most of the subjects are undergraduate students with the average age of 20.26 years. In addition, the number of subjects was calculated from confidence interval of population proportion (see Weiers (pp.293-296)). By calculation, an appropriate number of subjects were 194; however, since the experiment composed of many treatments, we recruited 260 subjects.

[7] 1USD = 34.60THB as of May 5th, 2022. The minimum wage in Thailand is 330THB per day.

that successful trading is lowest in the stranger market at 29.52% of total trading rounds while more than half of the time there is a successful trading in the feedback and partner market. The uncertainty of the goods quality affected the feedback market more than the partner market as we can see from the difference in successful trading rate when p=1 and p=0.5 in the feedback market is 6% while in the partner market is 0.05%.

From Table 2, we can also analyze the buyers' and sellers' behavior separately. Buyers' purchase order reflects the level of buyers' trust in sellers which is different depending on the market structure. As expected, stranger market yields the lowest level of buyers' trust at 58.85% while the long term relationship market, partner market, yields the highest level of buyer's trust in sellers (75.96% when p=1 and 79.13% when p=0.5). Similarly, the sellers reciprocate buyers' trust in placing order by sending the goods at the highest rate in the feedback market (85.37% and 86.86% when p=1 and p=0.5 respectively). The shipment is lowest in the stranger market at 50.33%.

Table 2: Success trade, purchase order, and sellers' delivery rates

| | **Success trade** | | | | **Purchase order (Buyers' trust)** | | | | **Sellers' delivery (Sellers' reciprocal in trust)** | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | p=0.5 | | p=1 | | p=0.5 | | p=1 | | p=0.5 | | p=1 | |
| | Mean (%) | Std. Dev. | Mean (%) | Std. Dev. | Mean (%) | Std. Dev. | Mean (%) | Std. Dev. | Mean (%) | Std. Dev. | Mean (%) | Std. Dev. |
| **Stranger** | | | 29.52 | 9.48 | | | 58.85 | 11.46 | | | 50.33 | 12.76 |
| **Feedback** | 61.73 | 10.70 | 55.58 | 10.70 | 70.96 | 8.79 | 64.90 | 8.13 | 86.86 | 10.21 | 85.37 | 11.26 |
| **Partner** | 61.44 | 11.86 | 61.35 | 11.97 | 79.13 | 9.66 | 75.96 | 11.18 | 77.13 | 11.45 | 80.43 | 9.67 |

Note: 1. Success trade percentage is calculated by dividing the number of rounds where there is a purchase order and seller delivers a goods by the total number of rounds.

2. Purchase order percentage which reflect buyers' trust is calculated by dividing the number of rounds where there is a purchase order by the total number of rounds.

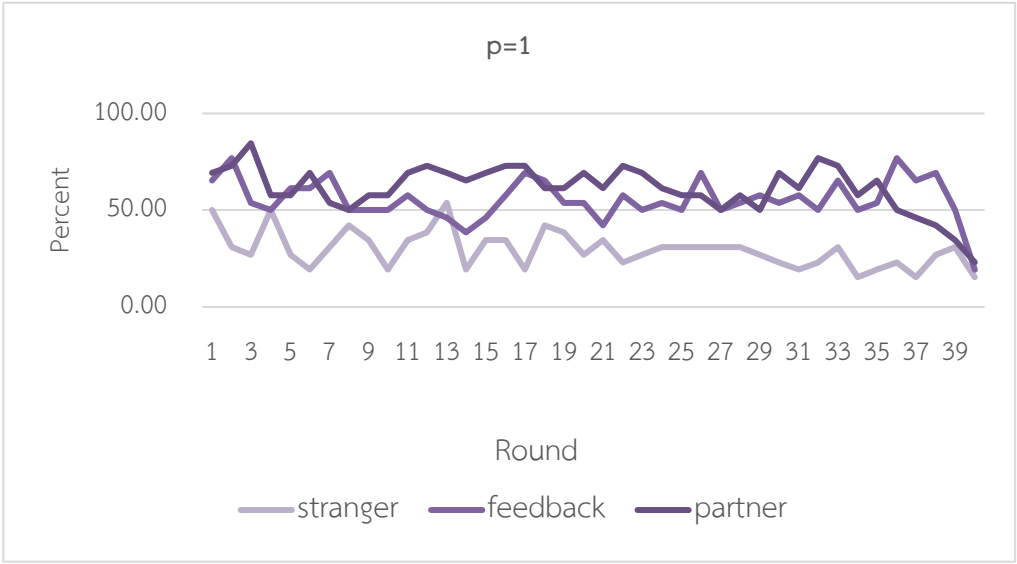
3. Seller's delivery percentage which reflect sellers' reciprocal in buyers' trust is calculated by dividing the number of rounds where sellers' send out goods by the number of rounds where there is a purchase order.

