# Cost of action, perceived intention, positive reciprocity, and signalling model

Bhirombhakdi, Kornpob and Potipiti, Tanapong

Faculty of Economics, Chulalongkorn University

19 February 2012

# Cost of action, Perceived Intention, Positive Reciprocity, and Signalling Model

Kornpob Bhirombhakdi* and Tanapong Potipiti**

*This study experimentally tests the positive relationship between perceived intention and positive reciprocity by altering material-payoff structures. To design the treatments, we apply a signalling model to explain how the intention of an action is signalled and perceived. The model shows that the cost of an action positively relates to the perceived intention. The results from seventy-nine subjects who participated in this four-session hand-run experiment that was double-blindly organized between August - September 2011 support the positive relationship. Moreover, this study hypothesizes on consistent decisions across treatments with different levels of perceived intention, and the results support the hypotheses.*

**JEL Codes:** C71, C91 and D82

*Revised on 8 July 2012*

## 1. Introduction

*"Intentions count in your actions."*
*Abu Bakr*

This experimental economic study aims to test a relationship between perceived intention and positive reciprocity by applying a different approach called *material payoff approach*.

Precisely, a positive-reciprocity situation is a situation that, for instance, there are two players; one player is a *giver* who gives the other (as a *receiver*) kindness and the receiver responses whether to reciprocally return kindness or not.

The giver's decision is driven by his private information on his intention; but the intention affects the receiver's decision. For instance, we (as receivers) would like to return a giver favors to whom gave us with altruistic-minded intention more than whom with strategic-minded one (Stanca, Bruni & Corazzini 2009).

Since the receiver cannot directly observe the giver's intention, under his beliefs he guesses the intention as the "*perceived intention*". The perceived intention is the latest controversial factor that determines reciprocity (Falk, Fehr & Fischbacher 2008, McCabe, Rigdon & Smith 2003, Stanca, Bruni & Corazzini 2009). By applying different approaches, the previous studies showed that the factor enhanced the reciprocity (or positive relationship).

*Kornpob Bhirombhakdi is a Ph.D. candidate in Economics from Faculty of Economics, Chulalongkorn University, Bangkok, Thailand. Email: bkornpob@yahoo.com

**Tanapong Potipit, Ph.D., Faculty of Economics, Chulalongkorn University, Phayathai Road, Bangkok, 10330, Thailand. Tel: +66 2218 6255. Email: tanapong.p@chula.ac.th.

However, the studies did not explain how the perceived intention is derived. Nor, they did not show whether subjects' decisions were consistently affected by the different levels of perceived intention (in later sections, we will explain more about this issue).

To fill the missing pieces of knowledge, first, we apply a signalling model to theoretically explain how the receiver perceives the intention of the giver's decision. We find the following findings: i) as presented in Lemma 1, the cost of an action of the giver signals his level of intention of his decision; the more cost of a decision the higher level of intention of the decision is. ii) Since the receiver knows the cost, he perceives the intention. As presented in Proposition 1, cost of a decision positively relates to the level of perceived intention of the decision. iii) The level of perceived intention positively relates to the positive reciprocity. In other words, as presented in Proposition 2, cost of a decision positively relates to the reciprocity.

Next, we apply the findings to design experiment to test the relationship between the perceived intention and positive reciprocity. Like the results of previous studies (Falk, Fehr & Fischbacher 2008, McCabe, Rigdon & Smith 2003, Stanca, Bruni & Corazzini 2009), we find that they have a positive relationship. Further, we test the issue of consistent decision. The results confirm that subjects' decisions are consistently affected by different levels of perceived intention.

For the rest of this paper, it consists of four sections: literature review, methodology, results, and concluding remarks.

## 2. Literature Review

Recent studies on kindness and reciprocity (Bolton & Ockenfels 2000 and 2005, Charness & Rabin 2002, Cox & Deck 2005, Dufwenberg & Kirchsteiger 2004, Falk & Fischbacher 2006, Falk, Fehr & Fischbacher 2003 and 2008, McCabe, Rigdon & Smith 2003, Stanca, Bruni & Corazzini 2009) report that a controversial factor that determines how one perceives kindness (or unkindness) from an action is -- *perceived intention from the action*.[1] For instance, stepping on someone's foot makes a victim perceive more unkindness if he perceives that the doer intentionally and unkindly stepped on his foot, and vice versa for a kind action. Precisely, perceived intention from an action increases one's perception to kindness or unkindness (Falk & Fischbacher 2006).

As a consequence from perceiving that an action is intentionally done, reciprocity (either positive or negative) is likely to be induced; as negative reciprocity, the victim is likely to have a fight if he perceives that he was intentionally stepped on. In this context, an important factor to induce reciprocity is the *perceived intention* that the victim perceives, not the doer's real intention which is his private information.

To test the relationship between perceived intention and reciprocity, previous studies designed two treatments as two-stage games, that a first mover decides then a second mover will decide after observing the first mover's decision by applying two approaches: random-device approach in McCabe, Rigdon and Smith (2003) and Falk, Fehr and Fischbacher (2008), and information approach in Stanca, Bruni and Corazzini (2009). The random-device approach distinguishes two treatments by letting the second mover play against a human-first mover in one treatment but play against a device-first mover (such as a dice or coin) in the other. Since a human mover can show intention of his decision but a device mover cannot, this approach introduces perceived intention from the human's action higher than from the device's one; as a consequence, the studies hypothesized that

a human mover could induce reciprocity more than a device mover, and the results supported the hypotheses.

