

THE IMPACT OF COMPETITION AND REPUTATION FEEDBACK SYSTEMS ON INTERNET TRADING

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Abstract

Many Internet trading platforms rely on 'feedback systems' to increase trust and trustworthiness and thus gains-from-trade in anonymous transactions. Competition creates incentives that arguably may enhance or curb the effectiveness of these feedback systems. We investigate how competition for trading partners or for price - compared to the absence of competition - influences the buyers' trust and the sellers' trustworthiness in a series of laboratory online markets. We find that competition in strangers networks (where market encounters are one shot) most frequently enhances trust and trustworthiness and always increases efficiency. One reason is that reputation feedback trumps pricing. Traders usually do not conduct business with someone who has a bad reputation, not even if he offers a substantial price discount. We also find that reliable reputation feedback can largely reduce the advantage of partners networks in promoting trust and trustworthiness if there is sufficient competition.

Keywords: Internet Trading, Feedback Systems, Competition, Experiment

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Research Context, Question, and Method

Internet trading platforms enable traders to break through geographical constraints to trade in larger and more competitive pools (e.g., Granados et al. 2006; Ockenfels et al. 2006). They mostly represent *strangers networks* (one shot, not repeated), where social entities trade in a different match for every transaction. For instance, Resnick and Zeckhauser (2002) found that 89% of all eBay trading encounters are one shot. [In contrast to trading in strangers networks, social entities in *partners networks* do not change over time. With repeated transactions, they build a trading history.]

In such anonymous electronic markets, trust and trustworthiness between buyer and seller are especially important for transactions to take place. The literature on electronic markets describes benevolence, meaning sellers' performance beyond contractual agreements, and credibility, i.e., the sellers' excellence in fulfilling contractual obligations as important dimensions of trust (e.g., Pavlou and Dimoka 2006). Trust-building can be based on buyers' and sellers' similar personal characteristics, on formal social structures such as institutional assurance, or on prior trading experience (Zucker 1986).

Further, starting with Kreps and Wilson (1982), there is a large body of literature on the theory of reputation dynamics and formation (e.g., Dellarocas 2003; Doney and Cannon 1997; Zucker 1986). That literature suggests that reputation is a matter of information, rather than of matching or of competition (see Bolton et al. 2004 for a discussion). A lack of direct information in terms of trading experience could hinder the creation of stable trust (Kim et al. 2002).

Many Internet trading platforms, such as Amazon, Cnet, eBay, Half, and Yahoo, are essentially strangers networks, they have implemented formal reputation systems to increase and stabilize trust and trustworthiness via reputation feedback and thus improve gains-from-trade in spite of a more or less anonymous environment (e.g., Ba and Pavlou 2002; Dellarocas 2003; Gefen and Straub 2004). In many formal reputation systems, numerical feedback builds the basis, whereas textual feedback posted by buyers can be used to add richness (Ghose et al. 2006; Pavlou and Dimoka 2006). Dynamically, the incentive of future profits constrains sellers from cheating – and thus harming their own reputation (Dellarocas 2003).

Economic theory indicates that reputation feedback allows indirect tit-for-tat strategies, as the buyer does business with the seller only if the seller has been reliable with third party buyers in the past. Reputation is an important precondition for tit-for-tat strategies which replace the often prohibitively costly legal action (e.g. Granovetter 1985).

In partners networks, tit-for-tat relies on a direct flow of reputation information, i.e., the trading history between buyer and seller. Strangers networks have no trading history as they are one shot. Tit-for-tat here must necessarily rely on an indirect flow of reputation information through trusted third parties. However, buyers in strangers networks can implement the same tit-for-tat strategy as those in partners networks (e.g. Kreps and Wilson 1982). Given the same reputation information, this results in equal gains-from-trade (sum of consumer surplus and seller surplus) in partners and strangers networks (see Bolton and Ockenfels 2006).¹

Besides enabling retaliation strategies such as tit-for-tat, reputation information can also be considered as signal. Unlike models of reputation dynamics, economic models of signaling identify competition among traders as a core issue. In these models a *signal* is information with imperfect forecast value. As reputation information on both Internet and laboratory trading platforms has forecast value but is noisy, it fits the definition. The theory of signaling (Cho and Kreps 1987; Riley 2001) suggests that the combination of seller competition and noisy signals can lead to one of two different kinds of outcomes:

- (1) If seller competition permits buyers to discriminate on the basis of seller signals thus encouraging sellers to invest in a good signal – i.e., in good reputation – sellers would have an incentive to maintain a reputation for

1 Dellarocas (2003) and Resnick and Zeckhauser (2002) provide comparisons of electronic and conventional dissemination of reputation information. Additional studies show that reputation feedback like the one employed by eBay has merit, although reputation information is less than fully reliable. In particular, field data and experimental work indicate that reputable Internet sellers are more likely to sell their items (e.g., Resnick and Zeckhauser 2002) and can expect price premiums (e.g., Lucking-Reiley et al. 1999); see Dellarocas (2006) and Bolton et al. (2004b) for discussions and surveys.

trustworthiness. Buyers would reward trustworthiness with trust; the result would be more transactions and greater gains-from-trade (e.g., Spence 1974).