The stranger market unsurprisingly yields the lowest percentage in every analysis from Table 2 as buyers and sellers are only matched once. There is no reason for sellers to keep their reputation. Therefore, their dominant strategy is to defect and not send the goods. Buyers possess the same information and therefore, will likely choosing not to place the purchase order. In contrast, agent's behavior is recorded and displayed publicly for a period of time in feedback market hence, sellers must maintain their reputation for extended benefit. Similarly, in the partner market, matching with the same trading partner is a natural mechanism in encouraging sellers to maintain their reputation for long term mutual gain. These suppositions are supported by the data from the experiments.

We can observe the long-term dynamic of buyers and sellers' behavior from Figure 3 which shows successful trading per round. The percentages of successful trading of the feedback and partner market are higher than those of the stranger market in almost every round.[8] The behaviors in the feedback and partner market are closely related to each other in both p=1 and p=0.5. In all the markets, successful trading decreases significantly in the last few rounds reflecting the fact that sellers are aware that they do not have to keep the reputation anymore and buyers are expecting that the sellers will not ship the goods.

[8] Except for the 13th round.

Figure 3: Successful trading percentage in each round when p=1 and 0.5



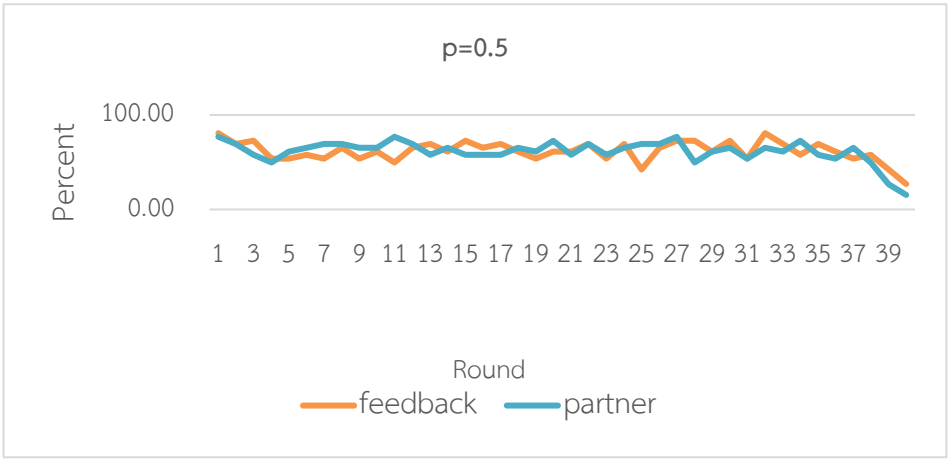
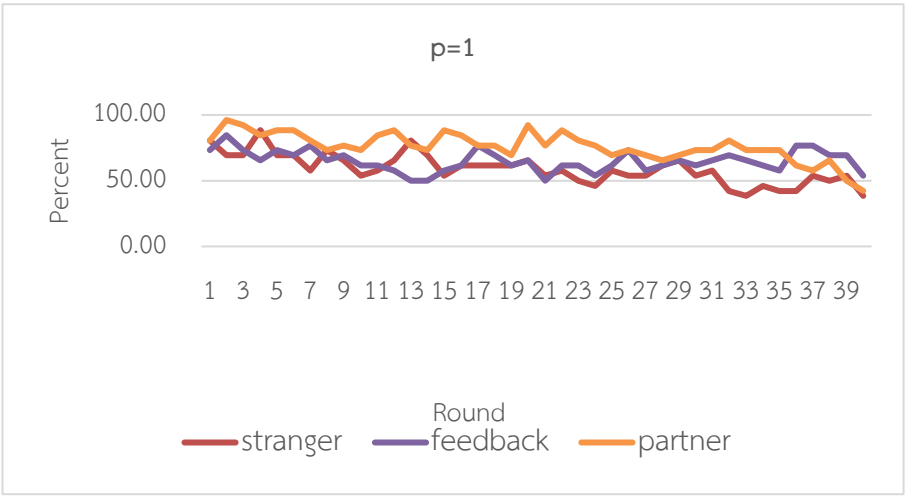
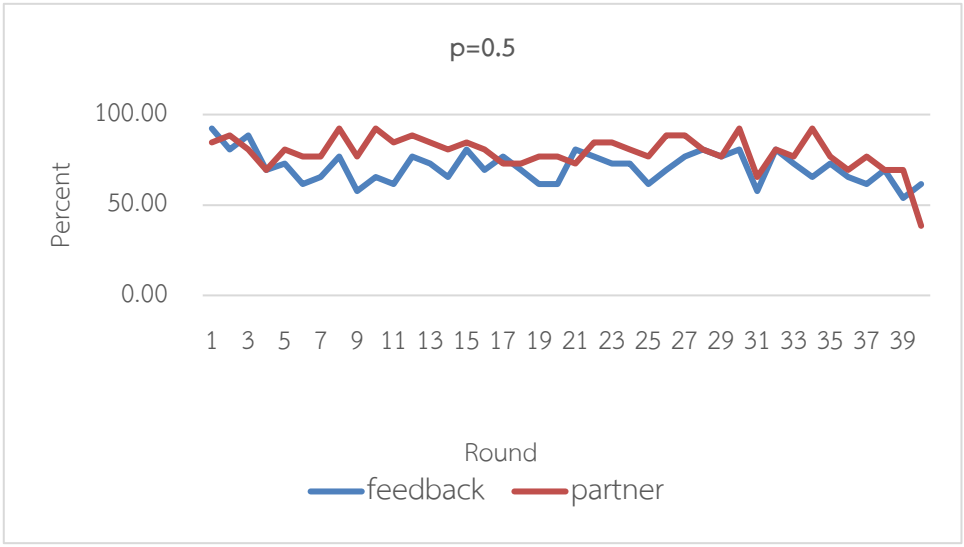



