

TRUCK, BARTER, AND EXCHANGE: AN EMPIRICAL INVESTIGATION OF RECIPROCITY IN ONLINE P2P BARTER MARKETS

Research-in-Progress

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Abstract

This study provides the first attempt to study the emerging online peer-to-peer (P2P) barter markets, in which individuals trade goods or services without the use of money. Using detailed transaction data from a leading P2P barter marketplace for books, we examine how the norm of reciprocity affects transaction outcomes. We find that although the barter marketplace is designed under the norm of indirect reciprocity, market participants also exhibit a strong preference towards direct reciprocity. We further find that both indirect reciprocity and direct reciprocity affect transactions, but in different ways. While both forms of reciprocity help improve the probability of success of a transaction, only direct reciprocity helps facilitate the fulfillment speed of a transaction. We also provide evidence that direct reciprocity is favored for exchanging rare goods. We discuss the implication of our findings for the design of P2P barter marketplaces.

Keywords: Reciprocity, barter, peer-to-peer, online market, information asymmetry

“The propensity to truck, barter, and exchange one thing for another... is common to all men, and to be found in no other race of animals... Nobody ever saw a dog make a fair and deliberate exchange of one bone for another with another dog.”

-Adam Smith (1776)

Introduction

Barter, defined as the exchange of goods or services without money changing hands, has been used throughout the world for centuries since its introduction in pre-historic times. This most primitive form of trade incurs higher transaction costs than monetary transactions for three major reasons. First, in a direct barter market, a trader who has apples but wants bananas must wait until someone willing to give up bananas for apples shows up. This search for “double coincidence of wants” is more expensive than the combination of a search for a buyer who will pay money for apples and then search for a seller of bananas (Heller and Starr 1976; Jevons 1985). Second, fiat money has virtually zero storage and transfer cost, making its exchange for goods less costly than the exchange of goods for goods (Freeman 1989). Third, each trader has private information about own-produced goods due to social specialization. This information asymmetry can incentivize the trader to produce low-quality products and take advantage of uninformed trading partners (Kim 1996). Fiat money, whose value is identifiable by every trader, reduces the information acquisition cost needed to mitigate the moral hazard and adverse selection problems in the exchange of goods (Banerjee and Maskin 1996; Brunner and Meltzer 1971). As a result, money has emerged from an evolutionary process as the predominant medium of exchange in modern society.

However, recent developments in Internet and Web 2.0 technologies have greatly reduced transaction costs associated with barter transactions. Online markets overcome geographic constraints, connect individuals from all over the world, and allow them to search for potential trade partners easily and at a nearly zero cost. Virtual currency, which usually has all of the characteristics of fiat money such as zero storage and transfer cost (Yamaguchi 2004), can be used as the medium of exchange in online barter markets. Online reputation systems, which help communicate product and trading partner quality and promote trust among buyers and sellers, have proved to be effective in reducing information asymmetry and the “lemons” problem (Dellarocas 2003). Moreover, Web 2.0 technologies enable individuals to self-organize quickly around specific interests, collaborate with each other, and build social relationships. The desire of belonging to an online social community and the benefit of sharing resources provide incentives for individuals to participate in online barter. Because like-minded people are already gathered together in a product-specific barter market for the purpose of exchange rather than profit maximization, transactions can be more fun and cost-effective than transactions in traditional monetary markets. In addition, online barter markets allow individuals to trade non-liquid goods which are hard to sell in traditional monetary markets. Due to reduced transaction costs, increased social networking supports, and the relative advantages of product-specific barter markets over monetary markets, the past four years have witnessed the growth of various online peer-to-peer (P2P) barter marketplaces. For example, there are barter marketplaces focused on books such as Paperbackswap.com and Swap.com, marketplaces focused on clothes such as thredUp.com and RehashClothes.com, marketplaces focused on music and movies such as SwapCD.com and SwapDVD.com, marketplaces focused on housing such as HomeExchange.com, and marketplaces open to anything such as BarterQuest.com. These IT-enabled barter markets might eventually replace the traditional money system (Friedman, 2001; Stodder 2009).