- (2) If buyers do not or only weakly discriminate on the basis of reputation signals, sellers have little incentive to invest in greater trustworthiness. Competition, then, would have little merit, or, at the extreme, it could lead to a lemons problem (Akerlof 1970), where all sellers are basically treated the same by buyers. Competition would lead to sellers becoming less trustworthy, reducing transactions, and thereby reducing volume of trade and gains-from-trade.

Hence, there is reason to suspect competition might be important to the effectiveness of reputation building. But, depending on the outcome, competition may promote trust and trustworthiness and thus gains-from-trade, or else leave trust and trustworthiness and thus gains-from-trade unchanged or even reduced.

In spite of extensive theoretical work and a large body of literature on the performance of reputation, there is to our knowledge no field research on the impact of competition in networks with reputation feedback. For instance, Ba and Pavlou (2002) combine experimental studies and fieldwork to investigate the relationship between feedback and trust, but do not specifically investigate the influence of competition. Part of the reason is that 'naturally occurring' field environments make it difficult, if not impossible, to isolate the impact of competition on different kinds of trading platforms with reputation feedback.

Recognizing this gap for field research on the impact of competition on networks with reputation feedback and taking into account that signaling theory does not predict an unambiguous outcome leads us to our research question: *How does competition and reputation feedback impact the trust of buyers in sellers, the trustworthiness of sellers and, ultimately the gains achieved from trade in both, strangers and partners networks?*

Complementing the literature on trust which suggests that prior interactions lead to more willingness to buy from the same seller (e.g., Komiak and Benbasat 2004; Strader and Ramaswami 2002), in this paper we investigate how trust and trustworthiness manifest themselves in market participant behavior. Accordingly, we will measure trust and trustworthiness in terms of whether a buyer buys (the only reason for not buying being a lack of trust that the seller will ship), and trustworthiness in terms of whether a seller ships (the seller having short-term pecuniary incentives not to).

While we deal with both partners and strangers networks, our research question is focused primarily on strangers networks as they are more representative of Internet markets. From previous work, strangers networks have a 'performance gap' relative to the partners networks prevalent to brick-and-mortar markets (Bolton et al. 2004a). We will see that the performance of partners networks provides a useful benchmark for judging the performance of strangers networks.

To investigate our research question, we conduct a *laboratory experiment* that allows controlling buyer and seller strategic behavior, involving manipulation and distortion of signals and retaliation by affected parties (Dellarocas and Wood 2006).

First we investigate partners networks to establish the benchmark. According to Bolton et al. (2004a), the partners network leads to higher gains-from-trade than does the strangers network (see also Granovetter 1985). With that reference value established, we then switch to a strangers network, initially without competition, and examine traders that are presented with a series of trading opportunities across a number of consecutive markets. The market encounters are linked over time via indirect reputation information: Prospective buyers are furnished with reputation information, a complete and accurate record of a seller's past shipping record within the community. The reputation information allows buyers to better decide whether they should *trust* the seller and buy, and thus creates incentives for sellers to be trustworthy and actually ship. The seller faces a 'moral hazard' concerning whether to ship after receiving the buyer's payment. Buyers have no legal recourse. The only extrinsic motivation for trust and trustworthiness comes from the flow of reputation information and from how this information is used by traders.

We then introduce two kinds of competition to the strangers and the partners networks: With *matching competition*, each buyer can choose between two sellers based on their reputation information; prices are fixed. With *price competition*, a buyer can choose between two sellers based on their reputation information and based on price. One might think that the two types of competition have different effects on trust and trustworthiness since matching competition increases the incentive to be trustworthy while price competition decreases it. Our experiment allows us to separate the (potentially) differing effects of matching and price competition.

While economic models alternatively imply that competition has little effect on reputation building, or are undecided on the effect, the main result of this paper is that competition improves the performance of reputation systems.

Experimental Design

Overview

The experiment has six treatments (see Table 1). Each treatment concerns a particular type of market. In all markets, transactions transpire over 15 rounds, each round beginning with the matching of buyers and sellers for the purpose of trade. The markets in each treatment are distinguished along two dimensions. The first dimension is network, *partners network* or *strangers network*. In markets in a partners network, each buyer can interact exclusively with a single seller if they so choose and so the traders can effectively pair for the duration of the market. Matches in the first stage of the game were determined at random. All the sellers start with a zero reputation. In a strangers network, buyers and sellers interact at most once, and so traders effectively rotate pairings through the market. 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 (although they can choose not to buy from the matched seller). In markets with matching competition buyers choose between two sellers on the basis of reputation information only (the price is fixed). In markets with price competition, buyers choose between two sellers on the basis of both reputation information and price offers.

