The Interplay between Competition and Feedback in Online Trading Networks

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ABSTRACT

Many online markets rely on feedback systems - well known from social networks - to facilitate trust and trustworthiness. However, there is barely any field research on the interplay between competition and feedback systems in online markets. Complex 'naturally occurring' field environments make it difficult to isolate the impact of competition in markets with feedback systems.

This experimental study illuminates the interplay between competition and feedback systems in online markets. It concludes that, overall, competitive online markets with feedback systems improve trust and trustworthiness and thus lead to higher gains-from-trade compared to markets without competition. It shows that feedback information trumps pricing in buyer decisions; while pricing is an important variable in seller trustworthiness.

Key Words: Online Networks, Social Networks, Feedback, Reputation, Competition, Laboratory Experiment

* Bolton gratefully acknowledges the support of the National Science Foundation. Ockenfels gratefully acknowledges the support of the Deutsche Forschungsgemeinschaft.
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INTRODUCTION

Well functioning markets, be they online or brick-and-mortar, must strike a delicate balance between competition and cooperation. On the one hand, competition on factors such as choosing a trading partner or a price is a main driver of the social and business benefits associated with trade. On the other hand, these benefits can be realized only if traders cooperate by making good on the agreement (e.g., delivering the product as promised). It is on this latter score that feedback systems, encouraging trust and trustworthiness among traders, have proven critical (Dellarocas, 2003; Gefen & Straub, 2004).

One advantage of online markets is that they enable traders to break through geographical constraints to trade in larger and more competitive pools (Granados, Gupta, & Kauffman, 2006; Malone, Yates, & Benjamin, 1987). Transactions in online markets tend to be more one-shot, between *strangers (strangers networks)*. For instance, 89 % of all eBay trading encounters are one-shot (Resnick & Zeckhauser, 2002). Trading relies on an indirect flow of feedback information; the buyer does business with the seller if the seller has been reliable with third party buyers. To facilitate trading, many online markets (e.g., Amazon, Cnet, eBay, Half, and Yahoo) have formal feedback systems that allow traders to post evaluations of those they exchange with for the benefit of other traders.[1]

In contrast, brick-and-mortar markets tend to have more repeated exchange between traders with a *partners* relationship giving importance to a direct flow of reputation information *(partners networks)*. For instance, the buyer does business with the seller if the seller has been

1 Brynjolfsson and Smith (2000), Dellarocas (2003), and Resnick and Zeckhauser (2002) provide comparisons of electronic and conventional dissemination of feedback information. There is a large literature showing that feedback mechanisms like those employed by eBay have merit, although feedback information is not fully reliable. In particular, field data and experimental work indicate that reputable Internet sellers are more likely to sell their items (e.g., Resnick & Zeckhauser, 2002) and can expect price premiums (Lucking-Reiley, Bryan, Prasad, & Reeves, 1999); see Bolton, Katok, and Ockenfels (2004a) and Dellarocas (2006) for discussions and surveys.

reliable with the buyer in the past. Partnering to create trust and trustworthiness is known to work well even when there is little legal safety net (McMillan, 2002).

In essence, with the same information, buyers can implement the same strategy (see Bolton & Ockenfels, 2006) independent of the amount of competition in the market. However, in markets with little competition, the volume of completed trade is substantially higher in partners networks than in strangers networks (Bolton, Katok, & Ockenfels, 2004b; this is contrary to reputation building theory, see Kreps & Wilson, 1982).

From this, we develop the following *research question* for this paper:

What kind of interplay between competition and feedback provision develops in anonymous online trading markets that provide feedback about sellers and allow for matching competition for trading partners and for price competition?

We examine laboratory versions of anonymous online markets where sellers have to decide - whether to ship to a trusting buyer or not. Market participants are presented with a series of trading opportunities across a number of rounds. The market encounters are linked over time via feedback systems: Prospective buyers are furnished with feedback information, a complete and accurate record of a seller's past shipping record within the market community. Hence our experiment looks at the performance of feedback systems under ideal conditions. The information flow allows buyers to better decide whether they should trust the seller by buying, and creates incentives for sellers to be trustworthy and shipping.