Our study is the first one to systematically examine this emerging trading model--online P2P barter markets. Traditional electronic marketplaces are based on the monetary system that operates under the maxim “money buys goods and goods buy money; but goods do not buy goods” (Davidson 1972). Because money is a universally accepted medium of exchange, sellers can use the money from selling goods or services outside the electronic marketplace. However, barter markets operate under the norm of reciprocity. There are two major forms of barter: direct barter and indirect barter (Oh 1989; Rice 2003). Direct barter is the exchange of one good from one party for another good from the other party, and is therefore guided by direct reciprocity. Indirect barter involves the use of an intermediary good such as gold. In indirect barter marketplaces, one good from one party is given to the second party in exchange for the intermediary good, and afterwards the intermediary good can be used by the first party to exchange for another good from a third party. Because the intermediary good gained from giving a good is usually

valuable only in the same marketplace, rational good holders who give up the good and do not receive a good in turn immediately are expecting indirect reciprocity: they will benefit from somebody else who will do the same in the future. The norm of reciprocity, either direct or indirect, is a necessity in online P2P barter marketplaces but is not a requirement in traditional electronic marketplaces.

Our study seeks to understand how the norm of reciprocity affects transaction outcomes and market efficiency in online P2P barter marketplaces. Using detailed transaction data from a leading online P2P indirect barter marketplace, we show that even though the barter marketplace is designed under the norm of indirect reciprocity, market participants exhibit a strong preference towards direct reciprocity in order to improve transaction outcomes. We further show that indirect reciprocity and direct reciprocity play different roles: both indirect and direct reciprocity help improve the probability of success of a transaction; but only direct reciprocity helps facilitate the fulfillment speed of a transaction. We also provide evidence that direct reciprocity is favored for exchanging rare goods. Whereas many studies have examined direct reciprocity and indirect reciprocity separately in explaining cooperative behavior among humans (e.g., Berg et al. 1995; Fehr et al. 1998), our study is among the first to empirically examine how indirect reciprocity and direct reciprocity might coexist and be utilized by individuals differently in online markets.

The rest of the paper is organized as follows. Section 2 presents the theoretical motivation and review of relevant literature. Section 3 describes the research context. Section 4 presents the preliminary data analyses and results. Section 5 presents the ongoing research and concludes.

Literature Review

Previous research on bartering falls into two major streams. The first stream of research focuses on macroeconomics of the barter market and concludes that barter markets are in general less efficient than monetary markets (e.g., Banerjee and Maskin 1996; Brunner and Meltzer 1971; Freeman 1989). The second stream of research focuses on barter practice among firms and provides theoretical justifications for the use of bartering by firms as a tool for price discrimination (Magenheim and Murrell 1988), screening different buyers (Guriev and Kvasov 2004; Prendergast and Stole 2001), and collateralizing trade credits under financial constraints (Marin and Schnitzer 2005).

Despite the justification of barter practice among firms, there is little research on barter among individuals. Our study seeks to bridge this gap. As discussed earlier, the backbone of P2P barter marketplaces is the norm of reciprocity. The study on reciprocity traces back to earlier evolutionary biology research on cooperation in animals and other species. Several theories have been proposed to explain the evolution of cooperation behavior. The theory of reciprocal altruism (or direct reciprocity) posits that species engage in bilateral cooperation in pursuit of net benefits from the other party (Trivers 1971). The theory of indirect reciprocity posits that species helping others build a reputation or image score for themselves. This positive signal allows them to benefit from others in larger groups in the future (Nowak and Sigmund 2005; Zahavi 1995).

The theory of direct reciprocity to explain human behavior by evolutionary biologists is echoed by behavioral experiments in economics. Berg et al. (1995) design an investment game to study reciprocity among individuals. In the investment game, subjects in room A decide how much of their \$10 in hand to send to an anonymous counterpart in room B. Subjects are informed that the amount being sent will be tripled when it reaches room B. Then the anonymous counterpart in Room B decides how much of the tripled endowment to give back to the donor in room A. Whereas standard economic theory assuming self-interest and rationality predicts that subjects in room A should send zero amount, Berg et al. (1995) find that over 90% of the subjects in room A send some money in the expectation of a positive return. Other researchers conduct various lab experiments and confirm that direct reciprocity contributes to human cooperation (e.g., Charness 2004; Fehr et al. 1998; Kirchler et al. 1996). The conflict between observed direct reciprocation behavior and the hypotheses of self-interest and rationality can be explained by evolutionary game theory. According to evolutionary game theory, more successful strategies will survive and less successful ones will be washed out (Sethi and Somanathan 2003). Although self-interested individuals can gain more by defecting (i.e., not reciprocate), humans have evolved mental algorithms for identifying and punishing cheaters (Hoffman et al. 1998). Guth et al. (1982) and Ochs and Roth (1989) find that individuals are willing to punish opportunists even when it is costly. Therefore, self-