No subject participated in more than one treatment of the experiment (each treatment done in a single session). Within each treatment, subjects participated in two runs of the associated market. This enabled a check for experience effects. The rest of this section describes each treatment and the rules for the buyer-seller interaction within the associated market.

Table 1. Six Treatments

Competition	Network	
	Strangers	Partners
No	Strangers networks with <i>no</i> competition	Partners networks with <i>no</i> competition
Matching	Strangers networks with <i>matching</i> competition	Partners networks with <i>matching</i> competition
Price (i.e., matching and price)	Strangers networks with <i>price</i> competition	Partners networks with <i>price</i> competition

Treatments where Markets have No Competition

At the beginning of the laboratory session, participants are assigned to buyer and seller roles, with an equal number in each role. The roles are fixed for the entire experiment. Traders interface by computer. In each of the 15 rounds of a market, a buyer and a seller are matched to interact as illustrated in Figure 1.

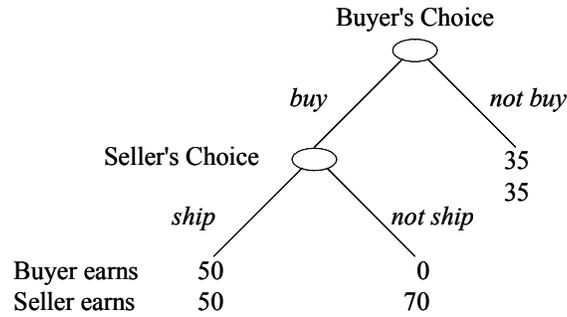


Figure 1. Base Buyer-Seller Interaction in Markets with No Competition

At the beginning of the round, both the seller and the buyer are endowed with 35 (hence the payoff if no trade takes place in the round). The seller offers an item for sale at a fixed price of 35. The item 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. So each successfully completed trade increases gains-from-trade by 30, with a consumer surplus of 15 and a seller surplus of 15. If the buyer chooses to buy an 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. To keep things simple, payments and moves of the game were described to subjects as in Figure 1, without the breakdowns of costs or efficiency analysis given here.

In both partners and strangers networks, buyers are provided with reputation feedback about a seller's past behavior. In all cases, the buyer knows what choice (*ship* or *not ship*, or *no buy*) the seller he is matched with has made in each of the prior rounds. In all markets, the matching procedure and the manner in which seller information would be recorded was publicly announced at the beginning of the lab session.

Upon completion of the first run of the market, all reputation scores are deleted and traders start the second market with blank records and identical rules. Matchings in the second market take place by the same rules as the first, but with a new set of random draws, so that the pattern of individual matches is not repeated.

Treatments where Markets have Matching Competition

To investigate the impact of *matching competition*, we modify the baseline buyer-seller interaction to allow, in each round, the buyer to choose between two sellers on the basis of reputation histories. As before, the buyer can also choose not to buy (see Figure 2).

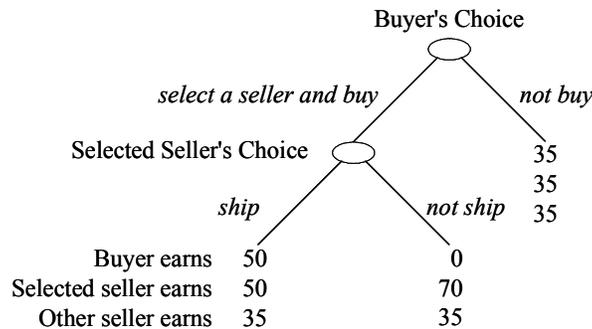


Figure 2. Buyer-Seller Interaction in Markets with Matching Competition

In the partners network, after the first market, 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 round, he can also choose to switch to a new seller. Hence, matching competition in the partners network does *not* necessarily *imply* a lasting partners relationship, but it allows buyers to build one. (Buyers who are not chosen in one round, become alternates to partners in the succeeding round.)

In the corresponding strangers network, however, lasting buyer-seller relationships cannot be developed. 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. Hence, buyers cannot repeat business with the same seller since they always have to choose between two sellers they have not traded with previously.

In these treatments, two thirds of the participants are assigned roles as sellers and one-third assigned roles as buyers. Sellers are not shown the profile of the seller they are competing with. In all other respects, the set-up and procedures for the treatments with matching competition are the same as for the treatments without matching competition.