Our study is organized as follows: It begins by examining strangers and partners networks with no competition. The partners network leads to higher levels of market efficiency than does

the strangers network. This reproduces the main result of Bolton et al. (2004 a). We take this result as a baseline for the rest of the experiment. We then introduce *matching competition* (each buyer gets to choose between two sellers; prices are fixed) and *price competition* (the two sellers compete on prices) to both the strangers and partners networks. The two kinds of competition plausibly have countervailing effects. In markets with matching competition, sellers can only attract buyers on the basis of reputation information. This competitive focus on competition may plausibly lead to more trustworthiness and larger gains-from-trade. Markets with matching and price competition permit buyers to trade-off pricing and reputation in their seller selection (i.e., to take a chance on a seller with a less reputation but also a lower price), which weakens the focus on reputation. This might plausibly destabilize trade.

RESEARCH DESIGN AND DATA COLLECTION

Base Buyer-Seller Game

Our experiments center on a simple buyer-seller game that captures the essence of trading hazard problems as they are present in any online market (see Figure 1). We organize market transactions to take place over a fixed number of rounds. At the beginning of each round, a potential buyer is matched (either exogenously or through selection by the buyer) with a seller.

INSERT FIGURE 1 ABOUT HERE

The buyer chooses whether to purchase an item (in the base game at a fixed price) or not. If not, both sides of the market receive a status quo payoff. If the purchase order is sent, the seller

decides whether to ship or simply keep the buyer's money. On receiving the money from the buyer, the seller has no immediate pecuniary incentive to ship the item. So a transaction that is in the interest of both parties may be thwarted either because the seller proves untrustworthy or because the buyer, given this risk, chooses not to trust.

In the game in Figure 1, both the seller and the buyer are endowed with 35 'francs' (hence the payoff if no trade takes place). The seller offers an item for sale at a fixed price of 35 which has a value of 50 to the buyer. The seller's cost of providing the buyer with the item − costs associated with executing the trade, shipping, handling etc., as well as production costs − is 20.[2] So each successfully completed trade increases efficiency by creating a consumer surplus of 15 and a net profit of 15 for the seller. If the buyer chooses to buy the item, he sends his endowment of 35 to the seller, who then has to decide whether to ship the item. If the seller does not ship, he receives the price plus his endowment of 35 for a total of 70. If he ships, he receives the price minus the costs plus his endowment for a total of 50. If the buyer chooses not to buy the item, no trade occurs. Prior to choosing, the buyer is informed what choice (ship or not ship) the seller has made in each of the prior rounds he was given a chance to do so.

In reputation building theory, as Kreps and Wilson (1982) indicate, such feedback is sufficient to build reputation over the trading rounds. It suggests that reputation building being independent of the interaction pattern in the market, be it stranger sort (one-shot trade) or the partner sort (long-term relationships).

2 These are production costs where either the seller produces the item after he knows the demand, or the product is produced before the buyer's decision is known but costs are not sunk (e.g., when the item can be resold at a price equal to production costs).

Treatments

We examine six different treatments, each associated with specific market institutions (see Table 1). The treatments are organized along two dimensions.

The first dimension is network: *partners* and *strangers network*. While in markets with partners networks a buyer can maintain a cooperative relationship with a single seller, buyers and sellers in strangers networks interact at most once.

The second dimension is competition: *no competition, matching competition,* and *price competition*. In markets with no competition, buyers have no choice with whom they are matched with. Matching competition involves buyers choosing between two sellers on the basis of reputation information only. Price competition involves buyers choosing between two sellers on the basis of feedback information *and* price offers by sellers.

We combine partners and strangers networks with each of the three competition forms, yielding treatments six in total.

INSERT TABLE 1 ABOUT HERE

Investigating Trading without Competition. The two experiments with *no competition* look at the strangers versus partners result as Bolton et al. (2004b) exhibited in a slightly different context.[3] At the beginning of the session, participants are assigned to buyer and seller roles, with an equal number in each role. The roles are fixed for the entire session. Traders interface by computer. Each round, a buyer and seller are matched to play the game as illustrated in Figure 1. A seller's history of actions - ship, no ship, or no buy - is recorded for each round. The entire history is displayed to the buyer with whom the seller is matched. Participants interact

3 Bolton et al. (2004b) had participants rotate between buyer and seller roles, while we fix roles.

in a sequence of two separate experiments of 15 rounds each. Upon completion of the first experiment, all feedback scores are deleted and traders start another experiment with blank records and identical market rules. Comparing behavior in the first and second experiment allows identifying learning trends.