By having a different hypothesis that the second mover will perceive more intention of a kind decision, and will reciprocate more, if the first mover makes his kind decision without knowing possible consequences of the decision (like pure altruism where one unconditionally gives kindness), Stanca, Bruni and Corazzini (2009) applied information approach to test the hypothesis. The approach distinguishes two treatments by information provided: full information and partial information. In the full-information treatment, subjects know that the game has two stages; in the partial-information treatment, subjects know that the game has only one stage and surprisingly the subjects know that there is another stage (the second stage) after the first stage has been completed. Hence, according to the hypothesis, the reciprocity rate in the partial information treatment was expected to be higher than in the full information treatment, and the result supported the hypothesis.

Different from the studies discussed above, this study questions that how intention of an action is perceived in human-human interaction with full-information treatments, neither device-human interaction nor partial-information; hence, this study applies the *material-payoff approach*, which is a non-device approach with full information, and develops a *signalling model* that explains how intention of an action is signalled and perceived.

Like in many previous studies (for examples, Falk et al. (2003), Bolton & Ockenfels 2005), the material-payoff approach, ideally, introduces an independent variable in one treatment but not in the other treatment by using treatments with different material-payoff structures. For instance, if you want to test the relationship between stake and decision in a dictator game, your experiment is easily designed by using (at least) two dictator games: low and high stakes.

Designing a material-payoff-approach experiment likes the previous studies sounds simple, but to test the relationship between perceived intention and positive reciprocity in this study is *not*. Why? Let us see; if we want to test the relationship, by imitating from the case of stake and dictator's decision, we need two treatments with different perceived intention from an action: low and high. *How can we quantify the perceived intention?* Re-think about the definition of intention (purpose, plan, aim, etc.), we see that intention is intangible and naturally unmeasurable, hence, *unquantifiable*. Which will be presented in the next section, we develop a theoretical method to quantify the perceived intention using a signalling model; hence we can theoretically design treatments with different perceived intention from an action.

Moreover, the material-payoff approach can solve the problem of changing preferences over human and device that made the conclusions in the random-device-approach experiments be obscure; rather than the perceived intention, a subject might want to reciprocate a human opponent more than a device one, hence results from the experiments were confounded. Although Falk, Fehr and Fischbacher (2008) concerned the problem and tried to solve it by its methodology, applying a non-device experiment is still the best solution.

## 3. The Methodology and Model

In this section, there are five subsections: the experiment protocol, the trust game that is used in this study, developing how intention of an action is signalled and perceived by

using a signalling model, hypotheses to be tested, and designed treatments to test the hypotheses.

## 3.1 Experiment protocol

Our subjects are sixty-four economic and fifteen non-economic undergraduate students ($n$=79). The subjects voluntarily participated in a four-session hand-run economic experiment (one subject participated once) that was double-blindly conducted. The experiment was organized during August and September 2011 at Chulalongkorn University, Thailand. Subjects knew the experiment from printed and social-network distributed announcements that provided necessary information especially session length, payment and activities.

To make them concerned cost and benefit of the participation, session length (one and a half hour) and minimum-maximum payment (100-400 baht) were informed in announcements. Moreover, the announcements informed that activities would compose of providing information in questionnaires and making decisions in various situations where the payment was depended on each subject's decisions and other subjects' decisions in the experiment that had four sessions. On average, the experiment paid 33 baht/hour which is higher than the minimum wage per hour.[2]

The payment was divided into two parts: shown-up fee (50 baht) and payment from decisions. The announcements informed that subjects would get paid within a month after the experiment end, but did not inform the payment process; this is to avoid subjects who only wanted the shown-up fee and unlikely to make decisions. Subjects knew the payment process after all decisions had been made.

In each session, subjects did three types of tasks: providing information in questionnaires, deciding in a dictator game, and deciding in eight trust games (which three games are presented here). The experiment applies strategy method that subjects contingently made decisions as both roles and in all games. Before making decisions in trust games, subjects were required to answer some questions to help them understand the game. To make them push more effort in understanding the game, a subject who correctly answered all questions got paid. Staff checked each subject's answers, publicly announced key of the questions and publicly answered some questions concerning the games but did not answer questions that would affect subjects' decision makings in the games.

This study introduced framing-effect-free and anonymous environment. By using bias-free words like "*situation*" instead of "*game*", "*person*" instead of "*player*", "*decision A*" instead of "*stop*", etc., framing-effect-free environment was introduced to make treatments were -- *neutral*, a subject was not convinced that a treatment was either game or reciprocity-related situation. Second, to prevent being confounded by changing decision according to opponents that, for instance, subject may likely to reciprocate friendly more than rivalry opponent, anonymous environment was introduced by informing that each subject's opponents would be randomly drawn from more than fifty participants in this experiment; no one knew one's opponents, the opponents were -- *anonymous*.

Last, this study concerned another important theoretical assumption, independent decisions between games. Eight trust games were separated into four sets (two games per set) and inserted in an envelope. Staff handed the envelope over each subject, announced rules and regulations, monitored subjects' behavior, and warned them against violating the rules; however, there was no punishment for any violation. The rules and

regulations that were announced is as following: draw only one set at a time, finish and return the current set to your envelop before the next set are drawn and changing any decision in finished sets are prohibited.

## 3.2 Trust game

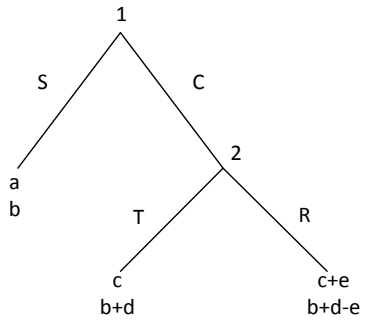


Fig.1 Designed trust game in this study

As presented in Fig. 1, this study uses reciprocity-related treatments named "*trust game*" that, in general, is a sequential two-player game which a first mover decides to stop $S$ or trustfully continue $C$ and, after observing that the first mover continued, a second mover responses: selfishly take $T$ or reciprocally return $R$. In this study the trust game is designed and focused on positive-reciprocity interaction -- kindness is given by the first mover and is returned to him by the second mover; the first mover decides whether to stop or give the second mover's $d$ additional points by continuing the game (kindness giving); if the first mover continued, the second mover decides to take all the additional points or return $e$ points, where $0 < e < d$, to the first mover (kindness returning).