Treatments where Markets have Price Competition

To investigate the impact of *price competition* in strangers and partners networks, we follow the same procedure as above. In addition, sellers must simultaneously post a selling price anywhere in the range from 0 to 100 for the buyer to see prior to choosing a seller (see Figure 3). As a result, a buyer can choose between two sellers, or not to buy at all, on the basis of both reputation *and* price information. A seller's reputation profile includes only information about his shipping history not his past price postings. So price competition always allows buyers to select sellers according to their reputation, as in matching competition, but adds price as an additional dimension of the competition. In all other respects, the set-up and procedures for the treatments with price competition are the same as for the treatments with matching competition.

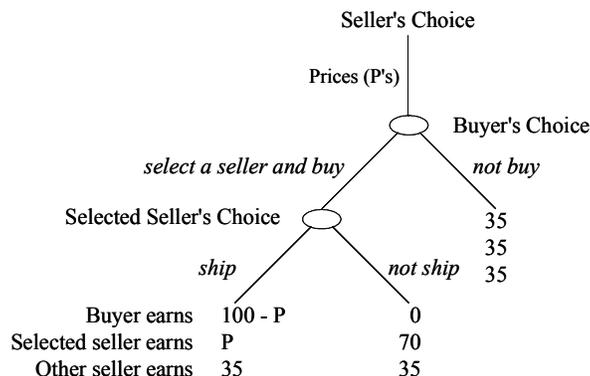


Figure 3. Buyer-Seller Interaction in Markets with Price Competition

Data Collection

In all, 216 subjects participated in the experiment; 36 subjects in each treatment. No subject participated in more than one treatment. Subjects were students, mostly undergraduates, from various fields of study. They volunteered through an online recruitment system. Cash was the only incentive to participate.

Upon arrival in the laboratory, participants were seated at the computers, separated by partitions. They were then asked to read the instructions. When all were finished, the experimenter read the instructions out loud in order to enter them into public knowledge. To get familiarized 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.

Payoffs were listed in laboratory 'francs' in the quantities given in Figures 1-3. The exchange rate of \$0.02 per franc was presented to the subjects in the instructions. Upon completion of the treatment, one of the two markets was

chosen at random and each subject was privately paid her earnings for that market 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

There is no statistically significant experience effect across the two markets played in any treatment. Contingency table tests each comparing frequency of trades per round across markets. No test is significant at any standard level. Tests exclude the respective last (15th) round because of low frequency of trade (see Figures 5 and 6).

For this reason, in the following analysis, we do not distinguish between the first and second markets within treatment, but aggregate the data.

Gains-from-Trade

The ultimate market measure of whether competition increases or diminishes the effectiveness of a trading platform with reputation feedback is the net effect on gains-from-trade. For each of the six treatments, Figure 4 displays the gains-from-trade as a percentage of the maximum achievable. The maximum achievable gains-from-trade are the total payoff achieved if all possible transactions are successfully completed minus the total payoff achieved if there are no buys. Taking a buyer perspective, data were statistically tabulated by buyer, yielding the same basic results as from the seller perspective. The gains are further broken out into amounts received by sellers and by buyers. Choosing the buyer perspective to calculate buyer gains and seller perspective to calculate seller gains causes marginal differences between total gains and the sum of buyer plus seller gains. Noticeable are the differences across treatments, both within and across network configurations.

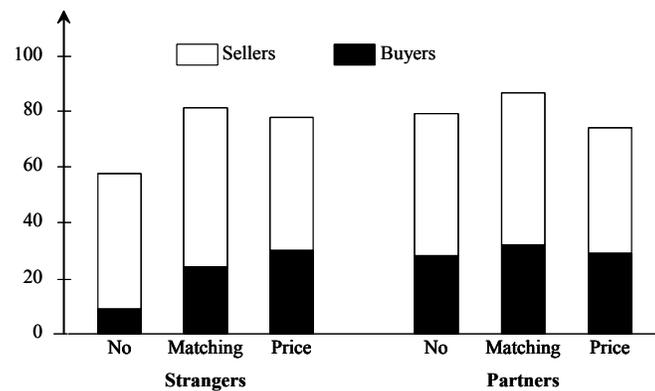


Figure 4. Gains-from-Trade as Percentage of Maximum Achievable Gains-from-Trade, by Type of Competition and Type of Network

Table 2 breaks Figure 4 out using Tobit regression analysis. For a detailed discussion of Tobit regression, see for example Davidson and MacKinnon (1993).

Tobit coefficient estimates are equal to the marginal effects of the individual independent variables on gains-from-trade. So the 0.567 estimate of the CONSTANT coefficient is, in fact, the proportion of the maximum possible gains-from-trade captured by the strangers network with no competition (as in Figure 4). $0.576+0.237=0.813$ is the proportion of the maximum possible gains-from-trade captured by the strangers network with matching competition (as in Figure 4), etc. Tobit standard error estimates correct for the censored nature of the data. There is no cross effects variable for PRICE and MATCH because, due to the experiment's design, the former is nested in the latter.