When the market is embedded in a strangers network, no buyer-seller pair interacts more than once (within this constraint, matches were random). In partners networks, the same buyer and seller are matched together for the duration of the entire experiment (but are randomly re-matched after the first and before the second experiment within a session). In both cases, the matching procedure is public information.

Investigating the Impact of Matching Competition. To investigate the impact of matching competition, we modify the basic game from Figure 1 to allow the buyer to choose between two sellers in each round on the basis of feedback histories (as before, the buyer can also choose not to buy at all in the round; see Figure 2).

INSERT FIGURE 2 ABOUT HERE

In the partners network, after the first round, the buyer chooses between the seller he last bought from and a new seller he was not previously matched with. So the buyer can always choose to maintain a longer relationship with a seller; but in each new market period, he can also switch to match a new seller. Matching competition in the partners network does not necessarily imply a partners relationship, but it gives buyers the opportunity to build one.

In the corresponding strangers network, however, partner relationships cannot be developed. Here, after the first round, the buyer chooses between the seller he was last matched with but did not buy from and a new seller he was not previously matched with. So buyers cannot do repeated business with the same seller. They always have to choose between two sellers they have not selected previously. In all sessions for these two experiments with matching competition, two thirds of the participants are assigned roles as sellers and one third is assigned to be buyers. Otherwise the set-up and procedures for these experiments are the same as for the ones without matching competition.

Investigating the Impact of Price Competition. To investigate the impact of *price competition* in strangers and partners networks, we follow the same procedure as above but also allow sellers to post a selling price prior to the buyer choosing between them (see Figure 3).

INSERT FIGURE 3 ABOUT HERE

Sellers are free to set a price anywhere in the range from 0 to 100. As a result, a buyer can choose between two sellers (or not to buy at all) on the basis of both feedback *and* price information. Price competition allows buyers to select sellers according to their reputation profiles as in matching competition, but adds price as an additional dimension of the competition. Otherwise the set-up and procedures for these experiments are the same as for those with matching competition.

Data Collection

In all, 216 subjects participated in the experiments. There were 36 subjects in each one. No subject participated for more than one treatment. The written instructions given to participants (available upon request) describe the protocol for the experiment in detail.

Subjects were students, mostly undergraduates, from various fields of study who volunteered through an on-line recruitment system. Cash was the only incentive to participate. Upon arrival at the laboratory, participants were seated at the computers, separated by partitions. They were then asked to read the instructions. When subjects finished reading, the experimenter read the instructions out loud in order to enter them into public knowledge. To familiarize them with the software, subjects played several practice games, sometimes as buyer sometimes as seller, with the computer in the opposite role making its moves at random.

Once familiar with the interface, subjects played a sequence of two experiments, both of the same condition, and subjects taking the same role in both experiments but trading encounters re-randomized. Payoffs were listed in laboratory 'francs' in the quantities given in Figures 1-3; the francs exchange rate of $0.02 per franc was presented to the subjects in the instructions. Upon completion of the experiment, one of the two experiments played by each subject was chosen at random, and each subject was privately paid his or her earnings for that experiment in cash plus a $5 show-up fee. Total earnings per subject ranged from $5 to $20 with an average of $15.80.

DATA ANALYSIS AND FINDINGS

Subjects engaged in each treatment twice, but there is no evidence of a statistically significant learning trend across the two. For this reason, in the following analysis, we aggregate the data per treatment.

Gains-from-Trade

Figure 4 displays the realized percentage of the maximum achievable gains-from-trade, thus pointing at market efficiency. Table 2 provides the corresponding inferential statistics using Tobit regression analysis.[4]

INSERT FIGURE 4 AND TABLE 2 ABOUT HERE

Figure 4 and Table 2 suggest three main findings:

(1) *In strangers networks, relative to no competition, both matching and price competition increase the total gains-from-trade by about the same amount. Relative to no competition, buyers gain from both types of competition while sellers lose from price competition.*

Relative to the strangers network without competition, the introduction of matching competition significantly increases total gains-from-trade by 41% (=0.237/0.576). The further addition of price competition dampens these gains only by a small, insignificant amount. The total gains from matching and price competition are significantly greater than