regarding cheating is unstable in the presence of preference towards reciprocal cooperation in the long run and reciprocity dominates as a norm during the evolutionary process (Sethi and Somanathan 2001).

Besides direct reciprocity (if you scratch my back, I will scratch yours), indirect reciprocity (if I scratch your back, somebody else will scratch mine) also proves to be important in explaining helping and cooperation. Indirect reciprocity is implemented via image scoring and is also evolutionarily stable (Nowak and Sigmund 2005). Individuals build image scores by helping others and a higher image score leads to higher probability of being helped by a third party. Seinen and Schram (2006) design a repeated helping game in which two subjects are randomly matched and randomly assigned the role of donor and recipient followed by the donor's decision to whether help the recipient or not. They find that the probability that the donor help increases as the recipient's image score built from her behavior as a donor increases, providing support for indirect reciprocity. Engelmann and Fischbacher (2009) posit that indirect reciprocity can be either strategic or pure. Image scoring provides incentives for individuals to strategically build image scores by helping others in the expectation of net positive benefits in the long run. In pure indirect reciprocity, donors are more willing to help recipients with a higher image score even when image scoring on the donor's side is disallowed. They further conduct the repeated helping game and find support for both pure indirect reciprocity and strategic indirect reciprocity.

Several other studies compare the direct reciprocity mechanism with the indirect reciprocity mechanism to see which one induces more cooperation but fail to reach conclusive results. Dufwenberg et al. (2001) conduct a revised version of Berg et al. (1995)'s investment game and find that the average amount of donation under indirect reciprocity is only insignificantly smaller than the donation under direct reciprocity. However, Guth et al. (2001) show that compared with direct reciprocity mechanism, indirect reciprocity induces substantially reduced amount of donations. On the contrary, Stanca (2009) conduct similar experiments and find that indirect reciprocity has a significantly stronger effect on donation than direct reciprocity.

In the sociology literature, reciprocity is regarded as one of the fundamental norms underlying social exchange wherein resources are transacted among individuals (Gouldner 1960). Network exchange theory and social exchange theory are two complementary theories that have been proposed to explain individual behaviors and interpersonal relations in social exchange processes. Whereas network exchange theory primarily focuses on individuals' positions and power issues in a network context, social exchange theory primarily focuses on individuals' actual interactions and the consequences of relationships (Faraj and Johnson 2010). According to network exchange theory, individuals deliberately choose partners by carefully evaluating their resources and the possibility of reciprocation before engaging in an exchange relationship (Willer 1999). This indicates that exchange outcomes are directly related to reciprocity. Because P2P barter markets are often specialized in particular types of goods (e.g., books), individuals typically share similar long-term interests in the particular types of goods. As a large number of individuals are interacting with each other in the P2P barter market, they may start to repetitively transact with certain fixed partners after some time of learning. In addition, barter can be seen as a subtype of gift exchange (Bell 1991), which gives rises to psychological contracts between the giver and the receiver (Davis 2009; Schein 1965). A psychological contract is an individual's belief in mutual obligations between herself and another party and is formed under the norm of direct reciprocity (Coyle-Shapiro and Kessler 2002; Dabos and Rousseau 2004). Psychological contracts exist between buyers and sellers in online markets and affect their transaction decisions (Pavlou and Gefen 2005). Therefore, both indirect reciprocity and direct reciprocity could arise in online barter markets and affect transaction outcomes.