**Table 2. Influence of Treatment Factors on Gains-from-Trade
(as proportion of maximum achievable)**

Tobit regression estimates (and standard errors)			
VARIABLES Independent \ Dependent	TOTAL ^a GAINS	BUYER GAINS	SELLER GAINS
CONSTANT = gains in strangers network, no competition market.	0.576*** (.0248)	0.095*** (.0239)	0.435*** (.0434)
MATCH = 1 if either match or price competition market, and 0 else.	0.237*** (.0392)	0.146*** (.0373)	0.073 (.0574)
PRICE = 1 if price competition market, and 0 else.	-0.035 (.0429)	0.060 (.0407)	-0.126*** (.0531)
PARTNERS = 1 if partner network, and 0 else.	0.216*** (.0351)	0.183*** (.0335)	0.034 (.0614)
PARTNERS x MATCH = cross effects variable.	-0.162*** (.0554)	-0.107 (.0527)	-0.047 (.0813)
PARTNERS x PRICE = cross effects variable.	-0.091 (.0607)	-0.071 (.0575)	0.028 (.0753)
Number of observations	84 buyers	84 buyers	132 sellers
Log-likelihood	69.97	66.14	28.52

^aTotal gains tabulated by buyer.

*** Significant at .025 level, ** significant at .05 level, * significant at .10 level, all two-tailed.

We draw three main observations from Figure 4 and Table 2:

- (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 stranger network without competition, the introduction of matching competition in a strangers network significantly increases total gains-from-trade by 41% ($=0.237/0.576$). The further addition of price competition dampens these gains by a small and insignificant amount (as measured by the PRICE coefficient). The total gains from price competition are still significantly greater than in case of no competition (Wald test, two-tailed $p < 0.001$). The gains from matching competition primarily go to buyers, a significant 154% ($=0.146/0.095$) increase over no competition; the analogous gains to sellers are small and insignificant. Adding price to matching competition further increases buyer gains by a small, insignificant amount, but sellers incur a significant 29% ($-0.29 = -0.126/0.435$) decrease. (Later, we will see that the average price sellers receive with price competition is lower than what they receive with fixed prices.)

- (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 gains-from-trade from adding matching competition are 9% ($=(0.237-0.162)/(0.576+0.216)$) and weakly significant (Wald, two-tailed $p=0.056$). The total gains from adding price competition, relative to no competition, are negative ($-0.05=0.237-0.035-0.162-0.091$) but not significant (Wald, two-tailed $p=0.195$). Directly from Table 2, buyers capture significant gains from adding matching competition with no significant effect on sellers. Further adding pricing competition has no significant effect on buyers but significantly reduces what sellers capture.

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

Consistent with the findings of Bolton et al. (2004a), with no 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 buyers and sellers (e.g., Brosig et al. 2003; Dellarocas 2005), nor by the distances or anonymity between buyers and sellers (Granovetter 1973). Both were kept constant across treatments.

When we add matching competition to treatments without competition, however, the total gains-from-trade in partners networks are 5% (=0.216-0.162) higher than in strangers networks, but not significantly so (Wald test, two-tailed p=0.207). When we add price competition, the difference between partners and strangers networks completely disappears: total-gains-from trade in partners networks are now less than those in strangers network by 3%, which is not significant (Wald test, two-tailed p=0.393).

In summarizing these results, we observe that the addition of competition among sellers, be it matching or price, has much the effect on trader role-shares that elementary economic theory would lead us to expect: Buyers gain and sellers lose. However, in the strangers networks overall surplus rises from competition (both types) whereas it changes little for partners networks. The net result is that the performance gap disappears. Table 3 sheds further light on why it vanishes: In partners networks without competition, the buyer cannot switch away from his assigned seller. In the partners networks with competition, the buyer can and does switch 19% of the time under matching competition, rising to 42% under price competition. The temptations offered by matching competition, and especially price competition effectively break down partnering. That is, with the addition of competition, the transaction patterns in partners networks look like those in strangers networks. The performance gap vanishes because competition causes the difference in the pattern of networking to vanish.

Table 3. Buyer Choice Patterns in Partners Networks with Competition

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

Trust and Trustworthiness

Having observed the pattern in gains-from-trade, we turn to examine the underlying trust (buy) and trustworthy (ship) behavior in these markets. Figure 5 shows the frequency with which buyers trust their sellers by taking the 'buy' action. Figure 6 displays the frequency, conditional on receiving a buy, with which sellers are trustworthy and ship.