4 Tobit estimation accounts for the censored nature of the data. There is no cross effects variable for PRICE and MATCH because, the experiment's design, the former is nested in the latter. For our data, the estimated coefficients are equal to the marginal effects of the individual independent variables. The nonparametric Mann Whitney test, applied pair-wise to treatments, yields results comparable to those presented in Tables 2 and 4. The main advantage of the Tobit analysis is economy of exposition. For a detailed discussion of Tobit regression, see for example, Davidson and MacKinnon (1993).

for no competition (Wald test, two-tailed $p < 0.001$). The gains primarily go to buyers, the significant portion representing a 154% (=0.146/0.095) increase over no competition. Sellers are not hurt by matching competition, but lose significant surplus from price competition, -29% (=-0.126/0.435).

(2) *In partners networks, relative to no competition, matching competition increases the total gains-from-trade; these same gains are erased by the addition of price competition. Relative to no competition, buyers gain from both types of competition while sellers lose from price competition.*

In partners networks, the total gain from adding matching competition is just .075 (=0.237-0.162), but nevertheless weakly significant (Wald, two-tailed $p = 0.056$). There is no significant difference, however, for total gains-from-trade in 'no competition' and 'price competition' markets (Wald, two-tailed $p = 0.195$). It is clear that buyers gain from both matching and price competition while sellers lose (see Table 2). So, competition in partners markets leaves total efficiency little changed (different from strangers networks), but it redistributes trade surplus from sellers to buyers (as in strangers networks).

(3) *Introducing either matching or price competition erases the significant performance gap between strangers and partners networks.*

Absent any competition, the total gains-from-trade in partners networks are 38% (=0.216/0.576) higher than in strangers networks (the coefficient of the partners variable shows the difference to be highly significant). The result can neither be explained by differences in the communication channel between traders (Brosig, Ockenfels, & Weimann, 2002; Daft & Lengel, 1986; Dellarocas, 2005; Rice, 1992) nor by the distances or anonymity between traders (Granovetter, 1973, 1985), since these were kept constant.

With matching competition, however, the total gains-from-trade in partners networks are only 5% (=0.216-0.162) higher than in strangers networks, but not significantly so (Wald test, two-tailed $p = 0.207$).

When adding price competition, the difference completely disappears (Wald test, two-tailed $p = 0.393$). Hence competition erases the gap observed between non-competitive strangers and partners networks.

In the partners network with no competition, it is impossible for the buyer to switch away from the assigned seller partner. In competitive markets, the buyer can and does switch in about every fifth case (19%) under matching competition, and twice as often (42%) under price competition. So, with competition, (voluntary) partners networks look more and more like strangers networks (see Table 3).

INSERT TABLE 3 ABOUT HERE

Trust and Trustworthiness in Online Markets with Feedback and Matching Competition

Figure 5 shows the frequency with which buyers trust their sellers across the rounds. Figure 6 displays the frequency, conditional on receiving a buy, with which sellers are trustworthy and ship across the rounds of the experiment. Table 4 shows the Tobit analysis for the data in Figures 5 and 6.

INSERT FIGURES 5 & 6 and TABLE 4 ABOUT HERE

Both Figures 5 and 6 depict a steep drop in buying and shipping in the final rounds of the experiments. The consistency and magnitude are striking evidence of the strategic nature of trader behavior in these situations: Sellers build feedback and reputation for profit; at the end of the experiment, a good reputation is no longer useful and so they stop. Likewise, buyers largely anticipate this behavior, and in this sense they too are behaving strategically. Figures 5 and 6 and Table 4 suggest two main findings:

(1) In strangers networks, compared to no competition, matching competition increases both trust and trustworthiness. Adding price competition to matching competition leaves trust unchanged, but diminishes trustworthiness somewhat.

Matching competition significantly raises trust by 28% (=0.198/0.702) and trustworthiness by 21% (=0.155/0.754). An important implication of the latter observation is that competition not only allows buyers to evade untrustworthy sellers, but also tends to lift the trustworthiness of all sellers relative to the situation without competition. The addition of price competition, however, eliminates much of this gain in trustworthiness. Apparently, buyer trust remains high in price competitive markets because buyers are able to evade untrustworthy sellers. The movements in trust and trustworthiness explain the increase in efficiency when competition is introduced to strangers markets.

(2) In partners networks, both matching and price competition erase the advantage in trust and trustworthiness that partners networks have over strangers networks when there is no competition.