Since only the first mover's continuing $C$ leads to the second mover's decision node, hence we will test the relationship between the second mover's perceived intention from continuing and positive reciprocity. Moreover, the first mover's continuing is costly (if $a \geq c$) or beneficial (if $a < c$) to him; hence, which will be used in the next section, we define the cost of continuing as the difference between $a$ and $c$.

| DEFINITION 1 | Cost of continuing is $\delta = a - c$. |
|---|---|

## 3.3 Intention of continuing -- signal, perceive, and affect positive reciprocity

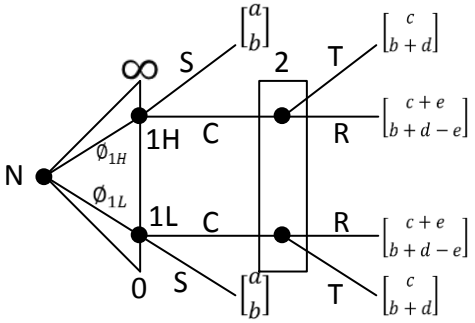


Fig.2 Signalling game of trust

*How is intention of continuing signalled and perceived? How does it affect positive reciprocity?* This section will answer the questions by using a signalling model. As result which will be presented in Proposition 1, cost of continuing signals the first mover's intention of doing so; as a consequence which will be presented in Proposition 2, the second mover who observed the first mover chose costly continuing will perceive more intention of the decision and will be induced to positively reciprocate the first mover's kindness from the continuing.

As presented in Fig. 2, the designed trust game is modelled as a signalling game of trust in which the first mover's type $\emptyset_1 \in \mathbb{R}_+$ is randomly selected by nature $N$ then he accordingly makes an optimal decision. The type represents the first mover's real intention of continuing, or *kindness intention*; it affects the first mover's utility function (which will be presented in the following section) by $\emptyset_1 = 0$ means he has no intention to give the second mover's favours and is likely to stop the game, and vice versa. After the first mover has made his decision, the second mover who can observe the decision but do not know the first mover's type optimally makes a decision according to information he has, which is the first mover's decision.

To simply illustrate the equilibrium of this game, we compare two extreme cases: continuing is hugely costly ($a \ll c$) and hugely beneficial ($a \gg c$). In the former case, only the first mover who has high enough kindness intention, say $\emptyset_1 \geq \emptyset_1^C$, will continue the game whereas, in the latter case, the first mover who will continue the game has $\emptyset_1 \geq \emptyset_1^B$ where $\emptyset_1^B < \emptyset_1^C$; hence i) the cost of continuing affects the optimal decision by affecting the critical value of kindness intention ($\emptyset_1^C$ and $\emptyset_1^B$); precisely, the cost of continuing positively relates to the critical value. Then the second mover, who observed the first mover's continuing $C$, utilize the information of the first mover's decision to update his expectation on the first mover's kindness intention by $E(\emptyset_1|C)$; ii) the expectation $E(\emptyset_1|C)$ is equivalent to the second mover's perceived intention from continuing. In other words, since the second mover knows the structure of game, he knows the cost of continuing and knows the positive relationship between the cost and critical value of the first mover's kindness intention; iii) the second mover can derive a positive relationship between the cost and the perceived intention from continuing; since $E(\emptyset_1|\emptyset_1 \geq \emptyset_1^C) > E(\emptyset_1|\emptyset_1 \geq \emptyset_1^B)$, it implies the relationship. Last, as mentioned that perceived intention from an action positively induces reciprocity, iv) we can derive a positive relationship between the cost of continuing and reciprocity rate.

Besides the simple illustration, the following presentation visualizes the equilibrium by analyzing the signalling game of trust. The analysis consists of three steps: the first mover's optimal decision, the second mover's optimal decision and how the intention is signalled and perceived.

### 3.3.1 The first mover's optimal decision

To analyze the first mover's optimal decision, we will simply modify the simplest and most well-known reciprocity model -- *altruism* -- by inserting the perceived intention into it. As presented in (1),

$$u_1\left(\boldsymbol{a}, \widehat{\emptyset_2}; \emptyset_1\right) = m_1(\boldsymbol{a}) + \emptyset_1 \widehat{\emptyset_2} m_2(\boldsymbol{a}) \quad (1)$$

a first mover derives his utility $u_1$ from a weighted sum between two parts -- his material payoff $m_1$ and the second mover's material payoff $m_2$ -- by having $\emptyset_1 \widehat{\emptyset_2} \in \mathbb{R}_+$ as the relative weight;[3] the weight affects the first mover's decision by the more the weight is the more propensities to choose continuing the game. Both movers' material payoffs are

determined by strategy profile $\boldsymbol{a} = (a_1, a_2)$ where, according to the trust game, $a_1 \in \{S, C\}$ and $a_2 \in \{T, R\}$; The relative weight is derived from the interaction between the first mover's *kindness intention* $\emptyset_1 \in \mathbb{R}_+$ and the *perceived intention* from the second mover $\widehat{\emptyset_2} \in \mathbb{R}_+$. Since the first mover makes his decision before the second mover does, he simply takes it as a constant; without loss of generality, we normalize $\widehat{\emptyset_2} = 1$.