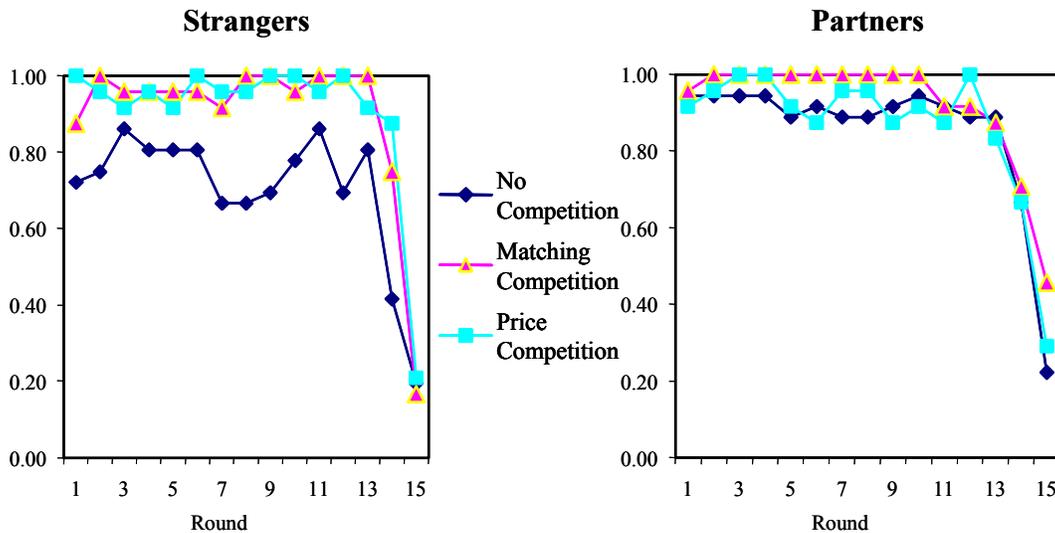


Figure 5. Trust: Frequency of Buy Decisions by Round

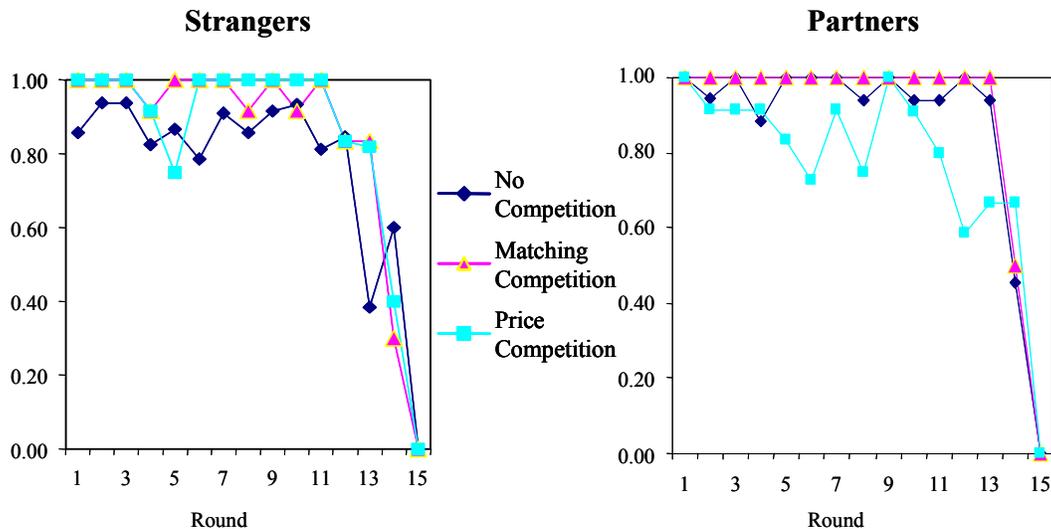


Figure 6. Trustworthiness: Frequency of Ship Decisions Conditional on Buying, by Round

Both Figures 5 and 6 show a steep drop in buying and shipping at the end of the market. The consistency and magnitude of this behavior are striking evidence of the strategic nature of trader behavior: Sellers build reputation for profit; in the final round of the market, a good reputation is no longer useful and so sellers largely stop being trustworthy. Buyers appear to anticipate this behavior, since buy frequency drops in the same rounds. There are other differences across treatments on display in Figures 5 and 6. To judge the significance of the differences, Table 4 provides the corresponding inferential statistics using Tobit regression analysis. Analog to Table 2, the coefficients are the marginal frequencies of buy (ship), and standard deviations are corrected for the truncation of the data. (A random effects model yields results that are comparable to those presented in Table 4.)

Table 4. Frequency of Buy (Trust) and Ship (Trustworthy) Decisions

Tobit regression estimates (and standard errors)		
VARIABLES	BUY ^a	SHIP ^b
Independent \ Dependent		
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 partner 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 buyers	132 sellers
Log-likelihood	63.86	-17.86

^a Frequencies tabulated by buyer.