This finding applies to both matching and price competition: The changes in trust and trustworthiness explain why efficiency does not rise when competition is introduced into

partners networks. They also explain why efficiency of matching and price competition does not differ across strangers and partners networks.

Adding Price Competition to Feedback and Matching Competition

If buyers chose primarily on price, we would expect the price to more closely reflect the fully competitive value of 35 (= marginal cost) or at least tend in this direction over time. However, on average, prices in both partners and strangers networks are well above the competitive prices and are rather stable over time.

Once feedback has led to trading reputations, price is not much of an indicator of selection. The lines for chosen and rejected prices cross several times (see Figure 7). This suggests that feedback information – not price – determines seller selection.

INSERT FIGURE 7 ABOUT HERE

Table 5 further strengthens the view that feedback trumps pricing. A quick read of the Table 5 however would suggest that there is no clear tendency to choose the better price when the feedback score is the same. No single measure of feedback is likely to capture how every person judges the better reputation. For example, some people may weight recent seller behavior differently than earlier behavior - and people who do so may use different weighting schemes.

Most selections of sellers are consistent with buyers looking first at feedback. If there is a difference in feedback, buyers select on this basis. If there is no difference in feedback, then and only then, buyers select based on price.

INSERT TABLE 5 ABOUT HERE

SUMMARY AND CONCLUSIONS

Many online markets with anonymous trading implement feedback systems to improve trading and increase gains-from-trade. This study investigated the interplay of matching and price competition on the one hand and reputation derived from feedback systems on the other hand in anonymous online markets.

Overall, our results imply that encouraging greater competition may be a powerful tool for increasing trust and trustworthiness in online markets with feedback mechanisms and thus increasing market efficiency.

In strangers markets, matching competition (sellers compete on feedback) yields significantly higher levels of buyer trust, seller trustworthiness, and market efficiency compared to markets without any competition. The reason is that buyers can discriminate between sellers on the basis of the feedback provided by the network, creating stronger incentives for sellers to be trustworthy.

Markets with price competition (sellers compete on feedback *and* prices) also perform better than those without any competition. Yet, the reason for the improvement is, ironically, that sellers do *not* engage in strong price competition. Price competition leaves sellers with less incentive to be trustworthy as the lower prices mean lower gains from maintaining a good reputation. Because there is some weak price competition, sellers are slightly less trustworthy compared to sellers in markets with only matching competition. This causes a negative, though not significant effect on the gains-from-trade. In this sense, price competition tends to undermine the merits of electronic feedback systems.

Feedback trumps pricing in buyer deliberations concerning which seller to conduct business with. Buyers usually do not conduct business with someone who has a bad reputation, not even for a substantial price break. As a result, the downward pressure on prices is moderate and average price offers are very stable over time. Overall, in strangers markets, price competition is therefore only a small threat to the increased trusting and trustworthy trading patterns resulting from matching competition.

Finally, we observe that competition largely erases the difference in performance previously found in partners and strangers networks. With either matching or price competition, there is virtually no difference in distribution of gains-from-trade in partners and strangers networks. The opportunity to partner with a seller for a longer bilateral relationship has only little value to traders in competitive markets. The implication of this finding for online markets is that a reliable feedback system in a competitive market can largely reduce the advantage of partners networks in promoting trust and trustworthiness.