According to the signalling game, we derive the first mover's optimal decision function (or best response function) $BR_1$ by:

$$BR_1(a_2; \emptyset_1) = \left\{ a_1 \in A_1 \middle| a_1 = \begin{cases} S \; if \; \emptyset_1 \leq \tau(\delta, \alpha) \\ C \; if \; \emptyset_1 \geq \tau(\delta, \alpha) \end{cases} \right\} \quad (2)$$

where $\tau(\delta, \alpha) = \frac{\delta - e(1-\alpha)}{d - e(1-\alpha)}$ and $\alpha = prob(a_2 = T) \in [0,1]$.

Similar to the previous illustration, the first mover's optimal decision is contingent to his kindness intention and the critical value of kindness intention $\tau$ which is positively related with the cost of continuing $\delta = a - c$, as presented in Lemma 1; besides the cost of continuing, the critical value is depended on $d$ and $e$, and his expectation on the second mover's decision $\alpha$.[4]

| LEMMA 1 | The critical value of kindness intention $\tau(\delta, \alpha)$ is increased in $\delta$. |
|---|---|

## 3.3.2 Perceived intention from the first mover

In equilibrium, the second mover can access to the best response function;[5] hence the second mover can utilize this information and form his perceived intention from the first mover's decision. Let $\widehat{\emptyset_1}$ be the second mover's perceived intention from the first mover's decision. As discussed in the previous illustration that the first mover's decision $a_1$ signals his kindness intention and makes the second mover update an expectation on the first mover's kindness intention $E[\emptyset_1 | a_1]$, we equivalently define the following:

| DEFINITION 2 | $\widehat{\emptyset_1} = E[\emptyset_1 \mid a_1]$.[6] |
|---|---|

Precisely, let $F(\emptyset_1)$ be a prior distribution function over the first mover's kindness intention; observing the first mover's continuing makes the second mover know that $\emptyset_1 \geq \tau(\delta, \alpha)$, hence he updates his expectation by $\widehat{\emptyset_1} = E[\emptyset_1 | C] = \int_{\tau(\delta,\alpha)}^{\infty} \emptyset_1 dF(\emptyset_1 | C)$.

According to Lemma 1 and Definition 2, we get a relationship between the cost of continuing $\delta$ and perceived intention $\widehat{\emptyset_1}$:

| PROPOSITION 1 | $\widehat{\emptyset_1}$ is weakly increasing in $\delta$.[7] |
|---|---|

## 3.3.3 Effect of perceived intention to the second mover's optimal decision

Next, we will see how the perceived intention affects the second mover's optimal decision. As presented in (3),

$$u_2\left(\boldsymbol{a}, \widehat{\emptyset_1}; \emptyset_2\right) = m_2(\boldsymbol{a}) + \emptyset_2 \widehat{\emptyset_1} m_1(\boldsymbol{a}) \quad (3)$$

is the second mover's utility function.

Without loss of generality, we normalize $\emptyset_2 = 1$ and, as presented in (4),

$$BR_2(\widehat{\emptyset_1}) = \left\{ a_2 \in A_2 \middle| a_2 = \begin{Bmatrix} T \; if \; \widehat{\emptyset_1} \leq 1 \\ R \; if \; \widehat{\emptyset_1} \geq 1 \end{Bmatrix} \right\} \quad (4)$$

derive the second mover's best response function. The function implies that a second mover who perceived high enough the first mover's kindness intention ($\widehat{\emptyset_1} \geq 1$) will reciprocate. Since $\widehat{\emptyset_1}$ weakly and positively relates with the cost of continuing $\delta$,

| PROPOSITION 2 | Reciprocity rate is weakly increasing in $\delta$. |
|---|---|

Hence, we have accomplished this analysis to show how the intention of continuing is signalled and perceived, and how the perceived intention affects reciprocity.

Besides what we have presented, according to the idea of Geanakoplos, Pearce and Stacchetti (1989) that unexpected costly decision can induce reciprocity which is later named "*surprise effect*" by Morrison and Rutström (2002), the signalling model can be re-analyzed to explain how the surprise effect functions. We leave this discussion in Appendix.

## 3.4 Hypotheses

From the results in Section 3.3, we now have the following hypotheses to test

H1: In treatments with equal level of perceived intention, reciprocity rates are equal.

H2: Reciprocity rate in treatment with low level of perceived intention (low-intention treatment) is lower than the rate in treatment with high level of perceived intention (high-intention treatment).

H3: A subject who chose taking $T$ in high-intention treatment will choose taking $T$ in low-intention treatment.

H4: A subject who chose returning $R$ in low-intention treatment will choose returning $R$ in high-intention treatment.

As presented, this study tests four hypotheses (H1 - H4) that can be grouped into two issues: the relationship between perceived intention and positive reciprocity (H1 and H2) and consistency of each individual's decisions across treatments with different levels of perceived intention (H3 and H4).[8]

In previous studies (Falk, Fehr & Fischbacher 2008, McCabe, Rigdon & Smith 2003, Stanca, Bruni & Corazzini 2009), only H2 was tested and the results supported the positive relationship between the perceived intention and positive reciprocity, hence we expect the same in this study. While the H1 that has not been tested in any study will confirm that the relationship is not caused by any noise.

Moreover, to make the established relationship be more reliable, the issue of consistency of each individual's decisions should be tested. To illustrate the meaning and importance of the test, imagine that you have three subjects, say Mr. A, B, and C and two treatments with different levels of perceived intention -- high and low. In the low-intention treatment only Mr. A chooses returning (reciprocity rate is 33%) and in the high-intention one only Mr. B and C choose returning (reciprocity rate in 67%). According to the result, as expected, we get the positive relationship between the level of perceived intention and reciprocity rate. But, according to (4), Mr. A who was induced to choose returning by the low level of perceived intention should also be induced to do so by the high level of

perceived intention, hence the result shows inconsistent decisions; the established relationship is still questioned whether it is reliable or not.