According to social exchange theory, indirect reciprocity involves higher risk than direct reciprocity, because individuals are dependent on the actions of multiple others from whom they cannot directly benefit, with risk increasing in proportion to the length of the chain (Molm et al. 2007). In addition, due to the lack of ability to directly reward or punish a trusting or non-trusting partner in indirect reciprocity, the amount or quality of reciprocation is expected to be lower in indirect reciprocity than in direct reciprocity (Buchan et al. 2002). However, other researchers like Bearman (1977) and Takahashi (2000) argue that the value of reciprocity should not be sensitive to its form: once an individual takes resources, she is obligated to return them to someone in the future. From these two conflicting arguments, it is unclear whether direct reciprocity and indirect reciprocity lead to differential outcomes in online P2P barter markets. While previous empirical studies examine settings that allow only one of the two forms of reciprocity, or treat them separately in the experimental settings, we will study direct reciprocity and

indirect reciprocity simultaneously in a real online P2P barter market and examine whether they lead to differential outcomes.

Research Site

We collect data from a leading online P2P barter marketplace for books. Although most of the market participants are from the United States, the site is open to individuals from all over the world. More than 1000 books are bartered every day. The market is an indirect barter market based on an intermediary good called “point”. Every book request costs the requestor 1 point (or 3, if book owner resides in another country). Every book given away earns the giver 1 point (or 3, if it is sent overseas). Book owners add books they have to their inventory lists. Individuals can also add books they want into their wishlists. Both the inventory list and the wishlist of an individual are available for others to see.

Similar to eBay, the market allows book requesters and book givers to rate each other. Each market participant has an overall feedback score equal to the number of positive feedbacks minus the number of negative feedbacks. A user can also give her partner an additional special praise -- publicly visible thanks plus 1 point donated to the partner--after a satisfactory transaction. In addition, a number of other indices regarding the user’s giving and receiving history such as the number of books reported by the book requester as lost in the mail, and the number of rejections to others’ requests, are also publicly displayed in every participant’s profile page. These serve to signal each participant’s image score reflected in previous barter performance. This provides a basis for indirect reciprocity, wherein one person’s kind or hostile acts to another person are rewarded or punished by a third party.

Detailed transaction data from January 1st 2009 to March 8th 2011 in the barter market is collected. More than 1.5 million transactions among more than 50,000 users are traded during the period.

Preliminary Results

Does Direct Reciprocity Exist?

We first examine the transaction patterns based on historical data from January 2009 to October 2010. We find that about 40% of individuals directly reciprocate with some partners (i.e., give books to each other) while not reciprocating with others (i.e., transactions between the two parties are only in one direction; this is an indirect reciprocal tie). Clearly, individuals engage in both indirect reciprocity and direct reciprocity. We then compare an individual’s reciprocal partners with her non-reciprocal partners. We focused on 4048 active book traders who have transacted with at least 10 other (unique) individuals¹. The results are shown in Table 1. One major difference between reciprocal partners and non-reciprocal partners of a given individual is that reciprocal partners are more similar to the focal individual in book tastes than her non-reciprocal partners². Indeed, two users with similar tastes are more likely to be reciprocal simply because one party is more likely to have the book the other party wants. Therefore, in the next section we will use taste similarity as a proxy for possibility of future direct reciprocity.

We also observe that books transacted with reciprocal partners are rarer (i.e., more wanted) and significantly likely to be delivered sooner than books transacted with non-reciprocal partners. These results seem to suggest that direct reciprocity affects transaction outcomes. We next examine if individuals take direct reciprocity into consideration when making transaction decisions.

¹ Analyzing all individuals who had both reciprocal and non-reciprocal partners yields similar results.

² Similarity in book tastes is measured using the cosine similarity index based on book categories (Salton et al. 1975). The categorization of books is provided by the site and is consistent with Amazon’s. The calculated similarity index is very similar regardless if it is based on inventory list or wishlist or both. Using other similarity indexes such as the Jaccard index (Tan et al. 2005) yields consistent results. Also, measuring similarity based on books’ detailed topics yields consistent results. For simplicity, we only report the cosine similarity measure based on individuals’ inventory lists.