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FIGURE 1

Base Buyer-Seller Interaction in Markets with No Competition

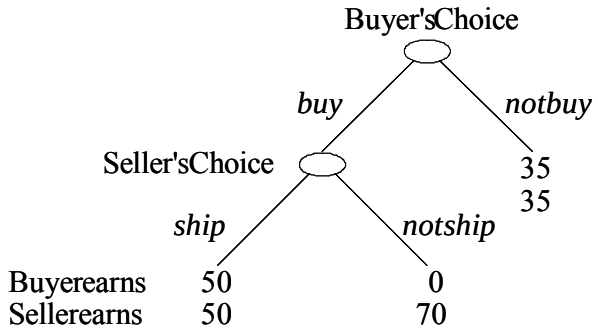

FIGURE 2

Buyer-Seller Interaction in Markets with Matching Competition

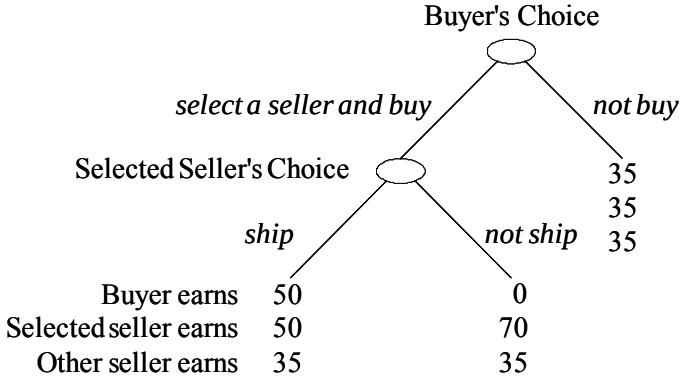

FIGURE 3
Buyer-Seller Interaction in Markets with Matching and Price Competition

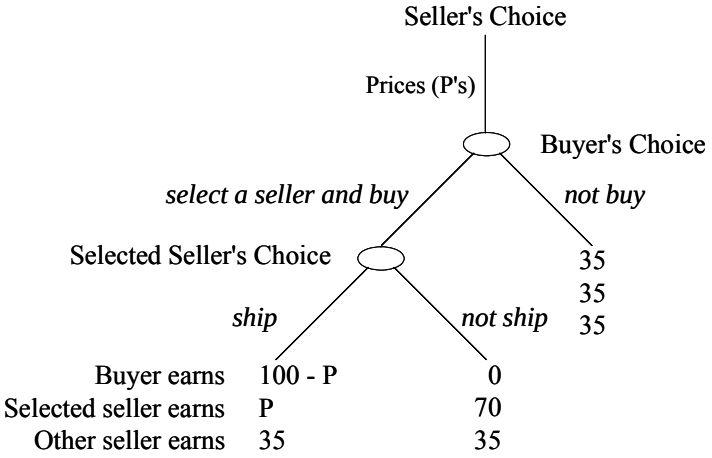

FIGURE 4
Gains-from-Trade as Percentage of Maximum Achievable Gains-from-Trade, by Type of Competition and Type of Network