Hence, this study tests the issue of consistency of each individual's decisions that previous studies ignored. Precisely, we hypothesize that if the low level of perceived intention can induce one to reciprocate then he should reciprocate in a treatment with higher level of perceived intention (H4); similarly, in reverse, if the high level of perceived intention cannot induce one to reciprocate then he should not reciprocate in a treatment with lower level of perceived intention (H3). We test H3 and H4 by measuring conditional probabilities that are expected to be 100% in each event.

## 3.5 Treatments

According to the designed trust game presented in Fig. 1, the material-payoff approach designs treatments with different material-payoff structures, precisely, different $(a, b, c, d, e) \in \mathbb{R}^5$. According to the Proposition 1, to introduce different levels of perceived intention from continuing, the treatments are focused on varying the cost of continuing $\delta = a - c$. To avoid being confounded, the treatments are fixed as $d = 300, e = 100$ and $a = b$.

Table 1 Treatments and introduced factors

| Name | $a$ | $c$ | Level of perceived intention | Stake (classified by $a$) | Equal split |
|---|---|---|---|---|---|
| Low-payoff and low-intention treatment (LLT) | 50 | 150 | Low | Low | Yes (with $R$ choice) |
| High-payoff and high-intention treatment (HHT) | 100 | 100 | High | High | No |
| Low-payoff and high-intention treatment (LHT) | 50 | 50 | High | Low | No |

As presented in Table 1, this study designs three treatments: LLT, LHT and HHT. By the Proposition 1, we know that continuing in LHT and HHT introduces equal level of perceived intention ($\delta_{LHT} = \delta_{HHT} = 0$) but higher than in LLT ($\delta_{LHT} = 0 > -100 = \delta_{LLT}$).

According to the hypotheses, precisely, we will test whether the reciprocity rates in LHT and HHT are equal but higher than in LLT (H1 and H2), will test whether subjects who chose taking $T$ in LHT will do the same in LLT (H3), and will test whether subjects who chose returning $R$ in LLT will do the same in LHT.

Besides the perceived intention, the table also notifies other two confounding factors (stake and equal split) that need to be discussed. To design treatments with equal level of perceived intention from continuing, being confounded by an effect of different stake is unavoidable. And the effect is unpredictable; it may increase or decrease reciprocity rate.

Unlike the effect of different stake, the effect of equal split is introduced to the return choice $R$ in LLT to make the conclusion of the effect of perceived intention to positive reciprocity be stronger. Precisely, since inequity aversion behavior makes a subject prefer the equal choice $R$ to the other choice $T$, the effect of equal split increases reciprocity rate;[9] but we expect the rate in LLT is lower than in the other treatments; hence observing that the rate in LLT is lower than in the other treatments implies that the effect of perceived intention is stronger than the effect of equal split choice.

Moreover, to design a clean experiment, the treatments are controlled for other effects:

1. Fixing $d$ and $e$ controls an effect of reference point.[10] Moreover, as presented in (2) that $(\delta, \alpha) = \frac{\delta - e(1-\alpha)}{d - e(1-\alpha)}$ , besides $\delta, d$ and $e$ affect the critical value; hence they affect the perceived intention. Fixing them let us focus on the effect of cost of continuing to positive reciprocity.
2. According to the critical value $\tau(\delta, \alpha)$, to control an effect of the first mover's expectation on the second mover's decision $\alpha$, we introduce strategy method (which subjects contingently make decisions in both roles without knowing their opponents) and anonymous environment (which will be explained in the next section);[11] doing so makes each subject form a constant belief that he is playing against an anonymous opponent, hence he forms constant expectations on the anonymous opponent's decisions.
3. Fixing $a = b$ controls the effect of initial endowment.
4. To control an effect of different social welfare, either $T$ or $R$ gives the same amount of total sum of material payoffs of all movers, $\sum_{i=1}^{n=2} m_i(C, T) = \sum_{i=1}^{n=2} m_i(C, R)$.[12]
5. To control an effect of competition, either $T$ or $R$ gives the second mover material payoffs at least equal to the first mover's, $m_2(C, a_2) \geq m_1(C, a_2)$ for any $a_2$.[13]
6. To limit an effect of loss aversion, everybody gets strictly positive material payoffs for any strategy profile, $m_i(\boldsymbol{a}) > 0$ for all $i \in \{1,2\}$ and for all $\boldsymbol{a}$.[14]

## 4. The findings

According to the issues of hypotheses, this section consists of two parts: the relationship between perceived intention and positive reciprocity (testing H1 and H2) and consistent decisions across treatments (testing H3 and H4).

## 4.1 Perceived intention and positive reciprocity

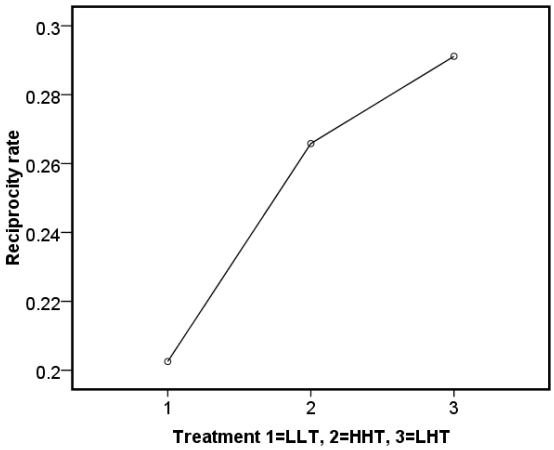

Fig.3 Reciprocity rates of treatments (1 is low-intention treatment, LLT. 2 and 3 are high-intention treatments, HHT and LHT respectively.)