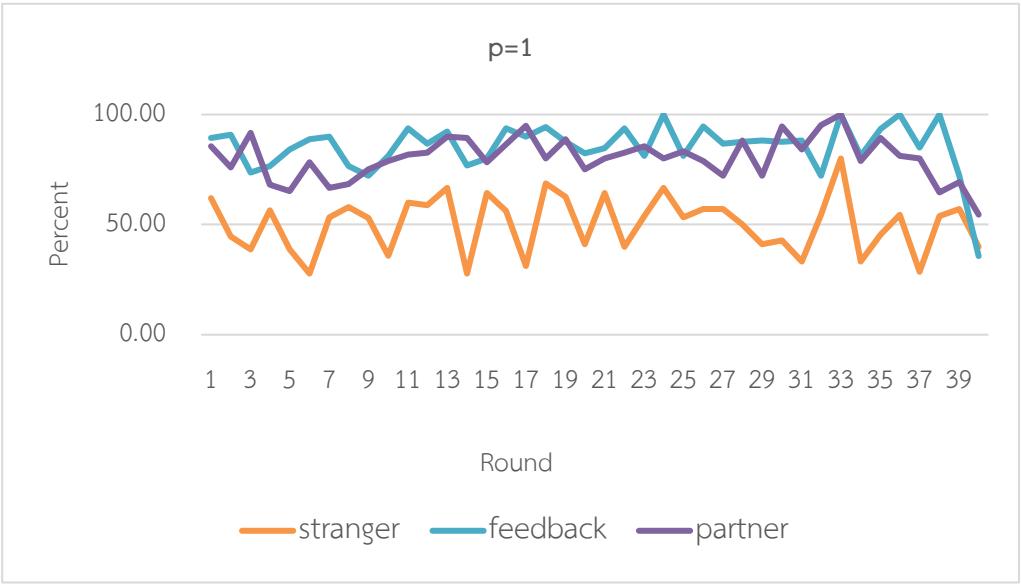
Figure 4: Purchase order (Buyers' trust) in each treatment when p=1 and 0.5



In Figure 4, we compare the buyers' trust between treatments. Partner market has the higher percentage of purchase order in almost every round meaning that the long-term trading partner is the prominent consideration factor for buyers. Feedback is not effective in the first half of the rounds when compared to stranger market. However, in the later rounds, buyers in feedback market starts to gain more trust. Similar with the results from Figure 5, purchase order decreases significantly in the final few trading rounds.