Table 1. Reciprocal Partners vs. Non-Reciprocal Partners

	Reciprocal	Non-Reciprocal	T-test
Similarity in book tastes between the individual and the partner	0.78	0.75	15.93***
How long the partner has joined the market	864.16	869.73	-1.53
Whether the partner has a bio	0.59	0.58	0.89
Whether the partner has a photo	0.43	0.43	0.09
Whether the partner has a homepage	0.16	0.19	-5.97***
Whether the partner is a librarything.com user	0.24	0.24	0.35
Book rareness: demand (number of appearances in the wishlist) to supply (number of appearances in the inventory list) ratio	1.14	0.82	15.59***
Book delivery speed (number of days)	6.81	7.03	-2.27*

*p<0.05, **p<0.01, ***p<0.001

Does Reciprocity Affect Transaction Outcomes?

In the marketplace, a transaction goes through three steps: the book requester initiates the request, the book owner (or book giver) decides whether to accept or reject the request, and then the giver mails the book if the request is accepted. We examine how reciprocity might affect each step of the transaction process. We consider two types of direct reciprocity: immediate direct reciprocity and future direct reciprocity. Immediate direct reciprocity is measured by a dummy variable (*if_pending*) to indicate whether the book owner also has a book to receive from the book requester. Future direct reciprocity is the probability of the book owner receiving a book from the book requester in the future and is measured by similarity in book tastes between the book requester and the book owner (*taste_similarity*). Both forms of direct reciprocity might incentivize the book owner to accommodate the book requester. Indirect reciprocity is measured by various publicly visible image scores, including feedback score (*num_score*), number of rejections to others' requests (*num_reject*), number of books sent but reported as lost in the mail (*num_lost*), number of special praises received from others (*num_praiseIn*), and number of special praises given to others (*num_praiseOut*). We will also control for individual characteristics and other variables such as how many days have passed since the user's last activity in the market (*last_login*; this variable is logarithmized), whether the user has a bio (*if_bio*), whether the user provides a photo of herself (*if_photo*), whether the user provides a link to her web homepage (*if_homepage*), whether the user is also a member of librarything.com (*if_librarything*), whether the two parties are friends in the marketplace (*if_friend*), whether the two parties are in the same country (*if_same_country*), and number of other people besides the focal book owner who also hold the book (*num_alt_choices*). Variables on the requester side are marked with prefix "r_" and variables on the book giver side are marked with prefix "g_". Due to space limitation, descriptive statistics are not presented but available upon request.

In our preliminary analysis, we randomly choose 4-week data scattered in different months, ranging from November 21st 2010 to January 29th 2011. We observe the status of these transactions on March 8th 2011. 3441 transactions are cancelled, 1999 transactions are rejected, and 40543 transactions go through. We first examine how book requesters choose book givers. For this analysis, we consider 14443 transactions with multiple choices of potential givers at the time of request. Because each book requester faces different choice sets, the conditional logit model is used to estimate the marginal effect of each attribute of choices given an individual's specific choice sets. The dependent variable is whether a book owner is chosen by the book requester or not (*if_chosen*). The results are shown in Table 2. In Model I, we only use one image score *num_praiseIn* which we believe is the best proxy for indirect reciprocity. Its coefficient is significantly positive. This indicates that book owners with higher image scores indicated by more special praises received are more likely to be chosen. This provides support for indirect reciprocity: it is easier for individuals with higher image scores to "sell" their books. Immediate direct reciprocity proves to be a significant predictor of book owner choice. Meanwhile, book requesters have tendencies to choose book owners that share more similar book tastes, in the hope that book owners will consider possible future requests from them and accommodate their current requests. As a robustness check, in Model II we include other image score measures into the regression. There is no multicollinearity among the independent variables as the maximum VIF is 2.77, well below the threshold of 10. All the image score

measures are significant and in the predicted direction. Therefore, in our following analyses we will only use the variable *num_praiseIn* to measure indirect reciprocity.