As expected, as presented in Fig.3, the reciprocity rate in LHT (that has low level of perceived intention) is the lowest (20%) while the rates are 27% and 29% in HHT and LHT respectively. To statistically test the H1 and H2, as presented in (5) and (6) we apply two logistic regression models (corrected their variances by Huber/White Robust Covariances). The models are

$$\ln\left(\frac{Y_{ij}}{1-Y_{ij}}\right) = \alpha_0 + \alpha_1 D_{ij,1} + \mu_{ij} \quad (5)$$

$$\ln\left(\frac{Y_{ik}}{1-Y_{ik}}\right) = \beta_0 + \beta_1 D_{ik,2} + \varepsilon_{ij} \quad (6)$$

where $Y_{ix}$= 1 if the decision of $i^{th}$ subject in $x^{th}$ treatment is returning $R$ and = 0 otherwise which $i \in \{1,2,3,\dots,79\}$ is the index of each subject; $x \in \{j,k\}$, $j \in \{1,3\}$ and $k \in \{2,3\}$ are the indexes of treatment where the 1st, 2nd and 3rd treatments are LLT, HHT and LHT respectively. $\alpha_a$ and $\beta_b$ where $a,b \in \{0,1\}$ are constants and coefficients of the corresponding model. $D_{ix,y}$= 1 if $x = y$ and = 0 otherwise, where $y \in \{1,2\}$ in the corresponding model. Precisely, $D_{ix,y}$ is a dummy variable that tells us whether the decision of $i^{th}$ subject in $x^{th}$ treatment, $Y_{ix}$, is the decision in the $y^{th}$ treatment or not; if $x = y$ then $Y_{ix}$ is the decision in the $y^{th}$ treatment and we assign $D_{ix,y}$= 1; if $x \neq y$, $D_{ix,y}$= 0.

According to the model, to be precise, (5) tests the effect of being LLT to the propensity of choosing returning $R$ when compared to being LHT; $\alpha_1 > 0$ means a subject is more likely to choose returning $R$ in LLT than in LHT. Similarly, (6) tests the effect of being HHT to the propensity of choosing returning $R$ when compared to being LHT; $\beta_1 > 0$ means a subject is more likely to choose returning $R$ in HHT than in LHT.

Hence, according to the H1 and H2, we re-write the hypotheses in the forms (H1' and H2') that correspond to the models:

H1': Since HHT and LHT have equal level of perceived intention, we expect $\beta_1 = 0$.

H2': Since LLT has lower level of perceived intention than LHT's, we expect $\alpha_1 < 0$.

Table 2 Results of testing H1' and H2'

| Model | Estimated constants and coefficients (p-value from F-test) | Accept/reject hypotheses |
|---|---|---|
| $(5): \ln\left(\frac{Y_{ij}}{1-Y_{ij}}\right) = \alpha_0 + \alpha_1 D_{ij,1} + \mu_{ij}$ | $\widehat{\alpha_1} = -0.48$ $(0.20)$ | Accept H1' |
| $(6): \ln\left(\frac{Y_{ik}}{1-Y_{ik}}\right) = \beta_0 + \beta_1 D_{ik,2} + \varepsilon_{ij}$ | $\widehat{\beta_1} = -0.13$ $(0.72)$ | Accept H2' |

As presented in Table 2, according to the p-value from the F-test (which is equivalent to t-test) where we treat (5) and (6) as unrestricted models and treat $\alpha_1 = 0$ and $\beta_1 = 0$ as the restricted models, at the 0.20 level of significance we accept both H1' and H2'. Like what previous studies (Falk, Fehr & Fischbacher 2008, McCabe, Rigdon & Smith 2003, Stanca, Bruni & Corazzini 2009) found, the results show the positive relationship between the perceived intention and positive reciprocity; the more the level of perceived intention the more the reciprocity rate is.

## 4.2 Consistent decisions across treatments

This study further explores how decisions of each individual across treatments were consistent by testing two hypotheses: a subject who took in high intention treatment will take in low one (H3) and a subject who returned in low intention treatment will return in high one (H4).

Table 4 Cross table between LHT and LLT, and measurements to test H3 and H4 (1-tailed p-value from Wilcoxon signed-rank test is presented in the parenthesis)[15]

| | | LLT | | Measurements | |
|---|---|---|---|---|---|
| | | $R$ | $T$ | Taking in LLT given taking in LHT rate (TR) | Reciprocity in LHT given reciprocity in LLT rate (RR) |
| LHT | $R$ | 14 | 9 | 96.40% (0.08) | 87.50% (0.08) |
| | $T$ | 2 | 54 | | |

As presented in Table 4, the cross table presents a number of subjects in second-mover role who decided in LHT and LLT. For instance, as presented in the $(row, column) = (R, T)$, nine subjects returned $R$ in LHT but took in LLT. To test the hypotheses, we use two conditional-probability measurements (each measurement for each hypothesis): rate of taking in LLT given taking in LHT (TR) and rate of reciprocity in LHT given reciprocity in LLT (RR).

In an event that observing a subject, who had taken in LHT (n=56), took in LLT (n=54), TR $\approx$ 96.4% is the conditional probability of the event that means 96.4% of subjects who take in LHT will take in LLT. According to H3 that implies expected TR = 100%, although our measured TR is slightly less than the expectation, the Wilcoxon signed-rank test does not reject the null hypothesis that the TR is equal to 100% at 0.05 level of significance; hence, we *accept H3*.

Similarly, in an event that observing a subject who had reciprocated in LLT (n=16), reciprocated in LLT (n=14), RR $\approx$ 87.5% is the conditional probability of this event that means 87.5% of subjects who reciprocate in LLT will reciprocate in LHT. According to H6 that implies expected RR = 100%, the statistical test shows that the measured RR is equal to 100%; then H4 is *accepted*.

As expected, the results show that subjects consistently made decisions across treatments with different levels of the perceived intention. Hence, the positive relationship between the perceived intention and positive reciprocity is reliable.