Figure 5: Sellers' delivery (Sellers' reciprocal in trust) in each treatment when p=1 and 0.5



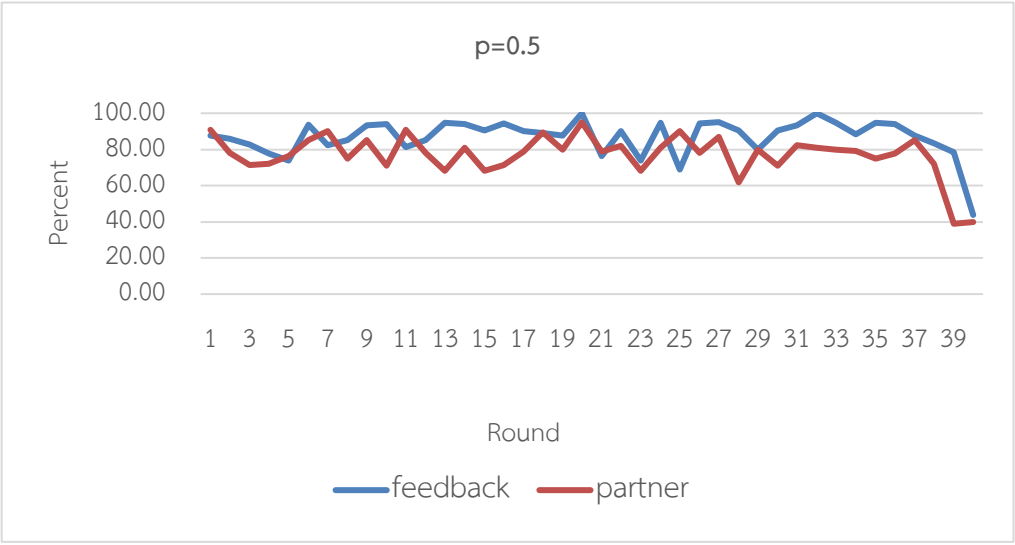



Figure 5 looks more closely at the sellers' shipments. We found that sellers do not keep their reputation at all in the stranger market. Therefore, there must be a mechanism to enforce their honesty. Another point to note is the sellers maintain slightly higher reputation when there is uncertainty in product quality (when p=0.5).

We can observe two important effects on decisions to purchase and decisions to honor the contract from figure 3 to 5. Firstly, there is an experience effect which is the declining level of trust as the time goes by, especially when there is no noise from quality delivery (when p=1). The result in lower level can observe from negative sloping curves of buyer's trust percentages. Secondly, there is a last round effect in every treatment. We can see that in every treatment, from round 36 onwards (the last 4 rounds), the level of purchase order and goods delivery fall significantly. This is consistent with the

theoretical prediction of finitely repeated game which suggest that players tend to break the contract toward the end of the game. From backward induction or rollback equilibrium, if the buyer knows that the seller will not deliver the goods in the last period, the buyer will not place the order. The seller also aware of this and will not deliver the goods in the second to last and so forth. Hence, the theoretical equilibrium is when there is no trade in any round. However, the empirical evidence here shows that subjects do not apply the logic of backward induction throughout the game, they apply only in a few last rounds. Furthermore, not all subjects think same as game theorist, even in the stranger market, in the last period there is still approximately 30% trading success rate which suggest bounded rationality in subjects in the sense that subjects do not perform utility maximization (Selten (1990)).

## 7. The treatment effects

We estimate the probit model to examine the treatment effect. The dependent variable is purchasing order, it is 1 when there is a purchase order and 0 otherwise. Table 3 describes all variables.

Table 3: Definition of variables

| Variables | Description |
|---|---|
| **1. Treatment group** | |
| Feedback | It is equal to 1 if the observations are from feedback treatment, 0 otherwise. |
| Partner | It is equal to 1 if the observations are from partner treatment, 0 otherwise. |
| **2. Probability group** | |
| Prob | It is equal to 1 if the observations are from p =1 treatment, 0 otherwise. |
| **3. Experience effect** | |

| | |
|---|---|
| Period | It is number of round of observations. The value is between 1 and 40. |
| Last3Period | It is equal to 1 if the observations are from the $37^{th}$ to the $40^{th}$ round, 0 otherwise. |
| **4. Reputation effect** | |
| 1LastDelivery | It is equal to 1 if the observations are from a buyer and a seller who deliver goods in the immediate previous round, 0 otherwise. |
| 5LastDelivery | The number of rounds that seller had delivered in the five previous rounds. |
| 5LastNotDelivery | The number of rounds that seller had not delivered in the five previous rounds. |

From the model 1 in Table 4, we can see that Feedback and Partner is statistically positive and significance at 1%. Buyers likelihood to place a purchase order in the feedback and partner market are higher than in the stranger market. As for the interpretation of the second group of independent variables, we observe that uncertainty in goods' quality does not effect buyers' decision to purchase. Specifically, uncertainty does not cause any difference in the probability that buyers' will place the order to buy in both feedback and stranger market and partner and stranger market. A plausible reason is because uncertainty in product's quality is determined exogenously. Sellers cannot control the quality of the product when it reaches buyers. Buyers decisions depend more on trustworthiness that occurs from indigenous factors and therefore, sellers will be punished for dishonesty behavior rather than uncontrollable factors.