^b Frequency tabulated by seller, conditional on buying.

*** Significant at .025 level, ** significant at .05 level, two-tailed, * significant at .10 level, all two-tailed.

There are two main observations to be made:

- (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.

Compared to no competition in strangers markets, matching competition significantly raises trust by 28% ($=0.198/0.702$) and trustworthiness by 21% ($=0.155/0.754$). Price competition, however, eliminates some of the increase in seller trustworthiness, to a net effect increase of 5% ($=(0.155-0.117)/0.754$) over trustworthiness under no competition, which is still significant (Wald, two-tailed $p=0.025$).

- (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.

Neither the hypothesis that the partners coefficient plus the PARTNERSxMATCH coefficient are equal to zero, nor the hypothesis that the PARTNERS coefficient plus both cross effect variables are equal to 0 can be rejected for buyer choices (Wald, two-tailed $p=0.303$ and 0.387 , respectively) or for seller choices (Wald, two-tailed $p=0.235$ and 0.905 , respectively).

Perhaps the most important observation under (1) is that both matching and price competition not only allow buyers to avoid untrustworthy sellers at low cost (by trading that round with another seller), but also tend to lift the trustworthiness of all sellers relative to the setting with no competition. The changes in trust and trustworthiness explain the increase in gains-from-trade when competition is introduced to strangers networks. Observation (2) details how trust and trustworthiness break down as competition is added to no competition partners networks. Referring back to Table 3, buyer switching reduces the incentive of sellers to be trustworthy, which in turn reduces seller trustworthiness. In adding either matching or price competition, the amount of trust and trustworthiness in partners and strangers networks converges as the transaction patterns converge.

Price Competition

One might have thought that price competition would weaken seller trustworthiness because competition pushes the incentives for trustworthiness lower. But, in fact, the gains-from-trade under price competition are not appreciably different than under matching competition. In this section, we look more closely at whether and how buyer choices tradeoff price and reputation.

We begin by comparing pricing in our markets with elementary economic theory. If we ignore the moral hazard issue for a moment and assume that sellers always ship, then the economic theory of competition implies that competition for buyers should push seller price offers to 35 (the marginal cost of producing). Figure 7 shows the average prices per round in the price competition markets. The average chosen price was 43.0 for the strangers network and 44.7 for the partners network. (The corresponding standard deviations are 1.90 and 0.84, respectively. The overall average price *not* chosen in strangers network (standard deviation) is 46.4 (3.25) and 45.2 (3.54) in partners network.) Even if we restrict attention to rounds when price patterns have settled down, in rounds 6 through 15, the observed round averages are significantly higher than the competitive price of 35 (t-test, $n=10$ rounds, two-tailed $p<0.001$ for both networks). Average round prices across strangers and partners networks, in rounds 6 through 15, are not significantly different both for chosen prices comparison as well as not chosen prices comparison (t-test, $n=10$ rounds, two-tailed $p=0.162$ and $p=0.251$, respectively).

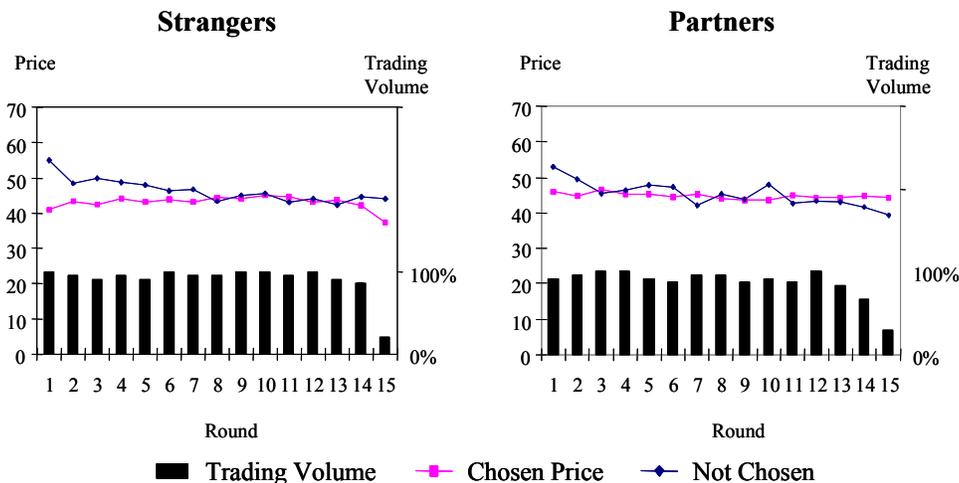


Figure 7. Price Movements across Rounds in Strangers and Partners

Also displayed in Figure 7, once prices have settled down (again rounds 6 through 15), price is not much of an indicator of selection: within markets, the average chosen price per round is not notably different than the average not chosen price per round (t-test, n=10 rounds, two-tailed p=0.096 for strangers and p=0.504 for partners). This, too, suggests that reputation information plays a more critical role in seller selection than does price.