## 5. Summary and Conclusions

This study designed a material-payoff-approach experiment that has three trust games with different material-payoff structures to test a relationship between perceived intention from a decision and positive reciprocity. In this study, an important challenge was to design treatments with different levels of perceived intention of a decision, hence we theoretically develop a signalling model that explains how the intention is signalled and perceived.

This study gets interesting results from the signalling model and the experiment data. From the model, cost of an action plays an important role in signalling and perceiving kindness intention; the more cost, the more kindness intention is signalled and perceived. Then, we applied the model's results to design treatments that tested the relationship between perceived intention and positive reciprocity.

From the experiment data, the results strongly support that perceived intention from a kind decision positively induces positive reciprocity. Moreover, the results support that decisions are consistent treatments with different levels of perceived intention for both forward argument (if positive reciprocity is induced in a low-intention treatment then it must be induced in a high-intention one), and backward argument (if positive reciprocity is not induced in a high-intention treatment then it must not be induced in a low-intention one).

Besides the contributions to theoretical and behavioral understanding, the results in this study can be put into practice. For instance, since the cost of an action implies kindness intention and induces positive reciprocity, it provides an implication which is similar to -- *sacrificing*; one who sacrifices himself (as a costly action) for the goodness of others will be positively (and hugely) rewarded for his sacrificing with (for instance) fame, power, money, and social position as a -- *hero!* In other words, if you want to be rewarded from your action, others must know that the action is costly and for the sake of their well-beings.

Although the results support that intention induces positive reciprocity, it is still far to conclude that; qualitative study like interview is necessary to deeply explore this question. Moreover, up to this study, at least three aspects of perceived intention have been stated and explored: ability to make a decision (McCabe, Rigdon & Smith 2003, Falk, Fehr & Fischbacher 2008), motivation (Stanca, Bruni & Corazzini 2009), and cost of action in this study; one may come up with a new aspect to be explored. Even one will stick to this study's aspect, one may extend to use other games or to do a filed study. Or even one will stick to the trust game in a lab experiment, one may use the decision method instead of this strategy method or introduce more factors. One interesting extension is to make a second mover can decide $e$ (the amount of material payoffs that the second mover returns back) instead of fixing it; unlike this study that measured reciprocity qualitatively (0 = take and 1 = reciprocate), the extension may draw a picture that how the intention affects $e$ and make reciprocity to be measured quantitatively.

It is worth to make notes on weakness of the material-payoff approach. Changing material-payoff structure is likely to unexpectedly introduce confounds. One must concern this important weak point for -- *a clean experiment*.

## End notes

1. Stanca, Bruni and Corazzini (2009) defined a new factor named motivation but, in the article's model, the motivation and intention are closely related; hence the effects of motivation and intention can be aggregated into only intention.

2. According to the Thai law, in year 2011, the minimum wage per day in Bangkok was 215 baht which was equal to about 20 baht/hour (1 day = 12 work hours).

3. In any reciprocity-related model, the first player's utility function is simply expressed as $\widetilde{u_1} = m_1 + \emptyset_1 r_1$, and vice versa for the second player. The function models the first mover who derives his utility from a weighted sum between his material payoff $m_1$ and reciprocal payoff $r_1$ by having the reciprocal parameter (which this study calls it "kindness intention")

$\emptyset_1 \geq 0$ as the relative weight; this is the common feature of expressing reciprocity-related models in previous studies, while the difference of each study's model is how the study expressed $r_1$. For examples, the *altruism* is expressed $r_1 = m_2$; the reciprocity model by Dufwenberg and Kirchsteiger (2004) is expressed $r_1 = P_1 G_1$ where $P_1$ is the first player's kindness-perceiving function and $G_1$ is the player's kindness-giving function; the reciprocity model by Falk and Fischbacher (2006) is expressed as $r_1 = \widehat{\emptyset_2}\widetilde{P_1}\widetilde{G_1}$ where $\widehat{\emptyset_2}$ is the intention factor (which this study calls it "perceived intention"), and $\widetilde{P_1}$ and $\widetilde{G_1}$ are the kindness-perceiving and kindness-giving functions respectively (but the functions are defined differently from the Dufwenberg and Kirchsteiger (2004)'s model).

4. $\alpha$ is equivalent to the *first-order belief* in the context of psychological game. See Geanakoplos, Pearce and Stacchetti (1989).

5. Since game theory has an intrinsic assumption that form of each player's utility function is publicly known (but individual parameter like type is still private information), everybody can exploit this public knowledge and access to each player's best response function.

6. Similarly, if we consider how the first mover perceives the second mover's kindness intention, $\widehat{\emptyset_2} = E[\emptyset_2|a_2]$; the first mover does not know $a_2$ hence he uses his expectation that $a_2 = \alpha$. Since applying $\widehat{\emptyset_2} = E[\emptyset_2|a_2 = \alpha]$ instead of the normalization (which $\widehat{\emptyset_2} = 1$) does not affect the Lemma 1 and the following analysis, we will continue applying $\widehat{\emptyset_2} = 1$ for simplicity.

7. We conclude that the relationship is weak since it is possible that the distribution function has some ranges $[\delta_1, \delta_2] \subseteq \mathbb{R}_+$ which $\int_{\tau(\delta_1,\alpha)}^{\tau(\delta_2,\alpha)} \emptyset_1 dF(\emptyset_1|C) = 0$.

8. Hypotheses H3 and H4 is logically equivalent: $A \rightarrow B \equiv \sim B \rightarrow \sim A$ where $A =$ reciprocate in low intention treatment, $B =$ reciprocate in high intention treatment, and $\sim =$ not ($\sim A =$ take in low intention treatment). But, to test each hypothesis, measurement methods are different.