For the experience effect, we found that as the round (time) goes by, the probability of placing purchase order in the partner market is 1.2% lower than in the stranger market, while it is 0.41% lower when comparing feedback market to stranger market. The partner market is affected by the last round effect significantly as the probability of placing purchase order in this

type of market is 57% lower than those in the stranger market.

Table 4: Probit model estimation (marginal effect)

| **Independent variables** | **Dependent variables: Purchase order probability** | | |
|---|---|---|---|
| | **Model 1** | **Model 2** | **Model 3** |
| Feedback | 0.437*** | 0.113 | 0.111 |
| | (0.095) | (0.096) | (0.104) |
| Partner | 1.004*** | 0.594*** | 0.691*** |
| | (0.126) | (0.103) | (0.107) |
| Feedback*Prob | -0.143 | -0.054 | 0.004 |
| | (0.097) | (0.085) | (0.081) |
| Partner*Prob | -0.031 | -0.036 | -0.071 |
| | (0.151) | (0.115) | (0.094) |
| Feedback*Period | -0.004* | -0.008*** | -0.018*** |
| | (0.002) | (0.002) | (0.002) |
| Partner*Period | -0.012*** | -0.015*** | -0.023*** |
| | (0.004) | (0.003) | (0.003) |
| Feedback*Last3Period | -0.078 | 0.020 | 0.081 |
| | (0.089) | (0.085) | (0.087) |

| | | | |
|---|---|---|---|
| Partner* Last3Period | -0.570***<br>(0.090) | -0.457***<br>(0.084) | -<br>0.494***<br>(0.092) |
| Feedback*1LastDelivery | | 0.698***<br>(0.057) | |
| Partner*1LastDelivery | | 0.819***<br>(0.093) | |
| Feedback*5LastDelivery | | | 0.298***<br>(0.021) |
| Partner*5LastDelivery | | | 0.272***<br>(0.025) |
| Feedback*5LastNotDelivery | | | -0.356***<br>(0.048) |
| Partner*5LastNotDelivery | | | -0.202***<br>(0.047) |

Notes: 1. *, **, *** represent statistical significance at 10%, 5% and 1% levels, respectively.

2. The standard error is calculated using robust standard error to prevent heteroscedastiticty and autocorrelation problem and because the data is segregated in group, we cluster by individual identification

## 8. The reputation effects

Next, we consider the reputation effect which is how sellers' reputation affect buyers' decision to purchase. In the

experiment, buyers can utilize records of sellers' behavior to help in the decision to purchase. This information is available in the feedback market only. However, in the partner market, although there is no information shown on the screen, subjects were trading with the same partner and therefore, were aware of the partner's track record.

Table 5: The reputation effects

| | Percentage of purchase order | | | | Total percentage of purchase order | |
|---|---|---|---|---|---|---|
| | Seller delivered the goods in the immediate previous round (Good track record) | | Seller did not delivery the goods in the immediate previous (Bad track record) | | | |
| | p = 0.5 | p = 1 | p = 0.5 | p = 1 | p = 0.5 | p = 1 |
| Stranger | | 24.10 | | 17.89 | | 6.21 |
| Feedback | 66.33 | 58.07 | 6.44 | 4.81 | 59.89 | 53.26 |
| Partner | 67.07 | 73.16 | 11.66 | 8.99 | 55.41 | 64.18 |

Notes: 1. From the sequence in the experiment, the game ends if a buyer does not place a purchase order. If this is the case, a matching seller does not make any decision. Hence, sellers' records can be of 3 values which are delivered, not delivered, and did not make a decision. Consequently, the sum of the percentage of good track records and bad track records is not equal to 100%.

2. Percentage of buyers placing a purchase order on a good track record seller is calculated by dividing the number of purchasing order from buyers who match to good record sellers in the last round, by the total purchase order in that round.

3. Percentage of buyers placing a purchase order on a bad track record seller is calculated by dividing the number of purchasing order from buyers who match to bad record sellers in the last round, by the total purchase order in that round.