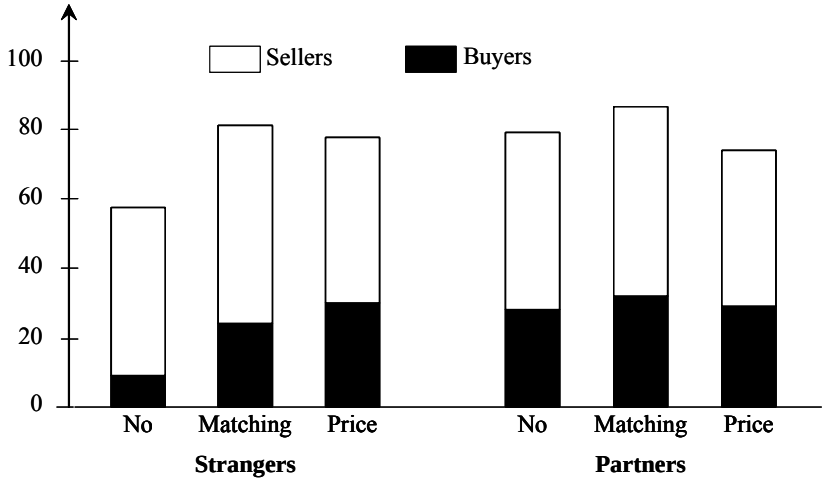

FIGURE 5
Trust: Frequency of Buy Decisions by Round

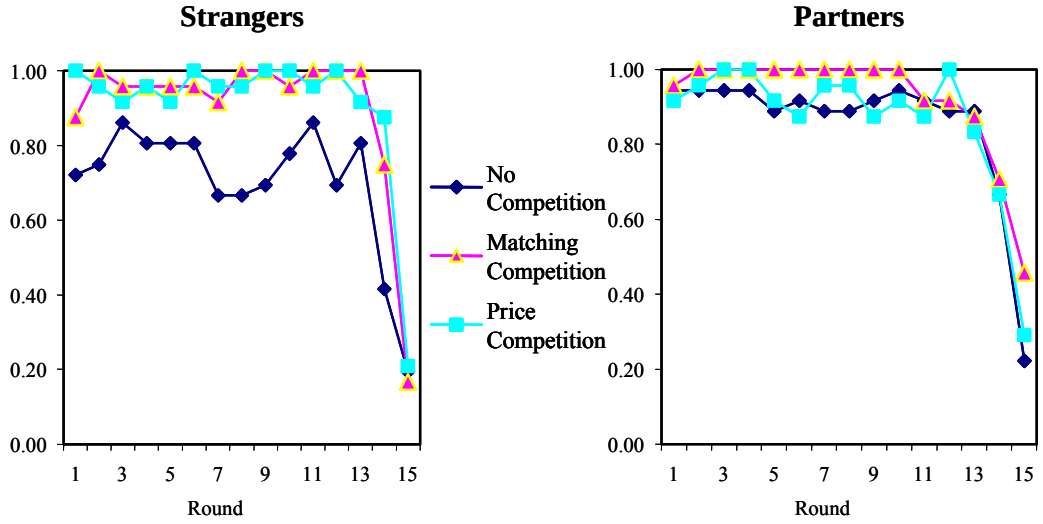

FIGURE 6
Trustworthiness: Frequency of Ship Decisions Conditional on Buying, by Round

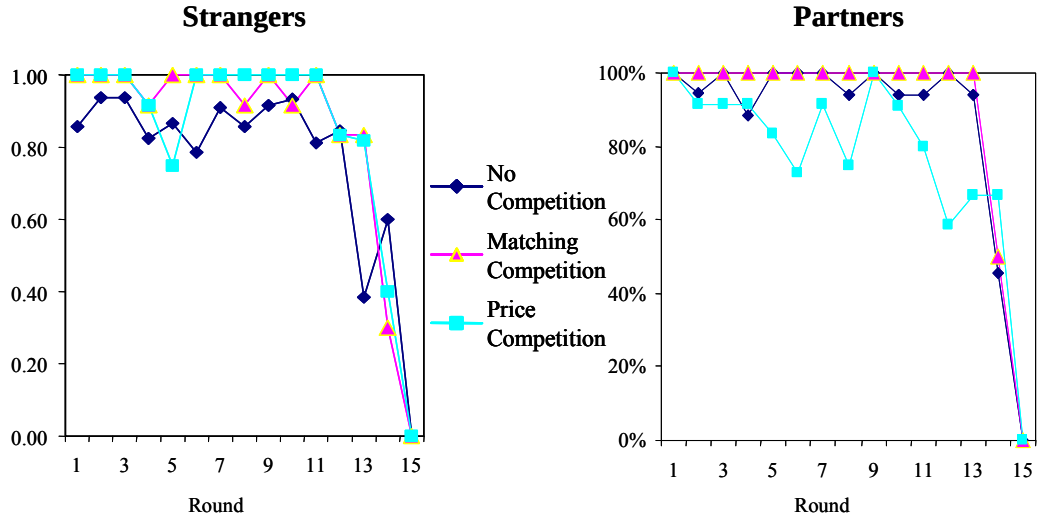

FIGURE 7
Price Movements across Rounds in Strangers and Partners

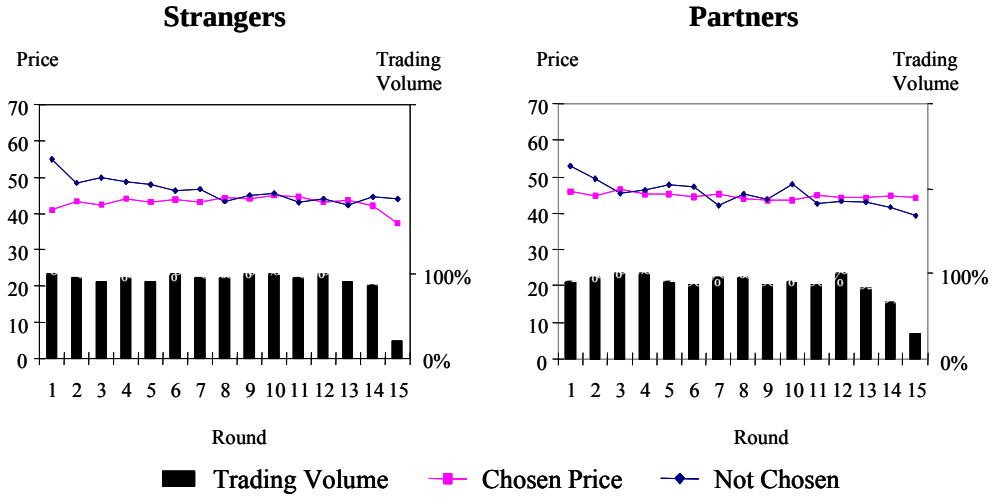

TABLE 1

Six Experiments

Competition	Network	
	Strangers	**Partners**
No	Strangers market with no competition	Partners market with no competition
Matching	Strangers market with matching competition	Partners market with matching competition
Price	Strangers market with price competition	Partners market with price competition