9. See Fehr and Schmidt (1999).

10. See Dufwenberg and Kirchsteiger (2004).

11. For more detail about the strategy method, see Stanca, Bruni and Corazzini (2009).

12. See Charness and Rabin (2002).

13. Normally, the second mover prefers a choice that $m_2 > m_1$ (advantage) to $m_2 < m_1$ (disadvantage); this effect is called "*competition*". See Bolton and Ockenfels (2000) for more detail.

14. See Bhirombhakdi (2011).

15. H3 - H4 are one-sided hypotheses, hence we use one-tailed p-values.

## Acknowledgment

Thank *The 90th Anniversary of Chulalongkorn University Fund (Ratchadaphiseksomphot Endowment Fund)* for support fund. Thank Ratinan Boonklurb, Chawarote Wallayamaytee and Yanapon Musiket for comments.

## References

Bhirombhakdi, K 2011, 'Performance of a reciprocity model in predicting a positive reciprocity decision', *Proceedings of the International Conference on Management, Economics and Social Sciences (ICMESS'2011)*, pp. 504-8.

Bolton, GE & Ockenfels, A 2000, 'ERC: A theory of equity, reciprocity, and competition', *The American Economic Review*, vol. 90, no. 1, pp. 166-93.

Bolton, GE & Ockenfels, A 2005, 'A stress test of fairness measures in models of social utility', *Economic Theory*, vol. 25, no. 4, pp. 957-82.

Charness, G & Rabin, M 2002, 'Understanding social preferences with simple tests', *The Quarterly Journal of Economics*, vol. 117, no. 3, pp. 817-69.

Cox, JC & Deck, CA 2005, 'On the nature of reciprocal motives', *Economic Inquiry*, vol. 43, no. 3, pp. 623-35.

Dufwenberg, M & Kirchsteiger, G 2004, 'A theory of sequential reciprocity', *Games and Economic Behavior*, vol. 47, pp. 268-98.

Falk, A & Fischbacher, U 2006, 'A theory of reciprocity', *Games and Economic Behavior*, vol. 54, pp. 293-315.

Falk, A, Fehr, E & Fischbacher, U 2003, 'On the nature of fair behavior', *Economic Inquiry*, vol. 41, no. 1, pp. 20-6.

Falk, A, Fehr, E & Fischbacher, U 2008, 'Testing theories of fairness- Intentions matter', *Games and Economic Behavior*, vol. 62, pp. 287-303.

Fehr, E & Schmidt, KM 1999, 'A theory of fairness, competition, and cooperation', *The Quarterly Journal of Economics*, pp. 817-68.

Geanakoplos, J, Pearce, D & Stacchetti, E 1999, 'Psychological games and sequential rationality', *Games and Economic Behavior*, vol. 1, pp. 60-79.

McCabe, KA, Rigdon, ML & Smith, VL 2003, 'Positive reciprocity and intentions in trust games', *Journal of Economic Behavior and Organization*, vol. 52, pp. 267-75.

Morrison, WG & Rutström, E 2002, 'The role of beliefs in an investment game experiment', *Mimeo, University of South Carolina*.

Stanca, L, Bruni, L & Corazzini, L 2009, 'Testing theories of reciprocity: Do motivations matter?', *Journal of Economic Behavior and Organization*, vol. 71, no. 2, pp. 233-45.

# Appendix

## Surprised effect and positive reciprocity

This section aims to re-analyze the signalling model presented in section 3.2 to explain the Geanakoplos, Pearce and Stacchetti (1989)'s idea, the surprise effect -- unexpected costly decision can induce reciprocity. According to (2), before the game will start, the second mover know that the first mover who has kindness intention $\emptyset_1$ greater than the critical value $\tau(\delta,\alpha)$, $\emptyset_1 \geq \tau(\delta,\alpha)$, will continue $C$ the game, then he can utilize this knowledge to form his prior expectation on observing that a first mover will continue by $E[C|\tau(\delta,\alpha)] = \int_{\tau(\delta,\alpha)}^{\infty} dF(\emptyset_1)$ where $F(\emptyset_1)$ is the prior distribution function over the first mover's kindness intention. Equivalently, $E[C|\tau(\delta,\alpha)]$ is the percentage of the first mover who will continue the game. And, according to Lemma 1 that $\tau(\delta,\alpha)$ is increased in the cost of continuing $\delta$, the more $\delta$ is the less $E[C|\tau(\delta,\alpha)]$.

The surprise effect occurs when the game is played and the second mover observes the first mover's continuing. Observing the first mover's continuing updates the second mover's expectation $E[C|a_1 = C] = 1$; comparing between the prior expectation and the updated expectation implies how much the second mover is surprised or the surprise effect $S$.

DEFINITION 3 The surprise effect from observing the first mover's continuing is measured by $S = 1 - E[C|\tau(\delta,\alpha)]$.

Since the surprise effect $S$ is closely related to the perceived intention $\widehat{\emptyset_1}$. The relationship is as following:

REMARK 1 The more $S$ is the more $\widehat{\emptyset_1}$.

Equivalently we can say that the less prior percentage of the first mover who will continue $E[C|\tau(\delta,\alpha)]$ is the more perceived intention from continuing.

To support the relationship between the prior expectation and perceived intention, here some discussions are; if you expect that a costly decision should not be made, observing that the decision is made implies the decision maker's intention of doing so; Or, like what Falk and Fischbacher (2006) proposed that perceived intention increases perception to kindness, we normally perceive kindness from an unexpected costly decision, that gives us favours, more than an expected one.

Since the Definition 3 makes a link between the surprise effect and perceived intention, we can get the Proposition 1 and 2 that equivalently implies that an unexpected costly decision can induce reciprocity; hence our task is accomplished.