Table 2: Conditional Logit Model: Choice of Book Owners

	Model I		Model II		Model III	
	β	p-value	β	p-value	β	p-value
<i>g_num_praiseIn</i>	0.012***	0.000	0.006***	0.000	0.014***	0.000
<i>if_pending</i>	0.378***	0.000	0.386***	0.000	0.386***	0.000
<i>taste_similarity</i>	0.819***	0.000	0.810***	0.000	0.770***	0.000
<i>if_same_country</i>	3.948***	0.000	3.957***	0.000	3.982***	0.000
<i>if_friend</i>	1.301***	0.000	1.269***	0.000	1.322***	0.000
<i>g_last_login</i>	-0.144***	0.000	-0.155***	0.000	-0.142***	0.000
<i>g_if_bio</i>	0.139***	0.000	0.132***	0.000	0.151***	0.000
<i>g_if_photo</i>	0.199***	0.000	0.184***	0.000	0.189***	0.000
<i>g_if_homepage</i>	-0.051	0.220	-0.026	0.526	-0.020	0.640
<i>g_if_librarything</i>	-0.085*	0.014	-0.087*	0.012	-0.098*	0.006
<i>g_num_score</i>			0.000***	0.000		
<i>g_num_reject</i>			-0.002***	0.000		
<i>g_num_lost</i>			-0.004*	0.027		
<i>g_num_praiseOut</i>			0.001*	0.024		
<i>rareness*if_pending</i>					0.036	0.585
<i>rareness*taste_similarity</i>					-0.077	0.822
<i>rareness*g_num_praiseIn</i>					-0.002	0.074
Obs.	109305		109305		105243	

*p<0.05, **p<0.01, ***p<0.001

Note: the smaller number of observations in Model III is due to missing rareness measure for some books.

A book requester's choice of book owners might be affected by the rareness of the book. For example, for a rare book, the book requester might exert more caution to successfully obtain it as soon as possible when competing with other individuals who want the same book. To examine whether book rareness affects a book requester's emphasis on reciprocity when choosing book owners, we introduce three interaction terms into the regression as shown in Model III. None of them are significant. In an unreported analysis, we also partition the sample into two subsamples based on the rareness of the requested book: high-demand subsample with each book's demand-to-supply ratio within the top 25% quantile and low-demand subsample with each book's demand-to-supply ratio within the bottom 25% quantile. We run Model I and find significances of direct reciprocity and indirect reciprocity in both subsamples. These results suggest that in general an individual relies on reciprocity to choose transaction partners regardless of the rareness of the book.

We then examine how book owners make decisions on whether to reject a transaction request or not. We construct a panel data of the 42542 transaction requests for 8729 book owners which are not cancelled. The logit regression model is employed. The dependent variable is *if_rejected*, with 1 indicating rejecting the request and 0 denoting acceptance. We try both the fixed effects logit model and the random effects logit model. Hausman test is conducted to decide which model is more appropriate (chi-square=56.45, p-value=0.000). We reject the null hypothesis that the random effects model is preferable over the fixed effects model. Therefore, the fixed effects logit model is used and the results are reported in Table 3. Multicollinearity is not a concern because the maximum VIF is 1.36. Requests from individuals who reside

within the same country as the book owner are less likely to be rejected. This indicates that book owners care about the delivery cost. Measures of direct reciprocity and indirect reciprocity are in the expected direction but not significant. Reciprocity does not seem to affect the book owner's decision on whether to accept a request or not. Given that book requesters deliberately choose the book owner with higher images scores or higher direct reciprocity (whether it is immediate or future), it is not surprising that the rejection rate is low (about 4%) and we do not observe an effect of reciprocity on rejection decision.

Table 3: Fixed Effects Logit Model: Decision on Transaction Requests

	β	p-value
<i>r_num_praiseIn</i>	-0.002	0.210
<i>if_pending</i>	-0.698	0.157
<i>num_alt_choices</i>	0.004	0.390
<i>taste_similarity</i>	-0.109	0.703
<i>if_same_country</i>	-0.809***	0.000
<i>if_friend</i>	-0.031	0.911
<i>r_if_bio</i>	0.142	0.115
<i>r_if_photo</i>	0.001	0.986
<i>r_if_homepage</i>	0.049	0.660
<i>r_if_librarything</i>	-0.090	0.380
Obs. ³	8421	