TABLE 2

Gains-from-Trade (Proportion of Maximum Possible)

Tobit regression estimates (and standard errors)

VARIABLES **Independent \ Dependent**	**TOTAL**[a] **GAINS**	**BUYER** **GAINS**	**SELLER** **GAINS**
CONSTANT	0.576***	0.095***	0.435***
= gains in strangers no competition market.	(.0248)	(.0239)	(.0434)
MATCH	0.237***	0.146***	0.073
= 1 if either match or price competition market, and 0 else.	(.0392)	(.0373)	(.0574)
PRICE	-0.035	0.060	-0.126***
= 1 if price competition market, and 0 else.	(.0429)	(.0407)	(.0531)
PARTNERS	0.216***	0.183***	0.034
= 1 if partners network, and 0 else.	(.0351)	(.0335)	(.0614)
PARTNERS x MATCH	-0.162***	-0.107	-0.047
= cross effects variable.	(.0554)	(.0527)	(.0813)
PARTNERS x PRICE	-0.091	-.071	0.028
= cross effects variable.	(.0607)	(.0575)	(.0753)
Number of observations	84	84	132
Log-likelihood	69.97	66.14	28.52

[a] Total gains tabulated by buyer. Regressing on data tabulated by seller yields similar results. Total gains in table differ slightly from buyer plus seller gains because buyer gains are tabulated by buyer, while seller gains are tabulated by seller.

*** Significant at .025 level, two-tailed.

** Significant at .05 level, two-tailed.

* Significant at .10 level, two-tailed.

TABLE 3
Buyer Choice Patterns in Partners Networks with Competition

	Frequency with which buyers switch seller partners when given the opportunity (%)	Frequency buyers buy from a seller when given the opportunity (%)
Matching competition	19	92
Price Competition	42	87

TABLE 4
Frequency of Trusting and Trustworthy Behavior

Tobit regression estimates (and standard errors)

VARIABLES Independent \ Dependent	BUY	SHIP[a]
CONSTANT	0.702***	0.754***
= frequency in strangers no competition market.	(.0233)	(.0548)
MATCH	0.198***	0.155**
= 1 if either match or price competition market, and 0 else.	(.0368)	(.0733)
PRICE	0.008	-0.117*
= 1 if price competition market, and 0 else.	(.0403)	(.0681)
PARTNERS	0.154***	0.177***
= 1 if partners network, and 0 else.	(.0330)	(.0775)
PARTNERS x MATCH	-0.112**	-0.259***
= cross effects variable.	(.0528)	(.1039)
PARTNERS x PRICE	-0.078	0.074
= cross effects variable.	(.0578)	(.0964)
Number of observations	84	132
Log-likelihood	63.86	-17.86

[a] Frequency conditional on buying.
*** Significant at .025 level, two-tailed.
** Significant at .05 level, two-tailed.
* Significant at .10 level, two-tailed.

TABLE 5
Buyer Choice Frequencies in Games with Price Competition

Seller Reputation measured as $\frac{\textbf{Number of Ships}}{\textbf{Number of Buys}}$

STRANGERS NETWORK	**Seller chosen has a better reputation**	**… worse …**	**… same …**	**Sum**
Seller chosen offers a better price	0.214	0.113	0.168	0.495
… worse …	0.287	0.012	0.153	0.453
… same …	0.018	0.003	0.031	0.052
Sum	0.520	0.128	0.352	1.000

PARTNERS NETWORK	**Seller chosen has a better reputation**	**… worse …**	**… same …**	**Sum**
Seller chosen offers better price	0.166	0.019	0.166	0.351
… worse …	0.265	0.089	0.220	0.575
… same …	0.032	0.006	0.035	0.073
Sum	0.463	0.115	0.422	1.000