4. Percentage of purchase order is calculated by dividing the total number of trading by the total number of matchings in a given round.

From Table 5, it is noticeable that buyers in feedback and partner markets place purchase order at significantly higher rates to the sellers with good track records when compared to the purchase order to sellers with bad track records. The differences in the percentages of purchase order are between 53-64%. On the contrary, the difference in the stranger market is only 6% which is significantly lower as expected as the matching trading partners in this market only met once and there is no information on sellers' track record available to buyers. There is no incentive for sellers to maintain their reputation as there is no punishment mechanism in place for buyers to utilize. However, the difference in purchase order when we observe difference in p (uncertainty in products' quality) is not significant. This confirms our earlier results that buyers do not treat products with exogeneous uncertainty differently from normal products.

We also estimate the reputation effect in model 2 (Table 3) by adding interaction variables between treatments and 1LastDelivery which is the variable that record sellers' history in the immediate previous round. We found that track record is positively correlated with the probability of placing purchase order. Buyers in feedback market's probability in placing purchase order is significantly higher than those in the stranger market at 69.84% while partner market probability increases by 81.89%. This result confirms table 5 result as reported above.

We also notice from Table 3 that purchase order in the feedback market is at 64.9% and 70.96% and the sellers' delivery rates are at 85.37% and 86.86% for p=1 and p=0.5, respectively. This shows that sellers place more importance on reputation more than buyers perceive. In other words, sellers over-emphasize on their reputation than its effect actually yield.

Having said that, the sellers' track record is still a crucial consideration factor for buyers' decision to purchase products even though sellers over-emphasize on them, we then delve deeper into sellers' track record from buyers' perspective. Particularly, we investigate sellers' history further than just the immediate previous round.

In the probit estimation model 3, we include the interaction term between treatments and the delivery record of previous 5 trading rounds of a seller (5LastDelivery). Feedback*5LastDelivery is the interaction variable that we use to observe the effects in the feedback market while Partner*5LastDelivery is to observe the effects in the partner market. On the contrary, we can see the bad records from the interaction term that include 5LastNotDelivery.[9]

We find that the sellers' history up until 5 previous rounds still affect buyers' decisions. Sellers with good track record in the 5 previous rounds increase buyers' probability to purchase order by 29.75% and 27.23% in the feedback market and the partner market respectively when compared to the stranger market. In contrast, bad track records in the last 5 rounds yield

[9] The variables 5LastDelivery and 5LastNotDelivery are not binary. They are the number of delivery and not delivery rounds in five last rounds, respectively. Since sellers have three statuses, delivery, not delivery and not decide, we separate not delivery and not decide in model 3; however, we attach those variables in model 2. The reason is when we analyze only one last period in model 2, the variation of not decide is small. The variable 1LastDelivery then is binary.

adverse effect. Probability of placing purchase order lowered by 35.56% and 20.21% in the feedback market and the partner market respectively when compared to the stranger market. We can conclude that buyers utilize the information of at least 5 previous trading rounds in making a decision.

## 9. Discussions

This paper explores the effect of feedback systems on building a reputation in finitely repeated game. The results show that, first, feedbacks can increase cooperation in which buyers order more and sellers deliver the goods as promised at a higher rate. Second, direct and indirect feedbacks yield indifferent results. Trading efficiency and the number of buyer's order are not statistically different between those two feedback sources. Lastly, we find that the exogeneous uncertainty does not have a strong effect on buyers' decision. The results are consistent to hypothesis one and two, but the third hypothesis is rejected.

We can see from the results that feedback is comparable to reputation in the theory of reputation and that it can increase cooperation in finitely repeated games. This evidence supports Kreps et. al (1982). Moreover, the effects of direct and indirect reputation are not different. This can explain the growing and successful usage of (indirect) feedback system in online market platform. Consumers browse through sellers' delivery records as an integral part of their decision-making process. In the view of sellers, they also place high importance on keeping their reputation. These findings are consistent with typical behavior of online platform players. The robustness of the result is confirmed by buyers' view that exogeneous uncertainty is less salient than the reputations. The plausible reason is that buyers view that exogeneous uncertainty is not in the sellers' control and they would penalize the sellers more

if the uncertainty is within their control (dishonesty arises from endogenous uncertainty).

Our results are based on the true report of feedback system which might not be realistic. The buyers' feedback might be bias because it is public goods (reviewers have never benefited from providing the review but the advantage belongs to next consumers); therefore, the number of providers is few and sometimes they are in extreme case. The role of bias feedback should be investigated in further research.

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