Turning to reputation information, Table 5 shows that frequency of buyer choice is always higher with better reputation independent of price. A combination of worse price and better reputation tends to be selected by buyers over combinations of better price and same, respectively worse, reputation.

Table 5. Buyer Choice with Price Competition

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

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

While a quick read of the Table 5 would suggest that there is no clear tendency to choose the better price when the feedback score is the same, keep in mind that no single measure of reputation 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. Hence, what looks like indifference in the table, may not look precisely like that to everyone. The basic results reported here are robust to other simple measures of reputation, such as the measure 'number of ships minus number of no ships', patterned after eBay's feedback number.

An alternative approach to Table 5 is to regress individual buyer choices on the differential price and reputation information they had at the time of the decision. Here we measure a seller's reputation by the number of times he ships minus the number of times he does not, similar to eBay's feedback number (measuring reputation as in Table 5 yields similar inferential results but the trade-off between price and reputation is more difficult to interpret):

BuyerChoosesSeller1

$$= 0.459 + 0.085PARTNERS + 0.045REPDIFF - 0.008PRICEDIFF - 0.338LASTRND$$

$$(<0.001) \quad (0.028) \quad (<0.001) \quad (<0.001) \quad (<0.001)$$

$$\text{adj.-}R^2=0.258$$

where

BUYERCHOOSSESELLER1 = 1 if choice is Seller 1, 0 otherwise (seller label 1 or 2 is arbitrary);

PARTNERS = 1 if Buyer is in the partners network, 0 otherwise;

REPDIFF = (#Seller1 ships – #Seller1 no ships) – (#Seller2 ships – #Seller2 no ships);

PRICEDIFF = Seller 1 price – Seller 2 price;

LASTRND = 1 if round 15, 0 otherwise;

(x.xxx) = two-tailed *p*-value of coefficient.

Estimating the same equation adding buyer fixed effects variables yields highly comparable results but modestly improves the explanatory power of the regression (adj.- $R^2=0.270$). Estimating with a random effect model (bounds estimates of the dependent variable between 0 and 1) also yields highly comparable results.

The estimates indicate that partners network buyers are, all other things equal, about 8.5% more likely to buy than strangers network buyers. A reputational difference equivalent to shipping one more time than one's competitor makes it, all other things equal, 4.5% more likely to be chosen, while offering a one token larger price than ones competitor makes is 0.8% less likely to be chosen. This implies that buyer average willingness-to-pay in order to deal with a seller with a net increment of one ship over his competitor is $0.045/0.008=5.6$ tokens, or about 13% of the selling price averaged across networks (although very different in experimental methodology, a field experiment by Resnick et al. (2006) on the value of seller reputation on eBay yielded a similar result).

To summarize the evidence, buyer choice of seller in the price competition markets is heavily weighted towards the reputation criteria over the price criteria.

Summary of Findings and Discussion

With our study we find that – overall – feedback systems and competition are powerful complements in promoting trust and trustworthiness in strangers environments such as Internet market platforms. In theory, competition increases trust, trustworthiness, and trade efficiency if the feedback system provides a reputation signal that has sufficient predictive value and buyers discriminate based on the reputation information. In our experiment, we find that buyer trust is often rewarded by trustworthiness, a point that stresses the high (albeit imperfect) signal value of reputation. Buyers are remarkably discriminating with regard to reputation information. When given the choice of two sellers, it takes a large price break to convince the average buyer to do business with the seller of lesser reputation.

We learn that competition (both matching and price) in strangers networks with feedback systems significantly increases gains-from-trade by promoting trust and trustworthiness. Finally, we observe that competition largely erases the advantage of partners over strangers networks in promoting trade. When given the chance, buyers switch sellers quite often, so that the difference between partners and strangers networks vanishes.

Holding the findings against the theory guiding this research puts the results into perspective. Competition complements feedback in disciplining seller behavior even though the dynamics of reputation models suggest competition has little or no additional influence on gains-from-trade (Dellarocas 2003; Kreps and Wilson 1982). At the same time, competition does not lead to price deterioration; transaction prices remain stable making reputation building a profitable strategy. So the market avoids the socially bad equilibrium outcome of many signalling models (Akerlof 1970). Thus, an increase of gains-from-trade as illustrated in this study is surprising from a theory point of view.

Of course, while our experiment includes the major factors that theory says are important to reputation building, it abstracts away from many practical market considerations that might be important, a caveat that need be kept in mind. That said, a major implication of our findings for working Internet markets is that encouraging competition increases market efficiency, not only through the traditional channels of competitive pricing, but also by improving the effectiveness of the feedback system in order to create a more trusting and trustworthy environment.

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