*p<0.05, **p<0.01, ***p<0.001

Table 4: Censored Normal Regression: Decision on Delivery Speed

	β	p-value
<i>r_num_praiseIn</i>	-0.002	0.095
<i>if_pending</i>	-4.790*	0.009
<i>taste_similarity</i>	-2.110*	0.047
<i>if_same_country</i>	-5.580***	0.000
<i>if_friend</i>	-4.180***	0.000
<i>g_num_to_send</i>	-0.448***	0.000
<i>r_if_bio</i>	-0.776	0.115
<i>r_if_photo</i>	1.677	0.109
<i>r_if_homepage</i>	1.608	0.077
<i>r_if_librarything</i>	-0.543	0.301
Obs.	37127	

*p<0.05, **p<0.01, ***p<0.001

Note: 3416 observations are excluded because of missing value for *taste_similarity*.

³ Because the fixed effects model focuses on within-group variation, observations of individuals who never reject or always reject are dropped from the model. This explains why the number of observations in Table 3 is only 8421.

Despite the rare occasions of rejecting a transaction request, book owners might still discriminatorily fulfill the need of a book seeker based on reciprocity. We next examine how book owners decide on delivery speed after accepting a request. For the 40543 answered transaction requests, 5961 requests are accepted but not yet delivered by March 8th 2011. The delivery speed is reversely measured by the interval in days between the request date and the shipping date (*speed_days*). This dependent variable is right censored at different points depending on when the transaction is initiated. Therefore, the censored normal regression model which allows different censoring points is employed. Individuals might send books in batches. To capture this possible batch-sending habit, we introduce another variable *g_num_to_send*, which measures the number of other books also to be sent by the book owner before sending the focal book. The results are shown in Table 4. The batch-sending habit is supported by the significantly negative coefficient of *g_num_to_send*. Both immediate direct reciprocity (*if_pending*) and future direct reciprocity (*taste_similarity*) significantly facilitate delivery speed. However, the image score of the requester (*r_num_praiseIn*) is insignificant, indicating that book owners do not reward book requesters with higher image scores by sending out books faster. This suggests that only direct reciprocity motivates book owners to deliver requested books sooner.

Conclusion and Ongoing Research

The developments in Internet and Web 2.0 technologies have brought about significant transformation in how business transactions are conducted as well as in the day-to-day lives of individuals. The emergence of P2P bartering serves as one vivid example that highlights such transformation. This study is one of the very first attempts to examine this emerging market. We find that participants in P2P indirect barter marketplaces exhibit a strong preference towards direct reciprocity even though indirect reciprocity is assumed to be prevalent. More interestingly, we find that market participants utilize indirect reciprocity and direct reciprocity differently. Whereas both indirect reciprocity and direct reciprocity are used to facilitate a transaction to go through, service levels are higher in instances where there is immediate direct reciprocity or the potential for future direct reciprocity. We also find evidence of rarer books being more frequently traded among partners with direct reciprocal relationships.

Our study suggests that reciprocity helps mitigate the information asymmetry problem in online markets. Individuals rely on reciprocity to make transaction decisions and ensure transaction quality. Therefore, online barter markets should increase the visibility of reciprocity by tracking, recording and publicly displaying every individual's past and current interactions. Also, policies that help facilitate the norm of reciprocity, such as disallowing anonymity and encouraging individuals to establish friendships in the market, among others, will be beneficial to the governance of online barter markets. In addition, the observed preference towards direct reciprocity for rarer books suggests that a recommendation system which intelligently recommends potential transaction partners based on similarity will benefit market participants by significantly reducing their search costs.

The current study can be extended in three major ways. First, the price of each book from Amazon.com is available in the barter market in this study only after early November 2010. This exogenous change offers a natural experiment setting to examine how the norm of reciprocity might interact with information provision to influence individual behavior. Second, we have collected data on individuals' web browsing histories in the barter market and their book purchase histories on Amazon.com through the barter site. Relevant analyses will be conducted to examine how individuals choose between online barter markets and traditional electronic markets such as Amazon.com and how the decision might be related to the quantity and quality of their reciprocal ties. Third, online barter markets are also online social communities wherein individuals who share common interests exchange goods and build social ties. It would be interesting to examine the social interactions between individuals from an online community perspective. These findings together will shed light on the differential roles of direct reciprocity and indirect reciprocity and deepen our understanding of P2P barter markets.

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